



SEHCM²⁰²⁰

2020
SEHCM

Conference Proceeding Book

**E-International Conference
on
Socio-economic and Health Challenges
Due to Covid-19 and Mitigation Strategies
(SEHCM - 2020)**

Editors :

•Dr. Lakhwinder Pal Singh •Dr Sonia Chawla •Dr Sushendra Kumar Mishra

**Centre for Continuing Education
Dr. BR Ambedkar National Institute of Technology
Jalandhar-144011, Punjab, INDIA**



2020
SEHCM



ਪਵਣੁ ਗੁਰੂ ਪਾਣੀ ਪਿਤਾ ਮਾਤਾ ਧਰਤਿ ਮਹਤੁ॥
ਪਵਣੁ ਗੁਰੂ ਪਾਣੀ ਪਿਤਾ ਮਾਤਾ ਧਰਤਿ ਮਹਤੁ॥

Pavan Guru Paani Pita, Maataa Dharat Mahat
“Air the guru; Water, the father; and Earth,
the great mother” Honor all of life,
Sri Guru Naanak Dev Ji reminds us,
for life honors us with its gifts

SEHCM-2020

Theme:

**Socio-economic and Health Challenges
Due to Covid-19 and Mitigation Strategies**

Organised by



Centre for Continuing Education
Dr. BR Ambedkar National Institute of Technology
Jalandhar-144011, Punjab, INDIA



Chairman's Message

Dr B R Ambedkar National Institute of Technology Jalandhar is one of the premier NITs in the country and is known for imparting Quality Technical Education and taking up research in frontier areas of technology. I am extremely delighted that the Institute is hosting E-International Conference on “Socio-Economic and Health Challenges due to COVID-19 and Mitigation Strategies” (SEHCM - 2020). The outbreak of Novel Coronavirus has a great impact in every arena of human life including jobs, business, knowledge and health system. This unique conference will put forward the strategies for mitigation of challenges resulted from COVID-19 as it is a unique blend of discreet subjects in social sciences, medicine and engineering. It is my strong conviction that doctors, social scientists and engineers need to work in close association to design and develop efficient medical equipment and advanced technologies for quality health care that would assuredly assist to overcome this pandemic situation. This conference is a veracious forum to exchange ideas and research results in sustainable solutions and new knowledge.

My deep sense of appreciation to the Centre for Continuing Education (CCE), for its efforts towards conceptualizing and coordinating such a significant event. I am confident that the institute will become a strong pillar of interdisciplinary research both academic and industrial, leading towards a conducive environment of innovation in the country. I extend my full support to the successful organization of the conference and welcome all eminent speakers from India and abroad.

God bless you all.

Jai Hind!

Subhash Chandra Ralhan

Chairman BOG

**Dr. B R Ambedkar National Institute of Technology
Jalandhar, Punjab (India)-144011**



Director's Desk

Dr. B.R. Ambedkar National Institute of Technology, Jalandhar is one of the most effervescent and stimulating place of learning and research, grounded on the standard of competent faculty, vigorous learning process and proclivity for academic research. In the contemporary era, Higher education is being challenged to rejuvenate itself; NIT, Jalandhar accepts the challenge as the institute always strives for excellence in every arena to make its students competent and proficient in the ever-changing milieu across the globe.

It is a matter of great pride and pleasure to welcome you to the E-International Conference on “Socio-Economic and Health Challenges due to COVID-19 and Mitigation Strategies” (SEHCM - 2020) which is scheduled to be held from 22nd -23rd October, 2020. COVID-19 has a detrimental effect on healthcare systems impending socio-economic crisis and recession across the globe. Researchers across many disciplines are working hard for the development of new binding technologies and medicines to control the spread of COVID-19. Despite the continuing efforts, there is a requirement for faster, more sensitive and reliable technologies to counter this pandemic. This conference will provide a forum for accessing the most up-to-date developments pertaining to Novel Coronavirus, sharing authoritative knowledge from both commercial and academic worlds which would be fruitful in mitigating the current and aftermath of this pandemic.

I sincerely hope that participants in SEHCM - 2020 will deliberate all of the significant aspects of this crucial topic and come up with recommendations that will lead to a healthier and happier world.

I appreciate the rapid growth of the Centre for Continuing Education (CCE) and best wishes to the organizers for successful conduct of the conference.

I welcome all the plenary speakers and delegates from different countries around the world and wish everyone good health.

Jai Hind, Jai Bharat!!

Prof. Lalit Kumar Awasthi

Director & Ex-Chairman BOG

Dr. B R Ambedkar National Institute of Technology

Jalandhar, Punjab (India)-144011



Messages from editorial Desk Conference Chairman cum Secretary



Dr Lakhwinder Pal Singh
Assoc. Prof., Deptt. of IPE
Coordinator CCE
NIT Jalandhar

The COVID-19 pandemic has huge impact on the economic and health system across the globe, and alarmed the countries for changing the strategic rules of business as well. Alongside the direct and indirect health impact the prompt lock down across the world has stopped the economic activities, therefore has raised several issues challenges. With implications, changing daily, business leaders need to be proactive. They need to know how corona virus could affect their business or industry and what strategic steps they

should put forward for the mitigation of those challenges evolved due to this global health crisis. It is matter of honor and pleasure to conceive and organize an E-International Conference on “Socio-Economic and Health Challenges due to COVID-19 and mitigation Strategies” (SEHCM - 2020) held on 22nd - 23rd October 2020.

Despite of knowing that organizing such event under such hard time was difficult but we also knew that we would be working with many individuals who have over the years been pillars of our community and that we would be doing little piece to give back to this wonderful interdisciplinary community in the tough time of pandemic COVID-19. We strongly believe that the inputs be different authors, keynote speaker, plenary speakers and session chairpersons will provide tools and knowledge to overcome significant problems appearing in our industry and society as they have come up with innovative ideas and technologies. The success of this conference will definitely encourage us in introducing many more initiatives for innovative trends in the coming years.



Dr Sonia Chawla
Assoc. Prof.
Deptt. of HUM
NIT Jalandhar



Messages from editorial Desk Conference Chairman cum Secretary

We have received tremendous response in varied areas viz; economic repercussions of COVID-19, Work from Home (WHM) in COVID-19 and Musculoskeletal Disorders, Office Ergonomics, workspace design, Working conditions, Human Factors in COVID-19 Pandemic Emergency Management, Human-Computer Interface, Usability Simulation and Virtual Environments, Logistics and Supply chain management challenges during COVID, Industry 4.0 in COVID-19 Pandemic, impact and implications of lockdown on Indian economy, social implications of COVID-19 and



Dr Pamita Awasthi
Assoc. Prof.
Deptt. of Chemistry
NIT Hamirpur

Role of Science and Technology for Mitigation and rehabilitation, etc.



Dr S K Mishra
Registrar
NIT Jalandhar

There is no easy way to describe their help-suffice to say that without them this event would not be possible. The conference witnessed overwhelming response and resulted in more than 100 good quality papers and 15 technical sessions under various tracks. We want to thank our research scholars, organizing secretaries, for helping us in so many ways. We cannot emphasize and thank

enough the area chairs, reviewers, advisory committee members, and authors for their many contributions for a high quality conference. Above all, we pay heartfelt gratitude to Shri Subhash Chandra Ralhan, Chairman BOG and Director, Dr L.K Awasthi for everlasting guidance, support and dynamic leadership that inspired us to work over the most contemporary issues.

Wish you all good health and best of spirit.

Jai Hind !



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INDEX

S. No	Title of Manuscript	Author(s)	Page No.
1.	Impact of COVID-19 on Socio-Economic and Perceived Stress Level among Scheduled Caste Single Mothers	Boominathan R, Ramesh P, and C Satheesh Kumar	1
2.	National Centre for Financial Education for A Financially Aware and Empowered India	Suresh G	5
3.	Phytochemical Screening, GC-MS, FT-IR Analysis of Methanolic Extract of Pergularia Daemia Linn, Forsk. (Utarani).	Ramankumar R Chandaka, Nachiket S Dhighe	16
4.	Impact of Covid-19 on the Indian Economy and Supply Chain	Sruthi. S	22
5.	Status of Health Inequality in Eastern India: A Geospatial Analysis	Dhananjay Patra	29
6.	Impact of COVID-19 Globally	Sheenu Nayyara, Kulbhushan Agnihotrib, Nishi Sondhic	36
7.	Applications of Industry 4.0 Technologies in Fish Processing Industries in Wake of COVID 19	Manivel Karthikeyan, Pradeep Ramesh and Karthickumar P	49
8.	Machine Learning Model to Predict and Map Happiness Index with Growth Rate	Shakti Arora, Vijay Anant Athavale	58
9.	Lockdown Implications on Various Environment Components During Covid-19	Sanjeev Kumar, Davinder Singh	64
10.	Emerging Trends in Software Engineering Post COVID-19	Deepika Singh, Tanya Garg	72
11.	Opportunities and Mitigation Strategies for Biomaterials: To Combat the Challenges of COVID-19 Outbreak	Shubhadip Paul and Shreyasi Paul	79
12.	Review on Applications of Artificial Intelligence in Brain Computer Interface	Debrupa Pal	87
13.	Formulation and Evaluation of Nanoemulsion for Non-Steriodal Anti-Inflammatory Drug	Vaibhav V Changediya, Rupalben K Jani	96
14.	Cloud Based and Machine Learning Integrated Tele Medical Approach for Patient Care During Covid-19 Pandemic	Sunil Gupta, Akansha Bansiya, Mansi Saini and Amuleek Sidhu	101
15.	COVID-19 Impact on Financial Markets: Evidence from India	Ms. Aparna Shukla	106
16.	Future of Manufacturing Sector After COVID 19	Guravtar singh, Lakhwinder Pal Singh , Pramod Kumar	113
17.	Impact of COVID 19 on Global Supply Chain	Gurmail Singh, Amit Dutt	119
18.	The Spread of Covid-19 and the Effect of Lockdowns on The Indian Environment	Gurpreet Singh, Harmesh Kumar	126
19.	Role of Technology in Business During Lockdown: An Empirical Study	Tripti Tiwari, Mohit Tiwari	136
20.	Education in The Pandemic Situation – Role and Limitation of Technology and The Road Ahead	Mohit Tiwari, Ms. Tripti Tiwari	146
21.	Study on Various Sources of Finance Available to Entrepreneurs in India	Harshpreet Kaur, Nittan Arora, Simarpreet Kaur	156

22.	Government Assistance to Agriculture Sector- Loan/Debt Waiver Scheme	Simarpreet Kaur, Nittan Arora, Harshpreet Kaur	161
23.	A Wideband Monopole Microstrip Antenna Using Two Cross- Shaped Radiator	Reshmi Dhara	169
24.	Socio-Economic and Health Implications due to Current COVID-19 Pandemic and Mitigation Strategies	Ruby Bhullar Garcha, Dr. Anjana Bhatia	179
25.	Impact of the COVID-19: Outbreak on Digital Payments in India	Sonia Chawla and Shani Kumar	196
26.	Review on Enhancement of Efficiency and Effectiveness of Material in Polyethylene Terephthalate Recycling Process	Yash Kishorbhai Joshi, Dr L P Singh	201
27.	Changing Dimensions of Marketing Communication in The Digitized Era	Swatantra Kumar and Prof. Sanjay Baijal	210
28.	Work from Home During Covid-19: A Cross-Sectional Analysis	Dr. Pooja Kansra	219
29.	Indian Libraries are Responding to Covid-19 Pandemic: With Special Reference to National Libraries I.E Nli, Ndli, Nvli And Nassdoc	Ramesh Yernagula	225
30.	Economic Impact of Covid-19: The Case of Uzbekistan	Dr Neha Bankoti, Dr Sweta Dixit, Dr Ajanta Deb	232
31.	Impact of Covid-19 on Logistic and Supply Chain of Indian Fisheries Sector	Pradeep Ramesh, Harini Ravi, Bavasri Ravichandran	242
32.	A Study on Performance Evaluation of Close Ended Mutual Fund Schemes in India	Nittan Arora, Dr. Sonia Chawla	248
33.	Privacy Preservation of Covid-19: A Review	Kritika Sharma, Dr. Kanwal Garg	258
34.	Socio-Economic and Health Challenges Due to COVID – 19 In Locked Union Territory (Jammu And Kashmir)	Mohd Altaf Beigh, Tanveer Sharma, Sameer Ahmad Ganai	264
35.	Adoption of Online Learning by Students- A Case Study	Dr. D. Shobhana, Subba Rao Kachiraju, Prabha Shukla	271
36.	X-Ray Radiography for Based Covid-19 Infection Detection: A Review on Possibilities and Limitations	Tushar Kanti Bera and Sampa Bera	277
37.	Ultraviolet (UV) Light Based Sanitation Systems for Disinfecting the Covid-19 Virus: Possibilities, Limitations and Challenges	Tushar Kanti Bera	282
38.	Analysis of Recommendation Systems: Techniques and Methodologies	Suresh Kumar, Jyoti Prakash Singh, and Sunil Dalal	290
39.	Significance of Game based User Interface in Spreading Covid-19 Awareness Among Users	Nikhitha Chowdary, Nishtha Arora, Dr. Goldie Gabrani, Dr. Sunil Gupta	298
40.	Impact Assessment of Covid-19 Pandemic on The Top 10 Affected Countries	Dr. Ruchita Verma, Dr. Dhanraj Sharma, Ms. Shiney Sam	306
41.	Impact of Covid-19 On Indian Education System: A Critical Study	Amandev Singh Sidhu	317

42.	Socio-Economic Impact of COVID 19 Pandemic in Kashmir	Huma Akhtar Malik, Fizana Ashraf Malik	321
43.	Impact of Covid-19 Pandemic on MSME Sector of Indian Economy	Dr. Gursimran Kaur, Mrs. Priya	328
44.	COVID and A Failing Economy: A Two-Front War for Syria	Md Zeeshan Mohnavi, Md Faizan Mohnavi, Md Imran Mohnavi, Md Rizwan Mohnavi	339
45.	Effects of COVID 19 Pandemic on Changes In Lifestyle And Physical Activities Of The Female College Students In India	Chauhan M.K., Sarma N., and Patel P.	351
46.	Impact of Covid-19 On Economic and Educational Status of Scheduled Tribes	Arul Actovin C , C Satheesh Kumar	361
47.	Dinkelbach Based Green D2D Communication Model for 5G and IoT Application	Krishna Pandey, Rajeev Kumar Arya, Vipin Sharma, Sandeep Kumar	367
48.	An Overview on History of Pandemics and The Oscillating Trends of Indian Economy Amid COVID-19	Santankumar Chaurasiya, Harpal, Gurraj Singh, Monika, Jaspreet Kaur	373
49.	Impact of Covid-19 Pandemic on Psychological and Physiological Health Status Among Academic Personnel: A Survey-Based Study	Chander Prakash, Lakhwinder Pal Singh , Rohit Kumar	387
50.	Socio-Economic Impact of COVID 19 Pandemic in Kashmir	Huma Akhtar Malik , Fizana ashraf malik	396
51.	Challenges in Education in The Time of Pandemic in India	Sulagna Saha, Nand Kishore Baraik and Sumit Kumar	404
52.	Helpless Education Sector in India During Covid-19	Ranjeet Kumar Ambast, and Ravi Kumar Arya	414
53.	The Impact of Covid-19 Lockdown on The Perceived Stress Level and The Mental Wellbeing of The Emerging Adults	Prasath Selvaraja, Anbu Krishnamoorthyb, Shankavi Vivekanandhanc, Haritha Manoharand	419

IMPACT OF COVID-19 ON SOCIO-ECONOMIC AND PERCEIVED STRESS LEVEL AMONG SCHEDULED CASTE SINGLE MOTHERS

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ABSTRACT

Increasing of the spouse's death, divorce and separation rates in India have resulted more growth in the number of single parent families. The problems of single mothers are linked with the upbringing of their children. According to UN report (2019), there are 4.5 percent of family which is run by Single mothers and also single headed family population are 13 million living in India. This study focused on the impact of COVID-19 Pandemic on Socio-Economic status and Perceived stress level of scheduled caste single mothers during the lockdown. The Descriptive research design was used and followed by semi-structured interview schedule on socio-economic and impacts of a pandemic. The perceived stress level scale developed by Sheldon Cohen (1983) administered in order to understanding the perceived stress level of the respondents. The data were collected from forty respondents of villages of Kandamangalam block in Villupuram District, Tamilnadu. From the study findings reveals that the majority of the respondents were daily wage workers. The major proportions of the respondents were widows. The Majority of the respondents were coming under the category of below poverty line and their socio-economic status declined comparatively before lockdown. The most of the respondents were losing their job during the lockdown. Because of the COVID-19 pandemic, which leads to perceived stress among the respondents due to upbringing of children in education, settlement and securing life. Through the study, the researchers have found that the majority of the respondents have economically unsound and also mostly affected more by psychologically. The study suggests that the government can relook the present welfare schemes in order to increase the welfare of the schedule caste single mothers.

I. INTRODUCTION

The 21st century is a time of profound transformation in society. According to UN report (2019), there are 4.5 percent of family running by Single mothers and also single headed family population are 13 million living in India, the high rate of death of spouse, divorce, and separation as well as the prevalence of widows indicated by both national and international indicators. In India Family is a fundamental system. The socio- economic, political, and cultural changes that have been produced are reflected in the changing face of family. All over India there are 1108 types of schedule caste population living in 28 state and eight union territories. The schedule caste single mother headed family is mostly economically unsound due to various reason like poverty, unemployment etc., the corona virus (COVID-19) pandemic has surprised the earth, following significant loss of life, income, health, and economic stability for many people. The COVID-19 virus were banquet entire global and

around 34.8 million cases affect and one million people has death by globally (WHO,5th Oct, 2020). The sudden spread of COVID-19 virus has created very worst of pandemic situation. Most of the economic experts estimated that due to spread of coronavirus the global economic have been fallout and in all kind of category people will affect more, however the spread meet to be control through proper societal interventions (Daniel Kurt (2020). Single parent families are at a higher risk of poverty and poor health than both parent families. Single parents have to face social problems, violence and stigma based on prejudices, stereotypes and myths. Now schedule caste families find themselves trying to adjust to the new normal life. This phenomenon has become one of the serious social issues in schedule caste single mothers headed families.

This research study is focusing on impact of COVID-19 on socio-economic and perceived stress level among scheduled caste single mothers.

Objectives:

- To understand the Socio demographic profile of the respondents.
- To know about the impact on COVID-19 of the economic status among the respondents
- To assess the Perceived Stress level of respondents.

II. METHODOLOGY

The present study used descriptive research design administered semi-structured interview schedule on socio-economic condition, impacts of a pandemic and the perceived stress level scale developed by Sheldon Cohen (1983) in order to understanding the perceived stress level of the respondents. The data were collected from 40 respondents in Rampakkam, Sornavour keezhpathi, Sorappur and Veeranam villages at Kandamangalam block, Villupuram District, Tamilnadu.

III. RESULTS

From the collected data, Socio-Demographic profile, Economic impact and perceived stress level has analysed.

A) Socio-Demographic profile

The socio demographic profile of the respondents were analysed in above table-I. The research finding shows that, the age of the respondents ranges from thirty-three years to sixty-nine years. Less than half (42.5%) of the respondents were belonging to the age group of thirty years to forty years. More than one third (35%) of the respondents has completed their primary education. Majority of the respondents were staying with their children with one and two siblings. Three forth (75%) of the respondent's engaged as agricultural laborer

for their occupation. Little more than half (52.5%) of the respondents were getting their monthly income Rupees below five thousand. More than half (55%) of the respondents lost their spouse due to various health issues, one fourth (25%) of the respondents lost their spouse due to intake of alcohol related death.

B) Economic Impact of Pandemic

The table-II shows that little more than two third (67.5%) of the respondents were psychologically and economically affected and one tenth (10%) of respondents had in Socio-economic and psychological difficulties. Majority (87.5%) of the respondents were lost their occupation and that led to financial instability among them. In order to full fill their basic needs the respondents managed through getting credit from Money Lenders, SHG’s Loan, Relatives, Friends, Jewel Loan and Pawn Brokers. The respondents utilized the credit for the purposes of basic needs, Health Purpose, Home construction, Family and other Relative Functions.

C) Perceived Stress Level

Table 3: The Perceived Stress Level

S. No	Perceived Stress Level	Frequency	Percentage
1	Low	0	0
2	Moderate	29	72.5
3	High	11	27.5
	Total	40	100

Less than three fourth (72.5%) the respondents perceived stress level was moderately.

IV. DISCUSSION

The SARS-CoV-2 has caused by respiratory illness, called COVID-19 (Lauren M. Sauer, M.S, 2020). On 11th March 2020 the World Health Organization (WHO) has declared COVID-19 as pandemic (WHO, 2020) In worldwide, the COVID-19 pandemic has affected worst in health sector and other sectors too in multiple levels. The current unpredicted pandemic has wide the gap of socio-economic inequality in Indian society. The study finding reveals that half (51%) of the respondents living without their spouse around one to ten years. The reason of loss of spouse most of the respondents were died due to various health problem and others by due to intake of alcohol related death and road accident. Most of the schedule caste single mothers are completed their education in primary level. Similarly, Härkönen (2018) the lower levels of education among single parents were found to be a partial explanation of their elevated poverty risks. The most of the respondent’s occupation is based on agriculture, except few of them working in private company as laborer. Due to COVID-19 pandemic, most of the respondents lost their job. Majority of them adjusted their day today life by credit from money lenders and self-help groups (SHG’s) for buying their daily home

needs and other family and relative functions. Majority of the respondents were financially got debt getting by various sources like money lenders, jewel loan, neighbors and relatives. Majority of the respondents expecting any government decent job according to their educational qualification especially these who are more youngest single mothers.

The maintenance the family and support of their children education majority of them working whichever work they are getting and continuing. Sometimes the Mahatma Gandhi National Rural Employment Guarantee scheme (MGNREGS) were assisting the respondents for hundred days of wage-employment financially. Most of respondents were living in hut types of home still now there is no proper support from anyone for constructing their own home, few of the respondents were living in under constructed house due to unavailable of fund to construct further. Some few of studies have been reported that regarding psychological distress, Stress, health concerns instigated from stressors (Campbell et al. 2015; Van de Velde et al. 2014). The study Rebecca Jayne Stack, Alex Meredith (2017) indicates that single parents were having high level of psychological distress, anxiety and stress which were related to their present position of sole responsibility and concerns about economic status. However, the current study researchers have identified that the scheduled caste single mothers economical condition directly affecting their psychological wellbeing. However, the current study the researchers has identified the barriers and facilitators of stress level, particularly, psychological management, support from other family members, overcome from the stress, financial hardship and isolation during the pandemic situation. For many single mothers has affected more in the aspect of psychological stress, fear and its making weaker to economically also, sometimes they feelings that how going to manage and settled their children.

V.CONCLUSION

The COVID-19 Pandemic has impacted among socio-economically sound to unsound communities in various factors. The schedule caste single mothers are the vulnerable group among the marginalized communities. Through this study finding reveals that the schedule caste single mothers have economically poor and affected more psychologically too. The study suggests that the government can relook the present welfare schemes in order to increase the welfare of the schedule caste single mothers. The health professionals like psychologist, social workers have to strengthen the schedule caste single mother's mental health. The civil organization can concentrate to their economical sustainability of the single mother's through self-sustainable programme.

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Declaration of Respondents Consent

The researchers obtained both oral and written consent from all respondents. The respondents were accepted to participating the research.

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Nil.

Conflicts of Interest

Nil.

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ABSTRACT

Most of the countries adopted unified and coordinated strategies for financial education for the people. India has a large population and fast-growing economy with focusing inclusive growth and vital need for developing an energetic and stable financial system for all sectors of people, especially for young generation. In India, for implementation of National Strategy for Financial Education, the National Institute of Securities Market (NISM) has identified the National Centre for Financial Education (NCFE) as the Nodal Agency. With the support of all Financial sector Regulators of India such Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), Pension Fund Regulatory & Development Authority (PFRDA), Insurance Regulatory and Development Authority (IRDA), and Forward Markets Commission (FMC), the NISM has set up the National Centre for Financial Education for further source of Financial Education and inclusion in our country in a collaborative approach. This paper has taken efforts to summarize the programs, campaigns, workshops, seminars, Trainings, discussion form initiated by NCFE to promote the essentiality of the

Financial Education for each sector of people across the country according to National Strategy for financial Education. The data for this present study have been collected through the secondary sources. The secondary data have been obtained from the website of National Centre for Financial Education, the Survey/Annual reports, the bulletin, booklets, pamphlets, fliers, worksheets, statements, Financial literacy guides/posters, various reputed journals and newspapers.

Keywords: Financial Education, Financial Literacy, Financial Education Programmes. Money Smart School Program (MSSP).

I. INTRODUCTION

It has come a general truth by the research conducted around the world, the level of financial literacy among the common people and well-educated people prevails in low level as considering the understanding about financial concepts such as savings, budgeting, Money management, insurances, financial assets, interests, investing, government initiatives, credit scores, better borrowings, time value of money and one's rights connected to finance and money. Financial Education is nowadays attractive new trend in most of developing and developed countries to extend the awareness on financial concepts. Most of the countries adopted unified and coordinated strategies for financial education for the people. India has a large population and Ifast-growing economy with focusing inclusive growth and vital need for developing an energetic and stable financial system for all sectors of people, especially for young generation.

By the Government of India and the states, every youth have been provided basic literacy, school education, college education and higher education, vocational education, professional education, as per requirement, availability, necessities raised in his/her life stages. When a youth comes out from regular education system, he/she is intended to lead rest of his life with required financial matters, as the finance management in his life determines all his needs and changes for a good life style. A youth with empowered financial literacy and management of finances effectively, he could take better decisions on every financial matters and get tremendous progress in different financial requirement raised in day to day life. There is a need to avail necessary basic financial concepts to make his life style in a best way.

II. OBJECTIVES OF THE PAPER

1. To summarize the activities being carried out by the NCFE in view of promoting the Financial Education in India among all sector people.
2. To critically analyze the initiatives and key services provided by NCFE on Financial Education for the beneficial of the people entire country.

III. METHODOLOGY

This present study is descriptive in nature and based on the secondary data that have been gathered through various articles, newspapers, reputed journals, National Centre for Financial Education, the Survey/Annual reports, the bulletin, booklets, pamphlets, fliers, worksheets, statements, Financial literacy guides/posters.

IV. REVIEW OF LITERATURE

The author reviewed many research articles, research papers from reputed journals, newspapers on Financial Education, Financial Literacy, Financial Inclusion, and Financial Management.

Aisa Amagir et al., (2018) have provided through the study carried out that financial education can improve the children's and adolescents' financial literacy level in schools and enhance the capabilities. There are some indicators regarding to three components of definition of financial literacy, financial education programs on school-based might improve the financial knowledge and attitudes of children and adolescents. The retention results of the study proved to be small and measured short term effects. Through the available evidences of the study suggested that the programs of financial education in colleges and secondary schools would be effective in reducing gender gap. The findings of the study support that financial literacy education should start in elementary schools as early as and should be repeated in colleges and secondary schools. Further, they concluded that financial literacy education must be compulsory in school curriculum to ensure continuous learning.

Boukje Compen et al., (2018) examined the elements important to the effective (TPD) Teacher Professional Development in Financial Literacy Education by a systematic literature review. By proposing a revised presentation of an existing general TPD model, they provided a Theoretical underpinning for literature review. Their results provided the insight into learning goals in financial literacy education among the students, the teaching behavior, the required quality and the contextual factors which play a role. Moreover, their findings suggested the lack of studies that investigate systematically whether and how the initiatives of TPD strengthen the effect of Financial Education among the students' financial literacy.

Diego Bellini et al., (2019) focused their study on mathematical competencies which needed for professional and educational tasks to enhance the talents. Their findings suggested the essentiality for considering sub dimensions of competence in mathematics to fill gap amongst the students in domains of mathematical competence and the results held promise to future research. It gives to the teacher's useful elements to target interventions for enhancing the speed of children's learning. The findings of the study show gender effect and positive correlation between the actual school performance among the students during the academic year and the scores of Mathematical Competence Scale (MCS). The MCS allows reading of teaching – learning process in perspective of sustainable development and psychology of sustainability and helps the teachers to sustain the talents of students through numeracy skills. The research of **Gosaitse E. Solomon et al., (2018)** reveals that the financial literacy level in both developed and developing countries are very low among the people of all ages. Through their study, the reprehensible state of affair has contradictory implications on the well-being of the populace, as evidenced by increased lower saving, indebtedness, poor planning for retirement, and making of many poor personal financial decisions. At secondary school level in Botswana and literature published on the subject of Personal Financial Literacy (PFL), they have analyzed the business subjects' curriculum. Further, they found that there is a need to offer PFL to learners in School system and exists a gap in the area. Furthermore, they discussed the benefits of personal financial education and concluded by recommending that a mandatory PFL subject in Secondary school curriculum in Botswana.

Kaiser and Menkhoff (2019) have shown through their studies that the financial education impacts financial behavior and financial knowledge and evidence suggested that financial education have important positive externalities such positive effects on financial knowledge of teachers and parents and recent experiments showed that financial education has an effect on inter temporal decision making among the youth and children, leading to consistent and patient inter temporal choices. They proved that the financial education improves understandings of financial affairs.

Arya P.(2018) conducted a research to provide the snapshot of existing status of Financial Literacy in India by many survey results and programs related to financial literacy in India. According to the survey of researcher, the access to finance by the poor sections in the

society living depends on degree of financial literacy available for the people. Further, for reduction of poverty, social cohesion, such group of people must be financially educated and to be brought to the normal financial climates.

Chijwani, M., & Vidyapeeth, D. Y. P. (2014) studied the financial literacy level of working women and in the research, the authors have assessed the knowledge of women on investment in many financial instrument by structured closed ended tools among them. The result of the analysis provide that women in India, inspite of their illiteracy on finance, they possess such kind of knowldege on financial matters and majority of women are ignorant on different investment opportunities as they are not having Demate account and not doing trade normally.

To deliver financial services and facilities, there is an acute requirement of financial inclusion to the people in equitable and transparent manner in the affordable cost. **Sanjukta Kumari (2009)** defined the objective as “The financial inclusion grants business opportunity for the financial institution at bottom of pyramid tot expands the volume of the business. Profitability can be only be increased by finding new avenues for deployment of funds.” Further, by the data collected, the researcher found that there is a vast prevalent of financial exclusion and the poor in the society could not be able to access financial services adequately from organized financial system, hence an imperative need to change the financial and credit services system to attain greater financial inclusion

Kumar and Ranganath, (2012) conducted a research to describe the future prospective of financial inclusions in India and explained how the Technology play vital role for its application. In their study, they have given a caution here to serve our poor villagers, our need is “Technology with a human touch” the banks must take care extra to ensure that poor people are not driven away by banking so the Technology interfaces are unfriendly.

To explore the initiative taken in India to overcome the barriers on financial inclusion and the role of financial inclusion for economic development, **Vanishri R. Hundekar (2018)** critically analyzed and found that for uplifting the living standard and for economic growth, the financial inclusions have enough scope. The study has elaborated such financial inclusion initiatives such as No-Frills Account (NFAs), Kisan Credit cards (KCCs), Self Help Group - Bank Led Initiative (SLBP), Business Facilitators (BFs)/Business Correspondents (BCs), Bank branch authorization, Mobile Banking, Kiosk / ATM based banking, Branchless Banking, Aadhaar Enabled payment services, Women SHGs Development Funds.

V. NATIONAL CENTRE FOR FINANCIAL EDUCATION (NCFE)

The Government of India has undertaken many initiative steps for providing financial education and promoting financial mindset among the people for concrete confidence and independency in managing financial matters to lead a better life style with financial strength and stability. We all aware that there is an existing gap between investments and regular savings among the people due to lack of knowledge on financial concepts, awareness on financial products, services provided by the financial agencies. The Government has taken various effective initiative measures for providing financial education for all sectors of people through its agencies such as Reserve Bank of India (RBI), National Council of Educational Research and Training (NCERT), Securities and Exchange Board of India (SEBI), Pension Fund Regulatory & Development Authority (PFRDA), Insurance Regulatory and Development Authority (IRDA), National Centre for Financial Education (NCFE). Each Agency have involved for providing valuable schemes, better financial services, for creating awareness on financial services, financial products, financial practices through uploading necessary inputs on financial concepts, creating effective messages, a number of lectures, in websites of the financial agencies in many Indian languages for the beneficial of the students.

The website section of all the financial agencies have a lot of messages on financial education with uploaded reading materials, games on financial concepts, messages in the modules have been given with colorful pictures, tables, required examples, simplified messages on savings, investing, financial planning for future and the beneficiaries can understand the concepts of banking, services provided by financial institutions, investment planning, financial benefits provided by the government and other organizations. Further, for promoting financial awareness, the financial agencies organize various competitions for school students on topics related to financial inclusion, insurances, pension schemes, retirement plans, investment scheme and organizes many exhibitions to extend financial literacy services.

National Centre for Financial Education (NCFE) has been established under Section 8 (Not for Profit) Company promoted by Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), Insurance Regulatory and Development Authority of India (IRDAI) and Pension Fund Regulatory and Development Authority (PFRDA). The NCFE promotes financial education across the country for all sector people and creates financial awareness and empowerment by conducting workshops, seminars, training program, and discussion forums. It has created more financial educational materials in electronic and non electronic formats also, pamphlets, booklets, fliers, worksheets, technical aids to enhance the financial knowledge, skills and competencies, understanding the concepts of finance and developed large number of blogs in its website on Financial Literacy, Financial planning, Loan & Borrowing, Banking, mutual fund, investment, retirement planning.

Objectives of the NCFE

- To encourage and promote the financial Education, across the country, for each sector of people, according to the National strategy for Financial Education formulated in this regard.
- To generate financial awareness and make empowerment among the people living in all sectors by financial education campaigns such, seminars, workshops, conclaves, trainings, programmes, campaigns, discussion forums with/without fees by itself or with help of institutions, organisations and provide training in financial education and produce financial education material in electronic or non-electronic formats, workbooks, worksheets, literature, pamphlets, booklets, fliers, technical aids and to prepare appropriate financial literature for target based audience on financial markets and financial digital modes for improving financial literacy so as to improve their knowledge, understanding, skills and competence in finance.

Mission of NCFE

To undertake massive Financial Education campaign to help people manage money more effectively to achieve financial well being by accessing appropriate financial products and services through regulated entities with fair and transparent machinery for consumer protection and grievance redresses.

Key components of financial education efforts by NCFE

With the main role of NCFE for creating financial education material for respective financial sectors, it creates and maintains a website exclusively for promoting the financial education. All the regulators and ministries websites shall have a link to the NCFE website. NCFE website shall have the details of various education programmes conducted across the country, financial education material including brochures, FAQs, videos etc. All educative materials

prepared by individual organizations shall also be made available on the NCFE website. The website should be a one stop repository for all financial education activities and material. The website should also be made available in various regional languages.

VI. FINANCIAL EDUCATION WITH THE FINANCIAL REGULATORS

The NCFE has developed a content as Financial Education in its website to extend financial services of the Financial Regulators such as RBI, SEBI, PFRDA, IRDAI. Themes such Financial Literacy, Banking, Loan & Borrowing, Financial Planning, Mutual Fund, Investments related videos, posters, materials with guidelines have been provided with well explanations in colorful pictures to inculcate the themes.

For newly inducted people in the financial system, the Financial Literacy theme has been developed by NCFE. The financial concepts such as Income, Expenses, budgeting and the priorities for Needs & Wants were explained with simple and colorful pictures. The importance of manage our money, how the financial goals should be set for short, medium and long term with specific, measurable, attainable, relevant and time based manner were provided with detailed and using in an informative method. The following concepts were provided with in detail with colorful pictures to inculcate the same for the beneficiaries.

- Income, Expenses and Budgeting
- Saving
- Credit and Debt Management
- Insurance
- Investment
- Retirement and Pensions
- Financial Planning
- Government schemes
- Fraud Protection
- Grievance Redressal

Banking and Finance

Under the Banking and Finance column, many financial concepts on services provided by the Banks such as credit/savings accounts, cheque books, mobile banking services

- Legends used in bank account statement
- Saving with banks
- Are you using a valid cheque book?
- What is exchange earners' foreign currency account
- Mobile Banking: A convenient way of transacting
- Saving tips for couples
- Saving beyond the savings account
- Save your Windfall Gains
- Bank Account Mergers

Financial Planning

Everyone has a plan while making expenses whether it is properly planned for in need or for want. If a person has sound Financial Planning, he would get great number of benefits such as to make smarter decisions, to avoid sidetracks and mistakes, to insulate from the turbulence of the economy, etc. By providing necessary skills regarding financial terms to the human being from the childhood, one can make financial planning in greater manner. The beginning

of the financial planning makes a human being to identify the financial problem by root itself and to solve the same in proper way by considering the factors.

To achieve financial freedom, one should know proper financial planning. Now a days, needs and circumstances are changing to every human being. To meet our life goals, we should know Financial Planning-the process of planning and managing our finances-Savings, expenses, income, assets and liabilities. To achieve financial security entire life, we should get to know timely and proper planning of our finances. There is no need for special qualifications for planning finances. We can get help to find all or some concepts as required on financial planning from the Experts like Chartered Accountants, Advisors on financial plan and consultants on Tax. As we all know that the significance and effectiveness of our financial plan always depends our involvement itself in making it. The NCFE has developed a large number of information such as following on financial planning in its domain with depth source of concepts.

- Financial Planning Overview
- What is Financial Planning?
- Broad areas of financial planning
- Who requires financial planning?
- How financial planning is different from wealth management?
- How its Different from Wealth Management?
- Why should you make a financial plan?



Fig.1 Who needs financial Planning;Source, NCFE 2013

Debt Management

The NCFE has developed in its Debts Management domain with extending following such services with detailed information on availing variety of Loans such as home loan, vehicle loan, property loan, personal loan, etc. and repayment procedures, tax benefits, interest schemes on each loan availability.

- Advantages of taking a home loan
- Housing loan terminology decoded
- The downside of 0% interest EMI schemes
- How to become a “loan eligible” borrower?
- Top ten tips to keep in mind while taking a home loan
- Things to note while availing commercial vehicle loan
- Know more about mortgage loan

Understanding Mutual Funds

For the investors, there are variety of investment avenues available. Good investments opportunities are offered by the Mutual funds for the investors. Mutual funds also carry such risks, like all investments. All the investors must measure the risks and yield expected in taking decisions on investments. Best advices may be availed from consultants and experts of mutual funds schemes while making investments. To make aware the investors, about functioning of Mutual funds, the NCFE has elaborately given the following information in question answer format in view of helping the investors in taking better investment decisions. An investor can get clear information about mutual funds schemes, tax beneficiary schemes, etc.

- What is a Mutual Fund?
 - What is the history of Mutual Funds in India and role of SEBI in mutual funds industry?
 - How is a mutual fund set up?
 - What is Net Asset Value (NAV) of a scheme?
 - What are the different types of mutual fund schemes?
 - What are Tax Saving Schemes?
 - What is a Fund of Funds (FoF) scheme?
 - What is a Load or no-load Fund?
 - Can a mutual fund impose fresh load or increase the load beyond the level mentioned in the offer documents?
 - What is a sale or repurchase/redemption price?
 - What is an assured return scheme?
 - Can a mutual fund change the asset allocation while deploying funds of investors?
 - How to invest in a scheme of a mutual fund?
 - Can non-resident Indians (NRIs) invest in mutual funds?
 - How much should one invest in debt or equity-oriented schemes?
 - How to fill up the application form of a mutual fund scheme?
 - What should an investor look into an offer document?
- (source, NCFE, 2013)

Financial Educational Programmers

National Centre for Financial Education has initiated many programmers for creating awareness, generating confidence on financial matters, providing financial services and products such as follows.

Financial Education Programme for Adults (FEPA)

Financial Education Programme for Adults (FEPA) has been initiated for creating financial awareness to the adult population of the country and for generating generate a confidence in the financially excluded sections of the society to use the financial services and products more effectively thereby bringing more people to the formal financial sector. The Adult population such as workers of different organizations, farmers and rural folks, SHG Members, household people, women groups, personnel from forces or other group of people financially excluded section of the society are the target group under this program. NCFE has a network of Financial Education Trainers for conducting this program workshops and materials such on Savings, Income, Banking, Expenses and Budgeting, Digital Transactions, credit and debt management, insurance, etc have been developed for targeting the adult population of the society.

Money Smart School Program (MSSP)

Money Smart School Program (MSSP) is an initiative to provide unbiased financial education in schools for improving financial literacy which is an important life-skill for holistic development of each student. The program is based on two pillars; education and awareness, and aims to establish a sustainable financial literacy campaign that will empower an entire generation.

Salient Features of Money Smart School

- NCFE invites schools to voluntarily introduce financial literacy as a part of their existing curriculum for students of Class VI to X.
- NCFE and CBSE had jointly developed the study material for students of Class VI to X, a set of five Financial Education Workbooks.
- Our financial literacy curriculum has been developed in such a way that it integrates with the existing subjects for different classes.
- Schools can send their teachers to NCFE's Financial Education Training Program (FETP) for school teachers for training purposes. Alternatively, we can also arrange training program for interested schools separately at their own premises.
- These NCFE certified Money Smart Teachers would facilitate in conducting financial education sessions for students in their respective schools. For evaluation of its' students, schools can encourage them to participate in NCFE's National Financial Literacy Assessment Test.
- Schools may also decide conduct their own evaluation in which case NCFE will provide them with all necessary support.

Benefits for the School

The foremost benefit for schools implementing the Money Smart School program is that their students after becoming financially literate will be better equipped to deal with today's complex financial products and services and exhibit prudent behaviour and attitude when it comes to managing their own money. Apart from this other benefits include:

- Schools implementing this program will be certified as Money Smart Schools.
- A certificate and a badge will be issued by the NCFE which the schools can put up in their website and social networks.
- Training and development programs for its teachers at free of cost from time to time.
- Students will be better equipped to perform in the National Financial Literacy Assessment Test.
- NCFE will facilitate school/students visit to financial sector regulators where they can gain a perspective on how the regulatory mechanism in our country works. Schools shall get priority in future endeavors of NCFE and shall be part of social media campaign of NCFE regarding Money Smart Schools.(Source: NCFE, 2013)

Financial Education Training Programme (FETP)

Financial Education Training Programme (FETP) has been initiated for providing unbiased financial education to the people and organizations for enhancing financial literacy of the country. The program, based on two pillars; education and awareness, aims to establish a sustainable financial literacy campaign that can empower people's lives.

FETP for School Teachers

NCFE is conducting FETP for school teachers of class 8 to 10 across India. After completion of the training, these teachers will be certified as "Money Smart Teacher" and would facilitate conducting financial education classes in schools and encourage students to obtain basic financial skills.

Financial Awareness and Consumer Training (FACT)

Financial Awareness and Consumer Training (FACT) has been initiated program by NCFE to provide financial education to our young graduates and post graduates, on topics relevant to them, which will positively impact their financial wellbeing.

Topics for School Curriculum

NCFE has developed number of listed topics for school curriculum to be implemented among the school students who are the pillars of future society. The topics are

- Money
- Household
- Banking
- Investment
- Behavioral Aspects
- Financial Planning
- Insurance
- Retirement and estate planning
- Securities marketing
- Use of technology
- Scams, Frauds, Ponzi Schemes
- Borrowings
- Consumer protection and redressal mechanism
- Taxes
- Importance of maintaining financial records.

Through the above topics, the curriculum has been covered all the required concepts on Finance which required for the students' day today life and future life.

VII CONCLUSION

Most of the countries adopted unified and coordinated strategies for financial education for the people. India has a large population and fast-growing economy with focusing inclusive growth and vital need for developing an energetic and stable financial system for all sectors of people, especially for young generation. The Government of India has taken various effective initiative measures for providing financial education for each sector of people in this society entire country, through its agencies. Each Agency have involved for providing valuable schemes, better financial services, for creating awareness on financial services, financial products, financial practices through uploading necessary inputs on financial concepts, creating effective messages, a number of lectures, in websites of the financial agencies in many Indian languages for the beneficial of the students.

In India, for implementation of National Strategy for Financial Education, the National Institute of Securities Market (NISM) has identified the National Centre for Financial Education (NCFE) as the Nodal Agency. With the support of all Financial sector Regulators of India such Reserve Bank of India(RBI), Securities and Exchange Board of India (SEBI), Pension Fund Regulatory & Development Authority (PFRDA), Insurance Regulatory and Development Authority (IRDA), and Forward Markets Commission(FMC), the NISM has set up the National Centre for Financial Education for further source of Financial Education and inclusion in our country in a collaborative approach. The website section of all the NCFE have a lot of messages on financial education with uploaded reading materials, games

on financial concepts, messages in the modules have been given with colorful pictures, tables, required examples, simplified messages on savings, investing, financial planning for future and the beneficiaries can understand the concepts of banking, services provided by financial institutions, investment planning, financial benefits provided by the government and other organizations. For teachers, Financial Education Training Programmes(FETP) has been developed and the trained teachers through this program, basic concepts on financial education will be provided for the students. A School Curriculum has been developed for school students. A large number of topics on financial terms such as Financial planning, budgeting, savings, investments, etc have been created to inculcate the concepts among the school students. We all aware that NCFE is an organization, created under section 8(Not for Profit) provide incredible services on financial education for each sector people in the society all over country. The Educational Institutions, Governmental and Non-Governmental Organizations around the country may take necessary initiatives for utilizing the services of NCFE for providing and promoting the basic financial literacy skills and awareness among the people so that they can lead their financial life in a smooth manner by taking financial decisions quickly and right way whenever required in all life stages. Through these efforts, we can achieve the target for financially aware and empowered India.

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PHYTOCHEMICAL SCREENING, GC-MS, FT-IR ANALYSIS OF METHANOLIC EXTRACT OF PERGULARIA DAEMIA LINN, FORSK. (UTARANI).

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ABSTRACT

The purpose of the current study is to monitor the phytochemical constituents in the *Pergularia daemia* linn Forsk, by GC MS and FT-IR analysis. The whole plant of *Pergularia daemia* linn Forsk. was extracted with Methanol at room temperature for 8 h. The bioactive compounds of *Pergularia daemia* linn Forsk. have been evaluated using GC-MS and FT-IR. Preliminary phytochemical analysis revealed the presence of tannins, terpenoids, flavonoid, alkaloid, phenol, phytosterol Quinones and saponins. Totally 15 compounds were identified and the chromatograph showed peaks with individual compounds. The major constituents were identified in the Methanolic extract were α -Santalol (46.90%), Retinal (10.72%), Alloaromadendrene (5.93%), Megastigma-3,7(E),9-triene (4.80%), Benzene, 1-(1,5-dimethyl-4-hexenyl)-4-methyl (4.38%) 5,8,11,14,17-Eicosapentaenoic acid, methyl ester, (all-Z)-(4.26%) Tricyclo [8.6.0.0(2,9)] hexadeca-3,15-diene, trans-2,9-anti-9,10-trans-1,10 (3.26%) and many other compounds were identified as low level. The FTIR analysis confirmed the presence of N-H, O-H, C=C, C-H, C-O and CH₃ functional groups. The result of this study offers a platform of using *Pergularia daemia* linn Forsk. as herbal alternative for various diseases and it can be used as functional and pharmaceutical food.

Key words: Phytochemical, *Pergularia daemia* linn Forsk. GC MS, FT-IR, α -Santalol and Retinal.

I INTRODUCTION

Whole plant of *Pergularia daemia* linn, Forsk is a large genus belonging to the family *Asclepidaceae*. It comprises about 70 species of whole herb distributed mostly in Southeast Asia as wild and cultivated plants. *Pergularia daemia* linn is a perennial herb with bluish-black rhizome native to Northeast and Central India. Whole plant of *Pergularia daemia* linn, Forsk (Utarani) is also sparsely originated in Papi Hills of East Godavari, West Godavari, and Khammam Districts of Andhra Pradesh. The Whole plant of *Pergularia daemia* linn, Forsk have a high economic importance because of its putative medicinal properties. The rhizomes are used in the treatment of smooth muscle relaxant activity 1 haemorrhoids, leprosy, asthma, cancer, epilepsy, fever, wound, vomiting, menstrual disorder, anthelmintic, aphrodisiac, inflammation, gonorrhoeal discharges, etc. 2 The Whole plant of *Pergularia daemia* linn, Forsk the plant are aromatic in nature. The inner part of the Whole plant is bluish-black in colour and emits a characteristic sweet smell, due to presence of essential oil. 3 Traditionally, the . Are used in treating leucoderma, tumors, asthma, piles, bronchitis etc. The paste is applied on bruises, contusions and rheumatic pains. 4 Fresh rhizome decoction is used as antidiarrhoeic and to get relief from stomach ache. The fresh whole plant paste of *Pergularia daemia* linn, Forsk applied during the snake bite and scorpion bite. 5,6 The advances in analytical techniques, including GC-MS and FT-IR that were powerful tools for identification and determination of phytochemicals compounds. The present study was carried out the bioactive compounds present in the Whole plant of

Pergularia daemia linn,Forsk in methanol extract with the aid of GC-MS and FT-IR techniques, which may provide an insight in its use of traditional medicine.

II MATERIAL AND METHODS

Plant material collection and extraction

Whole plant of *Pergularia daemia* linn,Forsk. were collected from Paithan road, Aurangabad,Maharashtra, and India. The collected whole plant was shade dried, powered and extracted with methanol using Soxhlet apparatus for 8 hours. The extracts were filtered and filtrates were concentrated under reduced pressure at 40o C using a rotary flash evaporator and stored at 4°C until use for phytochemical screening.

Phytochemical Screening

Phytochemical analysis was carried out for identification of tannins, terpenoids, flavonoid, alkaloid, phenol, phytosterol, Quinones and saponins according GC –MS Analysis

Preparation of extract

Whole plant of *Pergularia daemia linn*,Forsk. were shade dried. 20 g of the powdered tubers were soaked in 95% ethanol for 12 h. The extract was then filtered through Whatmann filter paper No.41 along with 2 gm sodium sulfate to remove the sediments and traces of water in the filtrate. Before filtering, the filter paper along with sodium sulphate was wetted with 95% ethanol. The filtrate was then concentrated by bubbling nitrogen gas into the solution. The extract contained both polar and non-polar phytocomponents of the plant material used.

GC Condition and Identification of Compounds

The sample was investigated through Gas Chromatography Mass Spectrometry/Mass Spectrometry Electron Ionization (GC-MS/EI) mode. The GC-MS/MS is a Scion 436- GC Bruker model coupled with a Triple quadruple mass spectrophotometer with fused silica capillary column BR-5MS (5% Diphenyl/95% Dimethyl polysiloxane) and Length: 30m; Internal diameter: 0.25 mm; Thickness: 0.25 µm. Helium gas (99.999%) was used as the carrier gas at a constant flow rate of 1 ml/min and an injection volume of 2 µl was employed (split ratio of 10:1). The injector temperature 250°C; ion-source temperature 280°C. The oven temperature was programmed from 110°C (isothermal for 2 min), with an increase of 10°C/min, to 200°C, then 5°C/min to 280°C, ending with a 9 min isothermal at 280°C and total GC running time was 41 min.9 This last increase was to clean the column from any residues. The mass spectrometer was operated in the positive electron ionization (EI) mode with ionization energy of 70eV. The solvent delay was 0-3.0 min. A scan interval of 0.5 seconds and fragments from m/z 50 to 500 Da was programmed. The inlet temperature was set at 280 °C, source temperature 250 °C. The relative percentage amount of each component was calculated by comparing its average peak area to the total areas. Software adopted to handle mass spectra and chromatograms was MS Work station 8. The NIST Version 2.0 library database of National Institute Standard and Technology (NIST) having more than 62,000 patterns was used for identifying the chemical components. The GC-MS/MS was performed by Food Safety and Quality Testing Laboratory, Institute of crop processing technology, Thanjavur.

FTIR Spectroscopic Analysis

Fourier transform infrared spectrophotometer (FTIR) is perhaps the most powerful tools for identifying the types of chemical bonds (functional groups) present in compounds. Dried powders of different solvent extracts of each plant material were used for FTIR analysis.

10mg of the dried extract powder was encapsulated in 100 mg of KBr pellet, in order to prepare translucent sample disc. The powdered sample of each plant specimen was loaded in FTIR Spectroscope (Shimadzu, IR Affinity1, Japan), with a scan range from 400 to 4000 cm^{-1} with a resolution of 4 cm^{-1} .

III RESULTS AND DISCUSSION

Plants are very important source of potentially useful bioactive principles for the development of new chemotherapeutic agents.¹⁰ The biological and pharmacological properties of many plants are still unknown. World over, the scientists are exploring the potential of utilizing pharmacologically active compounds from medicinal plants.¹¹ Herbal medicines are used by 80% of the people worldwide due to its high efficiency, cheap cost, nonnarcotic nature and fewer side effects.¹² In the present study, the exploration of phytochemical screening with Methanol extract of *Pergularia daemia linn* revealed the presence of carbohydrate, flavonoid, steroid, phenol, alkaloid, tannin, amino acid, terpenoid and glycoside compounds which are known to have remedial activity against diseases producing pathogen. Therefore it can be used pharmacologically to develop new compounds for health benefit (Table 1).

Table 1: Phytochemical constituents present in Methanolic extracts of *Pergularia daemia linn*

S.No	Phytochemicals	<i>Curcuma caesia</i> Methanol Extract
1	Tannins	+
2	Terpenoids	+
3	Flavonoid	+
4	Phenol	+
5	Phytosterol	+
6	Saponins	+

Phytochemical constitutes of plants serves as defense mechanism against by many microorganisms. The therapeutic properties of medicinal plants are possibly due to the presence of various secondary metabolites.¹³

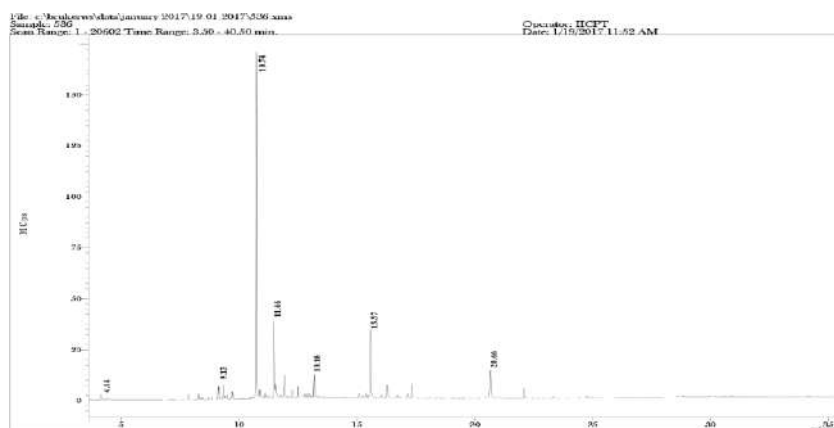


Figure 1: GC-MS analysis of *Pergularia daemia linn* of methanol extract.

Thus the preliminary screening test may be useful in the detection of the bioactive principles and subsequently may lead to the drug discovery and improvement. The compounds present in the methanolic extract of *Pergularia daemia linn*, were identified by GC-MS analysis (Figure 1). The active principles with their retention time (RT), molecular formula, molecular weight (MW) and concentration (%) are presented in (Table 2).

Table 2: Phytocomponents identified in the Methanolic extract of the *Pergularia daemia linn* By GC-MS.

S.No	RT	Name of the compound	Molecular formula	MW	Peak area (%)
1	4.14	(+)-2-Bornanone	C ₁₀ H ₁₆ O	152	0.91
2	4.39	Isoborneol	C ₁₀ H ₁₈ O	154	0.40
3	7.85	Alloaromadendrene	C ₁₅ H ₂₄	204	0.63
4	9.13	Benzene, 1-(1,5-dimethyl-4-hexenyl)-4-methyl-	C ₁₅ H ₂₂	202	4.38
5	9.33	Tricyclo[8.6.0.0(2,9)]hexadeca-3,15-diene, trans-2,9-anti-9,10-trans-1,10-	C ₁₆ H ₂₄	216	3.26
6	9.71	trans-Sesquisabinene hydrate	C ₁₅ H ₂₆ O	222	1.39
7	10.74	α -Santalol	C ₁₅ H ₂₄ O	220	46.90
8	11.46	Ar-tumerone	C ₁₅ H ₂₀ O	216	10.38
9	11.93	Megastigma-3,7(E),9-triene	C ₁₃ H ₂₀	176	4.80
10	13.18	5,8,11,14,17-Eicosapentaenoic acid, methyl ester, (all-Z)-	C ₂₁ H ₃₂ O ₂	316	4.26
11	15.57	Retinal, 9-cis-	C ₂₀ H ₂₈ O	284	10.72
12	16.29	Androstenediol	C ₁₉ H ₃₀ O ₂	290	2.85
13	17.15	(+)-2-Bornanone	C ₂₄ H ₄₀ O ₄	392	1.03
14	17.32	Isoborneol	C ₂₄ H ₃₂ O ₄	384	2.17

Seventeen compounds were identified in methanolic extract by GC-MS. The major components present in the *Pergularia daemia linn* (Black turmeric) were α -Santalol (46.90%), Retinal (10.72%), Ar-tumerone(10.38%), Alloaromadendrene (5.93%), Megastigma-3,7(E),9-triene (4.80%), Benzene, 1-(1,5-dimethyl-4-hexenyl)- 4-methyl(4.38%), 5,8,11,14,17-Eicosapentaenoic acid, methyl ester, (all-Z)- (4.26%) Tricyclo [8.6.0.0(2,9)]hexadeca-3,15-diene, trans-2,9-anti-9,10- trans-1,10(3.26%) and various other compounds were identified as low level . These phytochemicals are responsible for various pharmacological actions like antimicrobial and anti-oxidant anti-inflammation, Anti-cancer, Hepato protective, Diuretic, Antiasthma activities etc (Table 3). *Pergularia daemia linn* has medicinal value the presence of these major constituents.

Table 3: Activity of phyto-components identified in *Pergularia daemia linn* by GC-MS.

S.No	Name of the Compound	Compound nature	Activity
1	(+)-2-Bornanone	Monoterpene oxide	Anti-tumor, Analgesic Antibacterial, Anti-inflammatory Sedative, Fungicide
2	Isoborneol	Monoterpene alcohol	Anti-tumor, Analgesic Antibacterial, Anti-inflammatory Fungicide, Sedative, Antipyretic, Antifeedent, Candidicide, Hepatoprotective, Pesticide, Perfumery Tranquilizer, Myorelaxant, Antibronchitic
3	Alloaromadendrene	Sesquiterpene	Anti-tumor, Analgesic Antibacterial, Anti-inflammatory Sedative, Fungicide
4	Benzene, 1-(1,5-dimethyl-4-hexenyl)-4-methyl-	Color pigments	Skin care products Anti-inflammatory Anticancer, Antioxidant
5	Tricyclo[8.6.0.0(2,9)]hexadeca-3,15-diene, trans-2,9-anti-9,10-trans-1,10-	Steroid	Antimicrobial, Anti-inflammatory Anticancer, Diuretic, Antiasthma Haepatoprotective
6	trans-	Sesquiterpen	Anti-tumor, Analgesic Antibacterial, Anti-inflammatory

	Sesquisabinene hydrate	e alcohol	Fungicide, Sedative, Antipyretic, Antifeedent, Candidicide, Hepatoprotective, Pesticide, Perfumery, Tranquilizer, Myorelaxant, Antibronchitic
7	α -Santalol	Sesquiterpene oxide	Anti-tumor, Analgesic Antibacterial, Anti-inflammatory Sedative, Fungicide
8	Ar-tumerone	Ketone compound	Anti-tumor, Analgesic Antibacterial, Anti-inflammatory Sedative, Fungicide, Antiarthritic Antidote for arsenic, Anti HIV Anticancer,
9	Megastigma-3,7(E),9-triene	Alkene compound	Anticancer, Antitumor, Expectorant, Memory enhancer
10	5,8,11,14,17-Eicosapentaenoic acid, methyl ester, (all-Z)-	Unsaturated fatty acid ester	Cardio protective
11	Retinal, 9-cis-	Vitamin A precursor	Anticancer, Eye protective
12	Androstenediol	Steroid	Antimicrobial, Anti-inflammatory, Anticancer, Diuretic, Antiasthma Haepatoprotective
13	(+)-2-Bornanone	Acidic compound	Reduce gallstone formation, Chemo preventive
14	Isoborneol	Steroid	Cytotoxic steroid, Anti-inflammatory
15	Alloaromadendrene	cardiac glycoside	Inhibit membrane protein, Strengthen the failing heart

The FT-IR spectrum was used to identify the functional groups of the active components present in extract based on the peaks values in the region of IR radiation. When the extract was passed into the FT-IR, the functional groups of the components were separated based on its peaks ratio. The results of FT-IR analysis confirmed the presence of N-H, O-H, C=C, C-H, C-O and CH₃ functional groups (Figure 2 and Table 4). FTIR spectroscopy is proved to be a reliable and sensitive method for detection of bio molecular composition.

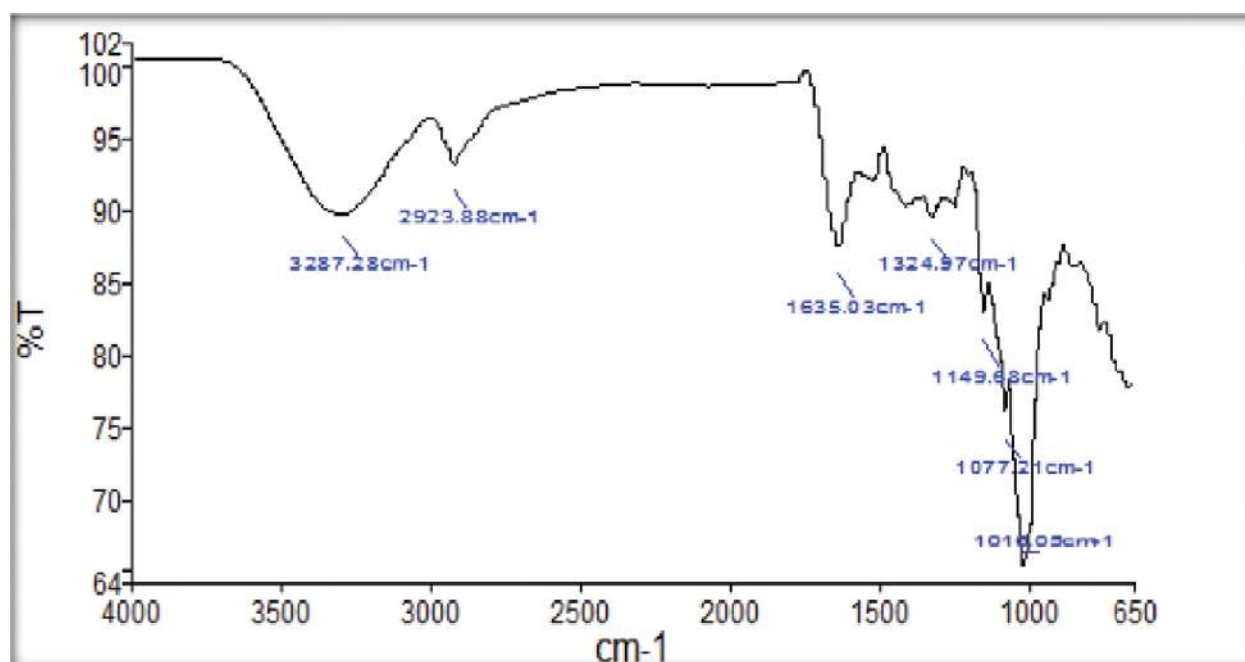


Figure 2: FTIR analysis of *Pergularia daemia* linn.

Table 4: FTIR Peak Values of Methanolic Extract of *Pergularia daemia* linn.

S. NO	PEAK VALUES	FUNCTIONAL GROUPS
1	3287.28	N-H
2	2923.88	O-H
3	1635.03	C=C
4	1324.97	C-H
5	1149.68	C-O
6	1077.21	C-O
7	1016.05	CH ₃

IV CONCLUSION

The present work has been performed to establish the various Phytochemical, GCMS and FTIR parameters, which could serve as important and has commercial interest in both research institutes and pharmaceuticals companies for the manufacturing of the innovative drugs. This primary information will facilitate in conducting further studies on discovery of bioactive constituents, resolve of their efficacy by *in vivo* studies and demonstration of their safety and efficacy in clinical trials.

V SUMMARY

Herbal medicines are used by 80% of the people worldwide due to its high efficiency, cheap cost, nonnarcotic nature and fewer side effects. The therapeutic properties of medicinal plants are possibly due to the presence of various secondary metabolites. The present work has been performed to establish the various Phytochemical, GCMS and FTIR parameters, which could serve as important and has commercial interest in both research institutes and pharmaceuticals companies for the manufacturing of the innovative drugs.

ACKNOWLEDGEMENT

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CONFLICT OF INTEREST

There are no conflicts of interest.

ABBREVIATION USED

GC MS: Gas chromatography–mass Spectrometry; FT-IR: Fourier transform- infrared.

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IMPACT OF COVID-19 ON THE INDIAN ECONOMY AND SUPPLY CHAIN

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ABSTRACT

At present time, world is looking from the coronavirus infection known as Covid-19. The main case of the coronavirus was accounted for in the December, 2019 in the Wuhan city of China which is known as the significant transportation center of China. After the spread of Covid-19 numerous nations have closed down their ocean ports and air terminals. They have restricted the import and fare exercises. Additionally, China is the significant wholesaler of the crude materials which influence the assembling exercises over the globe because of lockdowns. India is the creating nation because of the Covid-19 spread the cases announced in the India government has lockdown the nation for 41 days which influenced the assembling exercises and significantly it influences the gracefully chains and economy of the nation. The current flare-up gives important exercises to organizations as a rule and Indian organizations specifically. Lean gracefully chain systems, while expanding momentary benefits, add to flexibly chain weakness. Covid-19 has shown corporate leaders that in detailing future supply chain, aside from cost, quality and conveyance they would likewise need to pressure test the chains on new execution measures including versatility and responsiveness. Organizations would likewise try to broaden flexibly chains from a geographic point of view to decrease gracefully side hazard from one nation. Numerous wellsprings of key items or key parts would be recognized and conventions will be set up to enact elective wellsprings of gracefully in short notification. There are aggregate of 18 basic boundaries are discovered which influenced the gracefully chains in the India. It is normal that this investigation will supportive the specialists to build up the theoretical models to defeat from this issue. This research paper primarily aims to study about the impact of COVID-19 pandemic on the Indian Economy as well as the Supply chain side also.

Keywords: Indian Economy, COVID-19, Supply chain, Lockdown.

I INTRODUCTION

Manufacturing assumes a significant job in the improvement of countries by adding to the GDPs. Assembling businesses are the significant supporter in the worldwide economy. At present time businesses over the world are concentrating on the high worth and high edge items. Presently the creation of the low edge and high volume items have moved towards the low economies. The use of the in the nick of time and lean methods of reasoning had contributed towards the cost decreases in the businesses. At the same time because of the Covid-19 issues around 35% of producers have revealed the aggravations in the assembling rehearses. At present there is immense requests of numerous items in which the face shields and pharmaceutical items are primary. The interest of these items has expanded in most recent two months. The assembling units in the greater part of the nations have closed down due to Covid-19 spread and the majority of the nations are looking from the absence of the work because of the dread of Covid-19 spread. The principal instance of Covid-19 in India detailed in January, 2020 and now Government of India has announced the lockdown in the nation to limit the spread of Covid-19. Gracefully chain the country over is upset.

The Indian government has just held the significant level gatherings to set the new assembling techniques. Japan and different nations are additionally searching for the expand the gracefully chains and fabricating frameworks to new goals. Indian government is currently concentrating on the attempt and building up India as an option in contrast to the China for assembling for both the neighborhood and worldwide showcase. The vast majority of the nations have moved their creation out of China because of the interruption of the gracefully chain between significant exchanging accomplices. Flexibly chain is likewise disturbed in India at nearby level because of certain hindrances which are examined in the current examination. In the current paper we have examined the impact of Covid-19 on Indian economy and on gracefully chains in India. There are aggregate of 18 basic boundaries are discovered which influenced the gracefully chains in the India. It is expected that this examination will accommodating the scientists to build up the applied models to defeat from this issue.

II OBJECTIVES OF THE STUDY

1. To study about the impact of COVID-19 on Indian Economy
2. To study about the impact of COVID-19 on supply Chain

Research Methodology

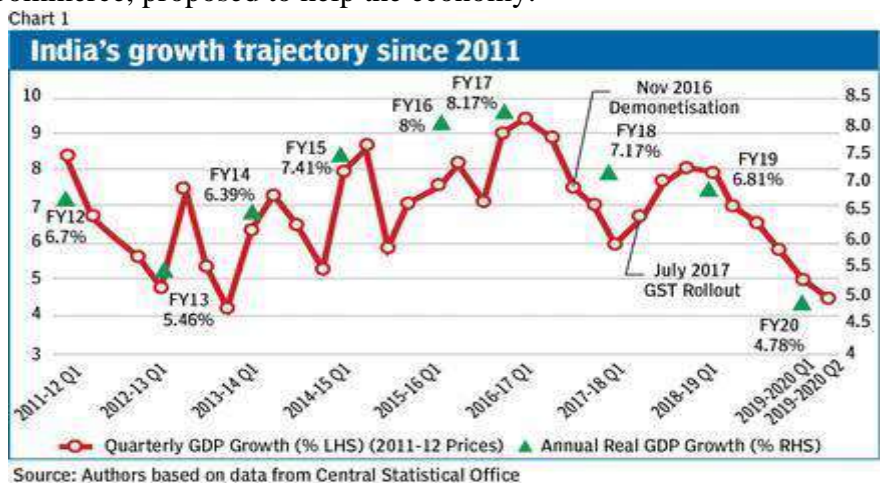
The data for this study is collected from various secondary sources such as articles, newspapers, magazines, and websites.

III IMPACT OF COVID 19 ON INDIAN ECONOMY

After the Great Depression of 1930, wherein the worldwide economy has confronted the most noticeably terrible downturn is presently confronting the worldwide pandemic of crown infection that has laid the unfriendly impact on all the financial initiates over the world. Given the nature of the disease which is highly contagious, the ways to contain the spread include policy actions such as imposition of social distancing, self-isolation at home, closure of institutions, and public facilities, restrictions on mobility and even lockdown of an entire country. These actions can potentially lead to dire consequences for economies around the

world. In other words, effective containment of the disease requires the economy of a country to stop its normal functioning. This has triggered fears of a deep and prolonged global recession. On April 9, the head of International Monetary Fund, Kristalina Georgieva said that the year 2020 could see the most exceedingly awful worldwide financial aftermath since the Great Depression during the 1930s, with more than 170 nations prone to encounter negative per capita GDP development because of the furious coronavirus pandemic. India recorded the first case of the disease on January 30, 2020. Since then the cases have increased steadily and significantly.

To limit the impact in the economy brought about by the COVID - 19 episodes, the Union Finance and Corporate Affairs Minister, on March 22, 2020, declared a few significant help estimates taken by the Government of India, particularly on legal and administrative consistence matters identified with a few divisions. The Central Government, among others, declared truly necessary alleviation quantifies in zones of Income Tax, GST, Customs and Central Excise, Corporate Affairs, Insolvency & Bankruptcy Code (IBC) Fisheries, Banking Sector and Commerce, proposed to help the economy.

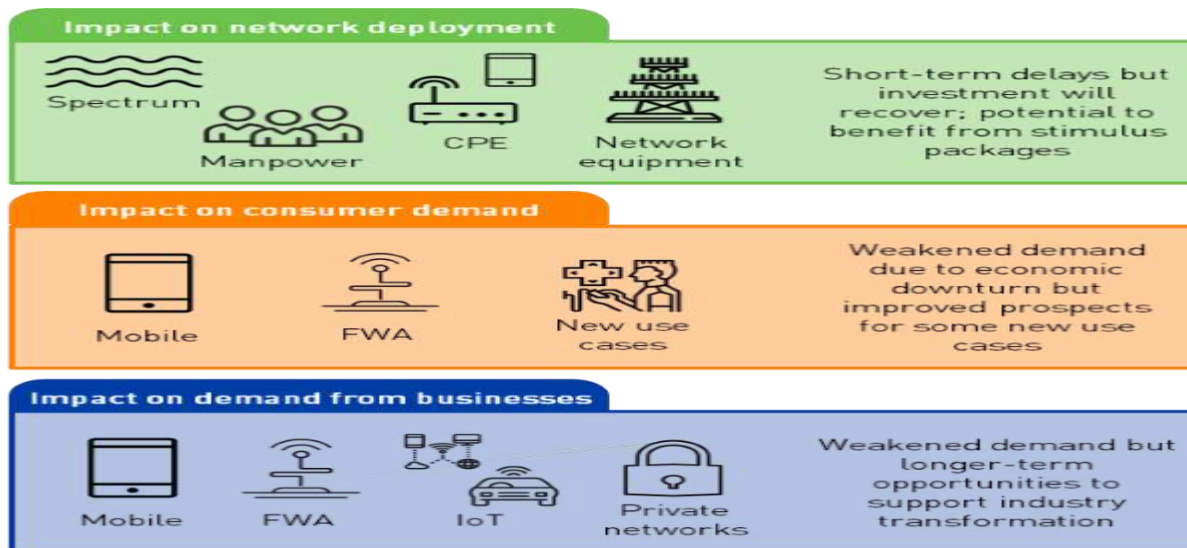


Source: Secondary Data

The nation will presently confront various difficulties as far as monetary emergencies, wellbeing emergencies, breakdown in ware costs and significantly more. The financial framework has expanded the overflow liquidity as a result of the interest side stuns that emerges because of vulnerabilities just as lock down in the showcase. There is an enormous effect on the monetary stun that incorporates securities exchange crash, liquidity emergencies as it emptied out of worldwide market in banking framework and different changes in money related strategies. The US dollar credit crunch has begun disturbing the world economy due to immense breakdown of income, dollar designated obligations. As the greater part of the organizations that relies on global exchange will endure serious weight. The worldwide financial creation is on decrease and anticipating a tremendous downturn in the whole economy. The worldwide pandemic has hit the economy which scrutinized the objective to make Indian economy of USD \$5 Trillion with 7% of GDP continuously 2024. According to the World Bank most recent evaluation, India is required to become 1.5 percent to 2.8 percent just as per IMF, it has anticipated a GDP development of 1.9 percent in 2020 and to accomplish the object of USD \$5 Trillion economy it is relied upon to develop at 9 percent consistently for a long time

Shock on Demand Side

The immense vulnerability and fall in showcase has prompted one-two punch of business that upset the whole chain of creation and request cycle. It incorporates the different offices and administrations given by the Indian government and private segments, for example, Tourism, Hospitality and Avionics are the significant parts that are confronting most extreme misfortune in the current emergencies. The travel industry that represents 9% of GDP may decrease at any rate next 2-3 quarters. Avionics that contributes around 2.4% of GDP has seriously affected and these areas incorporate workers around 42.7 million of individuals. Areas, for example, auto, that contributes 10% of GDP and representative around 40 million of individuals, is declining ceaselessly because of less of interest and because of which the negligible firms and different ventures has compelled to close down. Shutting of film corridors, declining in shopping from complex shopping centers has influenced the retail division as well and furthermore to the utilization example of buyer as far as fundamentals and extravagance products. The utilization example of buyer has affected and has demonstrated a defeat because of fall in pay and lost positions particularly to the day by day workers that scrutinized the Ratchet Effect and Demonstration Effect given by market analyst J.V. Dusenberry. The consistent dread of the pandemic in people in general has influenced their mental prosperity and certainty level that postponed their buying choice. The administration of travel and transport is on an interruption because of lockdown the nation over as has direct effect on lull in financial exercises. It is represented lost \$4.5 billion each day of the lockdown. The lodging administrations are getting colossal retraction from business voyagers from different meetings, workshops class that got dropped on such a huge scope.



Source: Secondary Data

IV IMPACT ON SUPPLY SIDE

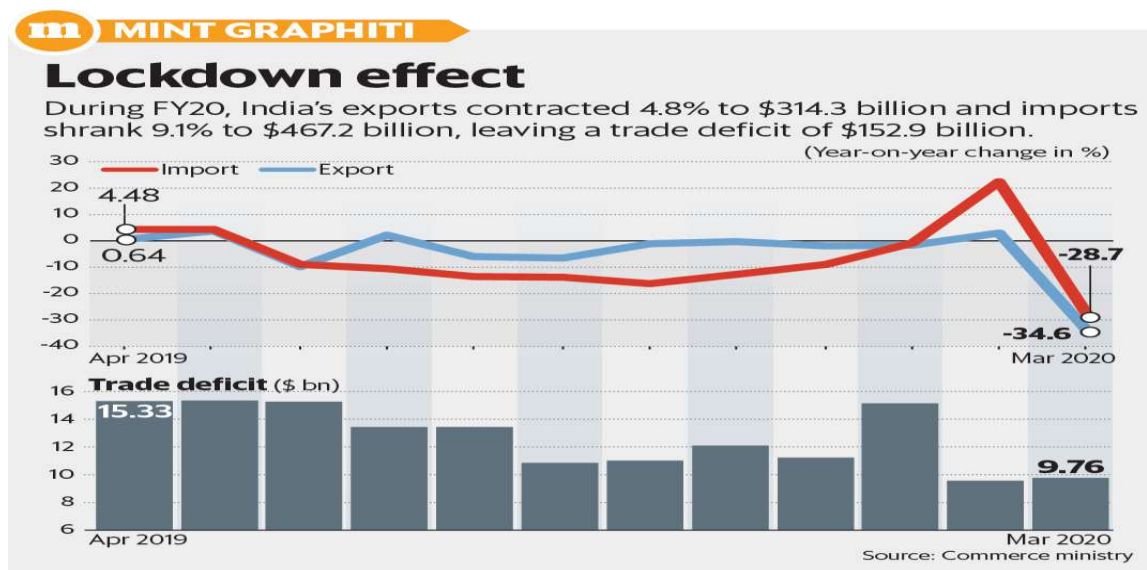
Some focused-on businesses in the flexibly side go for the shutdown that is the minimal firms. India being the most elevated exporter of crude material and import wellspring of products that are required for their halfway and last products are on stop now because of the deferral in gracefully of merchandise from china. Different areas, for example, pharmaceuticals, vehicles, hardware and synthetic items and so on are confronting a lack of required part. As china represents 27% of India's car part imports. India imports about 85% of

dynamic pharmaceuticals fixings (API) from china furthermore, because of the factor there is a chance of deficiency in accessibility and in this way costs may go on climb. Because of the lockdown and worldwide pandemic the business is hampering with the creation cycle that will additionally influence the ventures. There is about 55% of hardware are imported from china that has slid down to a rate. A decades-in length center around gracefully anchor enhancement to limit costs, diminish inventories, and drive up resource use has expelled supports and adaptability to retain disruptions and COVID-19 outlines that numerous organizations are not completely mindful of the defenselessness of their flexibly affix connections to worldwide stuns. Luckily, new gracefully chain advancements are developing that significantly improve perceivability over the start to finish flexibly chain, and bolster organizations' capacity to oppose such stuns. The conventional direct flexibly chain model is changing into computerized gracefully arranges (DSNs), where practical storehouses are separated and associations become associated with their total flexibly system to empower start to finish perceivability, joint effort, readiness, and streamlining.

Utilizing trend setting innovations, for example, the Internet of Things, man-made consciousness, mechanical autonomy, and 5G, DSNs are intended to envision and address future difficulties. Regardless of whether it is a "dark swan" occasion like COVID-19, exchange war, demonstration of war or psychological oppression, administrative change, work contest, abrupt spikes sought after, or provider chapter 11, associations that send DSNs will be prepared to manage the unforeseen.

V IMPACT ON INTERNATIONAL TRADE

In spite of the fact that market analysts and the policymakers are contrasting the present monetary stoppage and the extraordinary sadness and the money related emergency of 2009, the harm brought about by the COVID 19 pandemic is far more noteworthy and it has a one of a kind sort. Since during the incredible gloom of the 1930s banks were not shy of capital and the financial motor was fit as a fiddle. Yet, this time around, it isn't the situation. Due to exchange strains between different nations and easing back financial development, exchange was at that point trembling in 2019 even before the infection struck. Moreover, transport and travel are today legitimately influenced in manners they were not during the money related emergency ten years back. Today, the entire divisions of national economies are closed down. The WTO has said that all districts in the word will endure twofold digit decreases in fares and imports in 2020, with the exception of "Different locales" which is involved Africa, Middle East and Commonwealth of Independent States (CIS). World's major monetary powers, for example, the US, China, UK, Germany, Italy, France, Japan and numerous other rising economies like India, and so forth are nearly breakdown. The costs of unrefined petroleum have tumbled off a bluff and the OECD expressed that worldwide development could be sliced down the middle to 1.5 percent in 2020 if the infection keeps on spreading. For creation, the world needs human work and half of the globe at present is under lockdown for an uncertain timeframe which will hugy affect the economy and exchange general.



Source: Secondary Data

In Asia, policymakers reacted quickly with forceful spending to help the clinical reaction and powerless family units and firms. What's more, national banks took quick activities to grow liquidity. Be that as it may, the area is yet to confront its most noticeably terrible monetary bad dream. The whole locale was hit hard by the main influx of the coronavirus, as the abrupt stop in movement struck family units and firms all the while. Since the flare-up of the pandemic, the area has been experiencing exacting lockdown standards. Transportations and ventures have been restricted, the district lost its enormous profit from the travel industry, theaters and shopping centers have been shut inconclusively and each other financial exercises have been halted. The administrations are compelled to furnish the entirety of its residents with fundamental needs and social insurance administrations. The policymakers are additionally contributing a tremendous measure of cash on clinical foundation and other clinical hardware. As a creating area, Asia will confront grave financial risk in the coming days if the administrations and policymakers don't manage the circumstance astutely.

VI IMPACT ON FINANCIAL MARKETS

Since the flare-up of Covid-19, there has by and by been disturbance in the obligation markets. Credit spreads of corporate obligation papers have raised strongly to levels higher than what was seen in the fallout of the IL&FS emergency of September 2018. Obligation common assets, even those that contribute at the short finish of development – fluid assets, ultra-brief span reserves and so forth have endured genuine shots to their net resource esteems (NAVs) making financial specialists anxious. These assets are viewed as speculations second just to bank stores regarding security and subsequently decrease in their NAVs involves concern.

VII IMPACT ON GLOBAL MANUFACTURING AND SUPPLY CHAIN

The repercussions of COVID-19 flare-up are being felt all the more unequivocally as time passes, and regardless of the extraordinary advances and total endeavors attempted by governments, organizations and people to stem its development, the infection keeps on rampaging unchecked over the globe, causing death toll and hitting organizations across businesses and verticals. The way that the roots of the infection lie in China, the accepted 'manufacturing plant of the world', has just served to highlight the harm from a financial point

of view with a huge level of gracefully chains bringing in stun and disintegrating as time passes. According to a March review led by the Institute For Supply Chain Management, almost 75 percent of organizations revealed gracefully chain disturbances in a single structure or the other due to coronavirus-related transportation limitations, and the figure is expected to rise further throughout the following hardly any weeks.



Source: Secondary Data

Other intriguing figures that rose up out of the review incorporated the absence of any similarity to an alternate course of action for practically a large portion of the organizations in the event of a flexibly bind interruption driving back to China, and well more than 50 percent of the organizations additionally detailed encountering abrupt, surprising deferrals in getting orders, an issue aggravated by gracefully chain data power outage from China.

VIII CONCLUSION

These obstructions have the extraordinary effect on the Indian gracefully chain. In spite of the fact that these issues in the flexibly chain are summed up which needs further investigation and prioritization of these obstructions will assist the businesses with overcoming from the flexibly tie issues because of the Covid-19. These obstructions can be concentrated with the MCDMs strategies, for example, AHP, ANP, TOPSIS, DEMATEL, MAVT, MAUT, VIKOR, Fuzzy set hypothesis based MCDMs and other model approval can be done by information examination methods, for example, SEM, ANOVA, and ISM. In the current investigation the impact of Covid-19 on Indian economy and gracefully chain is examined. This concentrate likewise announced about the Covid-19 impact on worldwide assembling and gracefully chain. n-CoV has influenced the assembling firms and their flexibly chain over the world. COVID-19 is influencing our flexibly chains and assembling activities every day. The pinnacle of COVID-19 infection have just influenced the gracefully chain and constrained a large number of enterprises to choke down or shut down their sequential construction systems incidentally in the U.S and Europe and now in the creating countries like India. In the investigation with counsel with specialists aggregate of 18 basic hindrances were recognized which influences the flexibly chain at nearby level in India. This examination can be reached out by appraisal of boundaries with the multi-measures dynamic methodologies. Interrelationship between the boundaries can be related to the interpretive auxiliary displaying.

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STATUS OF HEALTH INEQUALITY IN EASTERN INDIA: A GEOSPATIAL ANALYSIS

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ABSTRACT

This study compares the status of health inequality of under 5 years' children based on three pillars such as nutritional status, child immunization status, and child feeding practices among the states of eastern India, namely, Bihar, Jharkhand, Odisha, and West Bengal using fourth National Family Health Survey (NFHS- 4) database. The present study attempts to measure the extent of various key components of health status like anthropometric indices such as stunting, wasting, underweight, and routine immunization coverage. The parameters of child feeding practices have been taken to examine the differential results of these variables in the account for integrated health status. A detailed analysis of inter-state inequality of health status has been done using respective statistical tools and spatial mapping. The nutritional status, child immunization, and child feeding practices of the status of health inequality have been developed by chi-square, Analysis of Variance (ANOVA), weighted average and mean method respectively. The result shows that the overall performance of health status highest in West Bengal. The state of Odisha and Jharkhand also placed in a good position compared to Bihar as well as total India. Bihar is the lowest rung of the ladder but it is comparatively better than that of total India. This study implies that, for being a homogenous country, needs to be urgent attention to people's awareness of health care facilities and government initiation.

Keywords: NFHS data, Health Inequality, Anthropometric Indices, Child Immunization.

I INTRODUCTION

India is one of the highest levels of child malnutrition and a large number of undernourished children in the World [9]. India is the home to a large number of stunted and underweight children in the World. India is a vast country where 1/6 of the population living in the whole states and union territories. There is a large variation in the social, economic, health, and nutrition profile between the states in the country [1]. It has been exposed that 38% of children are stunted, 21% are wasted, and 36% are underweight under five years' children in India [11]. The study shows that the reproductive health status of women among the variations of caste is greatly influenced in the three states of India, namely, West Bengal, Odisha, and Bihar [6]. It also shows the child loss is higher among the older age group of women that

revealed the negative correlation between caste and residence, caste and women's education across all states, which indicates the low nutritional status of the children [6].

Late introduction of the nutritional status, Bihar is the third largest state of India suffering from very poor primary health care facilities. At present, Bihar belongs to very low health status and health infrastructure composite index, which values are 2.49 and 1.202 respectively. The correlation coefficient between health status and health infrastructure is 0.22 that indicates an insignificant correlation [3]. On the other hand, semi-solid food is the cause of undernutrition and a high risk of morbidity in Jharkhand [7]. Child malnutrition is the major problem in Odisha, especially in rural areas, children of high birth order and for Christian children gain in stunted and underweight but wasting was remained unchanged between NFHS- 3 in 2005-06 and NFHS- 4 in 2015-16 [11]. The wasting children were increased from 17% (NFHS-3) to 20% (NFHS-4) and it has seen that, the variation of intra-state differences among the undernourished status of children in West Bengal [5].

Child immunization and child feeding practices are also another integral part of health status. The nutrition level took up the Expanded Programme on Immunization (EPI) in 1978 [2]. The Government of India launched the Universal Immunization Programme (UIP) on 19 November 1985 [2] as an expanded of EPI, the main purpose of reducing the incidence of six vaccine-preventable diseases. It was an important child survival intervention has reduced the infant mortality rate of 94 per thousand live births in 1985 to 67.7 in 2000 [2]. The percentage of a fully immunized child was 38.0 only [10]. In child immunization, India gains both BCG and full immunization but brought down of 3 doses of polio vaccine from 78.2% (NFHS-3) to 72.8% (NFHS-4). This trend also common in Bihar and Jharkhand. On the other hand, child feeding practices to make antibodies and substantial improvement of the high nutritional component in the body. The receiving of solid or semi-solid and breastmilk, age between 6-8 months' children brought down by 9.7% (42.9% in 2015-16 and 52.6% in 2005-06) in India with the states of Bihar, Odisha, and Jharkhand [11].

The main objectives of the study are (i) to evaluate the nutritional status of under 5 years' children in the four states of eastern India, namely, Bihar, Jharkhand, Odisha, and West Bengal, and to frame their comparative profile in the perspective of all India. (ii) To examine the status of inequality of child immunization and child feeding practices among the children.

II METHODOLOGY

Data source

This study is based exclusively on the secondary database. The data on nutritional status, immunization status, and child feeding practices were accessed from the fourth round National Family Health Survey (NFHS-4) in 2015-16. International Institute of Population Sciences (IIPS) organized the survey coordinated by the Ministry of Health and Family Welfare (MoHFW). The main emphasis of the study is focused on the comparative analysis among the four states of eastern India, namely, Bihar, Jharkhand, Odisha, and West Bengal in the account of the status of health inequality of under- 5 years' children.

Methods

The nutritional status of the children is broadly measured by three ways likewise the determination of anthropometric indicator, biochemical indicator, and clinical indicator. The study is focusing on anthropometric measurement that is the most popular indices to examine

the variations of the nutritional states of children than other methods. The anthropometric indicators including three indices- height for age (stunting), weight for height (wasting), and weight for age (underweight) which were computed by standard technique ‘Z’ score indices. Z score is defined as:

$$Z \text{ score} = \frac{\text{Observed value} - \text{Median of the reference population}}{\text{SD of the reference population}}$$

According to WHO (1995), the prevalence estimation point of the Z score value is ‘-2 SD’. The classification of Z score is less than minus two standard deviations (< -2 SD) called as ‘below normal’, greater than equal to minus two standard deviations and less than equal to plus two standard deviations ($\geq -2 \text{ SD}$ and $\leq +2 \text{ SD}$) called as ‘normal’ and greater than plus two standard deviations (> +2 SD) called as ‘above average’. However, here considered the stunted, wasted, and underweight which referred to as below minus two standard deviations (< -2 SD) only. Child immunization of the health status of children considered as the ages between 12-23 months, which have been included fully immunized with 3 doses of Hepatitis vaccine recommended by UIP, to protect the children from their life-threatening diseases. Full immunizations deal with one dose of BCG (Bacille Calmette- Guerin), one dose of measles, 3 doses of the polio vaccine, and 3 doses of DPT (Diphtheria, Pertussis, and Tetanus) vaccine. On the other hand, WHO (2006) has been recommended for Infant and Young Child Feeding (IYCF) practices to consider the age between 6-23 months’ children. Child feeding practices creates antibodies into the body of children, which have to inhale colostrum (highly nutritious first milk), and breastfed milk that provides a good health status. Child feeding practices would be generated into five weights scale, starting from higher to lower strata such as exclusively breastfed, 6-8 months receiving semi-solid or solid and breast milk, breastfed children with adequate diet, non- breastfed with adequate diet, and total children receiving an adequate diet age between 6-23 months [11]. Here I have used the appropriate statistical tools to find out the accurate results as per reflecting the concerned objectives followed by chi-square, ANOVA, weighted average, and mean method respectively. The statistical analyses have accomplished using R-tool and SPSS as a statistical package for social sciences, and geospatial mapping has been drawn by Quantum GIS.

III Results

Nutritional status

Table 1 describes the chi-square analysis to examine the goodness of fit test based on three parameters of nutritional status like stunted (Height for age), wasted (Weight for height), and underweight (Weight for age) among the states of eastern India, namely, Bihar, Jharkhand, Odisha, and West Bengal. The following hypotheses are:

H₀: There is no significant difference between the nutritional status of subjects such as stunting, wasting, and underweight among the stages of eastern India; H₁: There is a significant difference between the nutritional status of subjects such as stunting, wasting, and underweight among the stages of eastern India.

Table 1: The goodness of fit test

X-squared	Degree of Freedom	p-value
1.585	6	0.9537

The computed chi-square (χ^2) p-value is 0.9537 with 6 degrees of freedom at a 5% significant level. Since the p-value is much higher than 0.05, so the null hypothesis is accepted. Hence, I have concluded with 95% confidence that there is no significant difference (Homogeneous)

between the nutritional status of subjects such as stunting, wasting, and underweight among the states of eastern India.

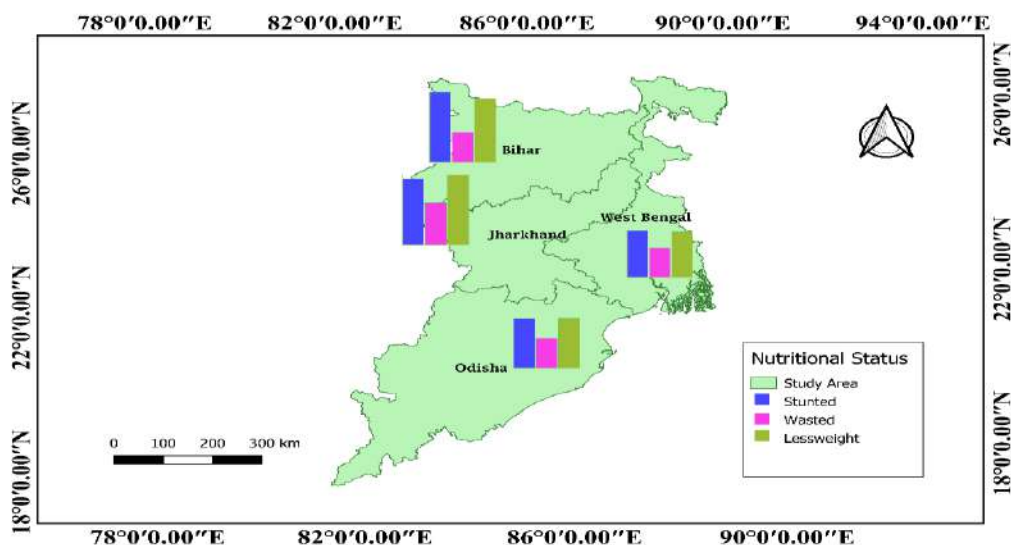


Fig. 1: Nutritional status of children in the states of eastern India

Fig. 1 gave the distribution of the nutritional status of under 5 years’ children among the states of eastern India, namely, Bihar, Jharkhand, Odisha, and West Bengal. The higher percentage of stunted (48.3%) children in Bihar, wasted (29%), and underweight (47.8%) children in Jharkhand and the corresponding percentage for India are 38.5%, 21%, and 35% respectively. The less percentage of undernourished children is found all level India only in West Bengal, followed by Odisha whereas Bihar and Jharkhand belong to the lower-rung compare to total India.

Child Immunization

Table 2,3 and 4 demonstrated the one-way Analysis of Variance (ANOVA) to compare the immunization coverage such as BCG, measles, polio- 3, DPT- 3, Hepatitis B, and full immunization status between 12-23 months’ children among the states of Bihar, Jharkhand, Odisha, and West Bengal.

Table 2: Analysis of variance among routine immunization coverage between 12-23-month children

States	Fully immunized	BCG	Measles	Polio-3	DPT-3	Hepatitis B	Mean	SD
Bihar	61.7	91.6	79.4	72.9	80.1	65.5	75.20	10.8
Jharkhand	61.9	95.8	82.6	73.8	82.4	56.4	75.48	8
Odisha	78.6	94.1	87.9	82.8	89.2	83.2	85.97	5.52
West Bengal	84.4	97.5	92.8	87.9	92.7	86.4	90.28	4.89

Source: National Family Health Survey- 4 (Computed by Author)

The computed value is larger than the critical value of the F distribution. The critical value of F distribution with d.f.N =3, d.f.D = 20, at 5% level of significance is 3.10. Since the computed value is larger than the critical value (3.586 > 3.10), so the null hypothesis is rejected. Hence, conclude with 95% confidence that the immunization status of children likewise BCG, measles, polio- 3, DPT- 3, Hepatitis B, and full immunization coverage among the states of eastern India are significantly different.

H₀: There is no significant difference between the immunization status of children likewise BCG, measles, polio-3, DPT-3, Hepatitis B, and full immunization coverage among the states of eastern India; H₁: There is a significant difference between the immunization status of children likewise BCG, measles, polio-3, DPT-3, Hepatitis B, and full immunization coverage among the states of eastern India.

Table 3: ANOVA

	Sum of Squares	Degree of Freedom	Mean Squares	F	p-value
Between Groups	1036.623	3	345.541	3.586	.032
Within Groups	1926.930	20	96.347		
Total	2963.553	23			

Table 4: LSD – Pair of treatments

Pairs of treatments	Mean Differences	p-value	95% Confidence Interval	
			Lower Bound	Upper Bound
Bihar and Jharkhand	-.28333	.961	-12.1046	11.5379
Bihar and Odisha	-10.76667	.072	-22.5879	1.0546
Bihar and West Bengal	15.08333*	.015	3.2621	26.9046
Jharkhand and Odisha	-10.48333	.079	-22.3046	1.3379
Jharkhand and West Bengal	14.80000*	.017	2.9787	26.6213
Odisha and West Bengal	4.31667	.455	-7.5046	16.1379

* The mean difference is significant at the 0.05 level.

Least Significant Difference (LSD) test

The Least Significant Difference (LSD) test has been done by ANOVA to explore the significant difference between the states using mean comparisons. LSD test revealed that the significant difference among the coverages of child immunization status exists in the states between Bihar and West Bengal (0.015 < 0.05) and Jharkhand and West Bengal (0.017 < 0.05) at a 5% significant level. Therefore, I have concluded that except for these two states, the immunization status of children is insignificantly different from the rest of the states.

Child feeding practices

Now, turn to investigate the child feeding practices of children considered the age between 0-23 months based on five parameters mentioned above, ranked for the states of Bihar, Jharkhand, Odisha, West Bengal, and India as well. Table 5 and fig. 2 show that West Bengal placed at the 1st position, which indicates better health conditions among the children compares to other states. Odisha got 2nd position; slightly different from West Bengal, followed by Jharkhand and Bihar respectively. It is also notable that the child feeding practices in Bihar (29.2%) lies at very poor condition compared to total India (33.97%).

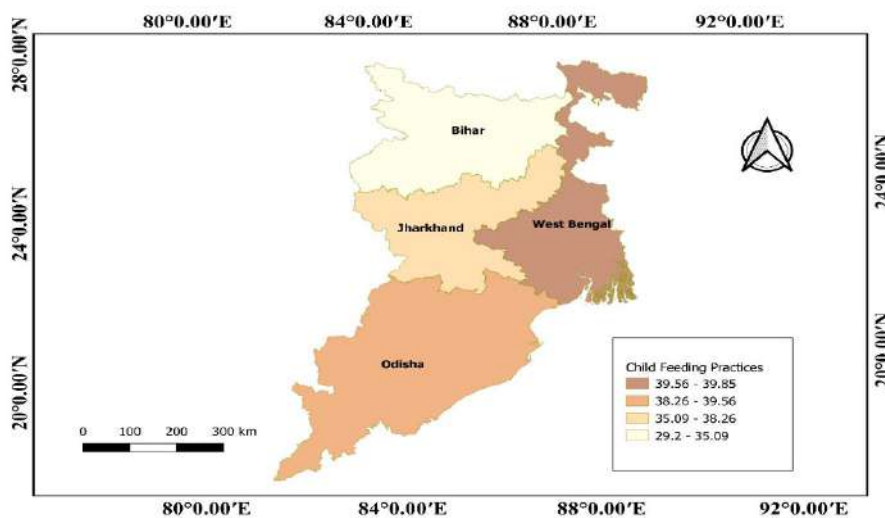


Fig. 2: The variations of child feeding practices in the states of eastern India

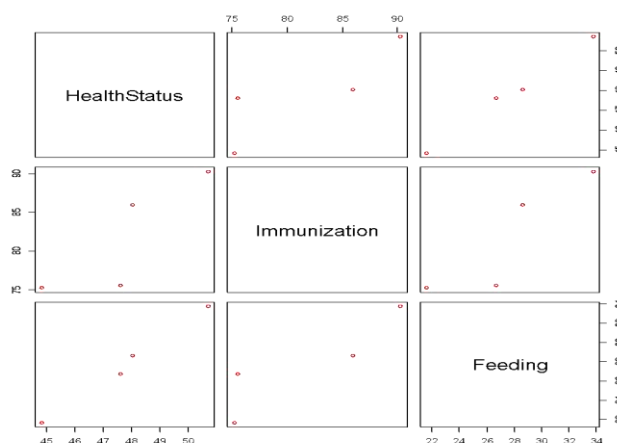


Fig. 3: Matrix plot of integrated health status

Table 6: Weighted average method analysis for child feeding practices of children

States	5	Exclusively breastfed	6-8 months child age received semi-solid or solid and breastfed	4	Breastfed child age received adequate diet	3	Non-breastfed child age received adequate diet	2	Total child age received adequate diet	1	W.A	Rank
Bihar	53.4		30.8		7.3		9.2		7.5		29.2	4
Jharkhand	64.8		47.2		7.2		7.1		7.2		37.05	3
Odisha	65.6		54.9		8.9		5.0		8.5		39.47	2
West Bengal	52.3		52		19.1		25.7		19.6		39.85	1

Source: National Family Health Survey- 4 (Computed by Author)

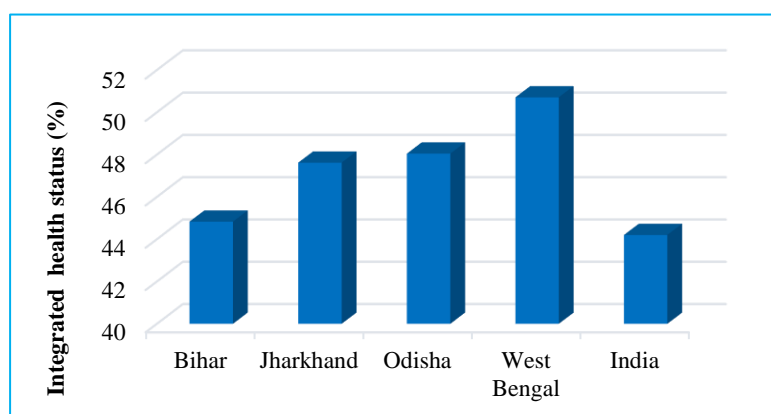
Table 6: Integrated status of health inequality in India

States	Child			Mean	Rank
	Nutritional status	Immunization status	feeding practices		
Bihar	37.66	75.2	21.64	44.83	4
Jharkhand	40.7	75.48	26.7	47.62	3
Odisha	29.63	85.97	28.58	48.05	2
West Bengal	28.13	90.28	33.74	50.71	1
India	31.73	74.83	26.04	44.2	

Source: National Family Health Survey- 4 (Computed by Author)

IV INTEGRATED HEALTH STATUS

The matrix plot of health status (Fig. 3) shows that the strong correlation and linearity exist between immunization and health status (0.85), immunization and child feeding (0.89), and child feeding and health status (0.996) as well. Finally, table 6 and fig. 4 justified the overall health status of children comprises of three base pillars, namely, nutritional status, child immunization, and child feeding practices among the states of eastern India, namely, Bihar, Jharkhand, Odisha, and West Bengal as well as total India. Awakened that integrated health status is highest in West Bengal (50.71%) followed by Odisha, Jharkhand, and Bihar.



It has also exposed that the integrated health status in the four states of eastern India placed at a healthy position compares to total India (44.20%).

V CONCLUSION

This study proposes the status of health inequality of under 5 years' children evaluated through nutritional status, child immunization, and child feeding practices in the four states of eastern India and also compare the same from the perspective of total India. It is found that the overall performance of health status is in West Bengal and Odisha situated at good positions whereas Bihar and Jharkhand are placed at a much lower position than that of all Indian figures. It has also been found that the percentage of undernourished children is highest in Jharkhand followed by Bihar, Odisha, and West Bengal. The

status of child immunization, West Bengal is in the highest rung of the ladder whereas Odisha, Jharkhand, and Bihar are placed comparatively better position in comparison to total India. On the other hand, child feeding practices show that West Bengal got a much better condition than other states. The Bihar is in the lowest of the ladder even in the India level also.

Therefore, I can conclude that in all conditions, compare to integrated health status, West Bengal placed at top position followed by Odisha and Jharkhand. As opposed to, Bihar positioned at the last stage that indicates the lower socio-economic condition such as poor education, low income, and occupational status may be ascertained the health status of children.

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IMPACT OF COVID-19 GLOBALLY

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ABSTRACT

The novel Coronavirus pathogen is a reason for worry in whole world due to the human-to-human infection spreading at a quick pace. The coronavirus had firstly reported in Wuhan city of China. Many developed and under developing countries have been alarmed due to expansion in number of deaths in USA, UK, Italy, Spain, German, France, Brazil, Russia and India. The purpose of present investigation aims to explore the impact of COVID-19 at an international level which will enhance measures to deal with the havoc created by this pandemic. Mitigation and suppression are the two methods which are adopted by various countries to combat this havoc. Lockdowns have been socially and economically costly, but they helped all the countries to avoid a far worse catastrophe. All the nations are raising awareness among people regarding this dangerous virus and its transmission. Researchers of every

country are busy in developing a vaccine against Covid-19. More health care services are restructured, clinical and paramedical staffs are getting prepared to tackle the contagious virus spreading at rapid speed. Different nations have different infection rates, recovery rates and mortality rates. So it is hard to foresee the spread of the infection and its destiny in particular country context.

Keywords: Mitigation, R0 (R-Naught, basic reproductive number), Covid-19, CFR (Case fatality rate), H1N1 influenza.

I. INTRODUCTION OF COVID-19

On-going COVID-19 outbreak reminds us the history of the 1918-19 Spanish influenza pandemic, which infected 500 million and killed fifty millions people in worldwide. The name “coronavirus” is derived from Latin corona, meaning “crown” or “wreath”. COVID-19 formerly referred to as ‘2019 novel coronavirus’ or ‘2019-nCoV’ where ‘CO’ stands for corona, ‘VI’ for virus, and ‘D’ for disease [16, 29, 5]. This infection is a lot littler than microorganisms and size ranges from 18 nm-400 nm. The world has experienced a series of pandemics — SARS in 2003, H5N1 (avian flu) in 2006, H1N1 (swine flu) in 2009, Ebola in 2013, Middle East respiratory syndrome (MERS) in 2015. COVID-19 virus is very contagious due to pneumonia of unknown etiology and all the cases detected in Wuhan City of China [16]. It was informed by the World Health Organization on 31st December 2019 [12]. Further International Committee Taxonomy of Viruses reported on 11th February, 2020 and Dr. Li Wenliang [Oct 12, 1986- Feb 7, 2020] raised the alarm about COVID-19 in the early days of the outbreak. It is accounted that the infection may be bat origin and transmission of the virus might relate to a seafood market (Huanan Seafood Wholesale Market) [3, 24, 26]. The incubation period of COVID-19 can keep going for about fourteen days or more. The virus is transmitted through direct contact with respiratory droplets of an infected person (generated through coughing and sneezing) and touching virus contaminated surfaces where virus may survive for several hours.

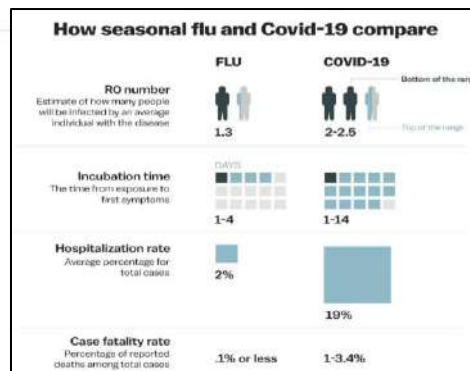
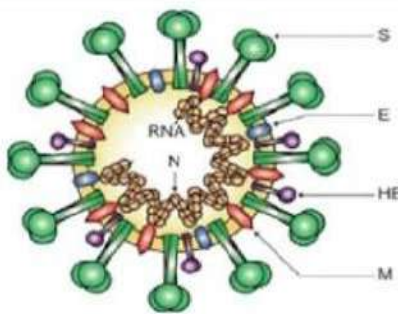


Fig 1: COVID-19 Structure

Fig 2: Comparison of Seasonal flu and COVID-19.

Basic symptoms resemble with the normal influenza are cough, cold, headache and fever to shortness of breath, whereas pneumonia and death can occurred in most severe case of COVID-19 [25, <https://www.cdc.gov/coronavirus/2019>].

A confirmed COVID-19 case was considered severe if the patient experienced at least one of the following: dyspnea, respiratory frequency of at least 30 per minute, blood oxygen saturation of 93% or lower, arterial blood oxygen partial pressure (PaO2) to oxygen concentration (FiO2) ratio of less than 300 mmHg, and/or pneumonia showing significant progression of lesions infiltrating more than 50% of the lung field on chest imaging within 24 to 48 hours.

The last time the world reacted to a worldwide 1918-19 H1N1 influenza pandemic in absence of vaccine same as emerging the current COVID-19 pandemic. In that pandemic, variety of non-pharmaceutical interventions (NPIs) were used by the United States (US) to lessen transmission. Researchers of all over the world are attempting to understand etiology and epidemiology of the disease and focussing on the basic reproduction number [Covid-19 R_0 2-2.5]. Mathematical models already used by different countries to predict Covid-19's path depend upon the complete data. Further if the virus has already established in-country transmission, to what degree would its effect be alleviated through isolation of symptomatic patients [26, 6]? Will the novel Coronavirus infect millions in world? How many are likely to die? Does social distancing and lockdown actually help save lives? The outbreak of the SARS-CoV-2 has also raised the concerns for the Government of India [1].

II. MATHEMATICIANS CALL “COVID-19’ HAS EXPONENTIAL GROWTH RATE”

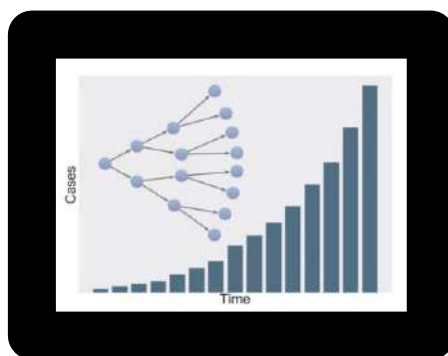


Fig 3: Exponential growth rate of COVID-19.

Mathematicians explain the exponential growth is that rate where one infected person infects two others on average, and this rate becomes doubles in each generation. Researchers propose that the number of affirmed COVID-19 cases are growing exponentially around the world as shown through “branching process” in fig 3 (Data collected from various nations how virus emerged firstly in Wuhan and arrived in Italy or Iran).

So the next question is: How well do people transmit the disease? In the field of epidemiology, R_0 (“reproductive number,” or pronounced “R-nought” or “R-zero”) is a mathematical figure that indicates number of people, on an average infected by one individual. R_0 depends upon the size of the population, recovery rate or death rate [4, 21]. It (R_0) decreases as the recovery rate increases. It is further reported by different countries that as R_0 less than one, then the infection will die out quickly, whereas R_0 larger than one is responsible for the outbreak exponentially. India’s R_0 was estimated 1.83 at the beginning of lockdown (from March 27 to April 6). As of end May India’s R_0 value was in the range of 1.22. The reproduction rate for the coronavirus pandemic in Germany fell to 0.94.

III. MATHEMATICAL MODELS ARE HELPING SEVERAL WAYS

With the help of Mathematical Models, researchers will be able to estimate infection rates of Covid-19 and rising demand for hospital beds and ventilators.

Transmission Model

Transmission events occur through contacts made between susceptible and infectious individuals in either the family unit, work environment, school or haphazardly in the network, with the latter depending on spatial distance between contacts. By mathematical models [15], it was concluded from

the past influenza pandemics (1918) that around 33% of transmission happens in the family, 33% in schools and working environments. Further different stages of disease are shown in following fig.

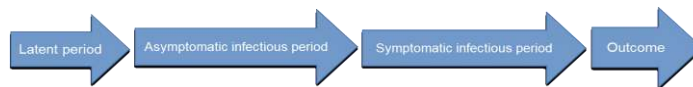


Fig 4: Different stages of disease.

The S-I-R model

The SIR model was developed for 1918-19 influenza epidemics and grouped the people in three categories i.e. "susceptible, infectious, recovered," Susceptible people haven't attained an illness yet; infectious are infected whereas recovered are those who've had the illness and survived.

Not considering virus evolution

Susceptible turning Into infective recovered Infective turning into dead or recovered



Considering virus evolution

Susceptible turning Infective Infective turning into dead or recovered

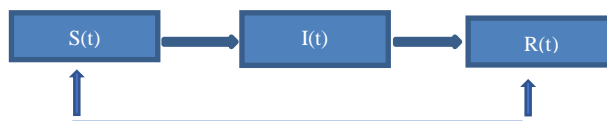


Fig 5: SIR model

Above model was used by mathematicians for dengue fever in Latin America, swine fever in the Netherlands and virus in Belgium. But this SIR model doesn't concentrate on behavioural of novel coronavirus as well as strategy changes like social distancing (maintain a distance of 2 metres from others) and stay-at-home requests. The standard four compartments SEIR (Susceptible, Exposed, Infected and Recovered) model is developed by scientists, to consider particular features of COVID-19 [20, 21, SEIR and SEIRs models 2019]. This model focuses on exposed people who are not yet infected. Furthermore this model does not consider the particularities of the specific disease (e.g. symptomatic or asymptomatic patients for COVID-19 or what fraction needs hospitalisation) and progression rate of disease in each case.

TheSEIR Model



Fig 6: SEIR Model

A θ -SEIHRD advanced mathematical model, which studies the special characteristics of COVID-19 disease for example the existence of infectious undetected cases, the different sanitary and infectiousness conditions of hospitalized people, is formulated [26, 6]. The main goal of θ -SEIHRD model is to estimate the total number of cases, deaths and requirements of hospital beds in those areas where COVID-19 is (or may be) a very severe medical issue.

Recently more standard model was formulated in January 2020 by researchers to estimate the number of undocumented or undiagnosed Covid-19 cases of Chinese population. Moreover researchers of Imperial College and US also split the infected population into two groups, diagnosed and undiagnosed (documented and undocumented). Those undocumented infected individuals were the prevailing driver of the epidemic. The countries should identify undocumented cases and handle a better way.

IV. NON-PHARMACEUTICAL INTERVENTION SCENARIOS

Two fundamental strategies are possible by the past and present scenarios of different countries.

(a) Mitigation, which centres around easing back yet not really halting pandemic spread. It is informed that ideal mitigation arrangements (joining home segregation of suspect cases, home quarantine of those living in a similar family unit as suspect cases, and social distancing of the elderly and others at most risk of serious illness) have decreased peak healthcare demand by 2/3 and deaths by half significantly. Subsequently R0 (reproduction number) can be less than 1 by diminishing case numbers to low levels or eliminate human-to-human transmission (as for SARS or Ebola).(b) Suppression, various countries have supported suppression policy indefinitely. The significant test of suppression is that this sort of severe intervention package comparably powerful at decreasing transmission should be kept up until a vaccine created.

Further Systematic washing of hands often with soap and water for at least 20 seconds or using a hand sanitizer that contains at least 60% alcohol should strictly followed. Avoid touching your eyes, nose and mouth with unwashed hands. Cleaning frequently touched surfaces and objects for e.g. tables, doorknobs, lifthandles, light switches, handles, desks, phones, keyboards, and sinks. The world utilized NPIs (different non-pharmaceutical interventions) in 1918, 1957, 1968 and 2009 influenza pandemics [32]. It is reported that the impact of a pandemic can be minimized at some extent by using NPIs (vaccines or drugs, if not available). The effect of different non-pharmaceutical interventions (NPI) implemented by different countries is shown in Table 1.

TABLE 1: Effect of different non-pharmaceutical interventions

Policy	Description
Home isolation	Symptomatic cases stay at home for 7 days, reducing non-household contacts by 75% for this period.
Voluntary home quarantine	Following identification of symptomatic cases in the household, all household members remain at home for 14 days.
Social distancing for above 70 years of age	Reduce contacts by 50% in workplaces, increase household contacts by 25% and reduce other contacts by 75%.
Social distancing of total population	All households reduce contact outside household, school or workplace by 75%.
Closure of schools, colleges and universities	Closure of all schools, 25% of universities remain open. Household contact rates for student families increase by 50% during closure.

IV. MATHEMATICIAN EXPLAINS FLATTEN THE CURVE OF CORONAVIRUS

Countries around the world are attempting to “flatten the curve “of the coronavirus pandemic. Flattening the curve includes diminishing the quantity of new COVID-19 cases day on day. As there is presently no vaccine, so only ways to diminish the transmission are cleanliness, isolating suspected cases, social distancing measures, cancelling large occasions and closing schools/ colleges. Governments of all the countries are focusing on gadgets like hospital beds and ventilators.

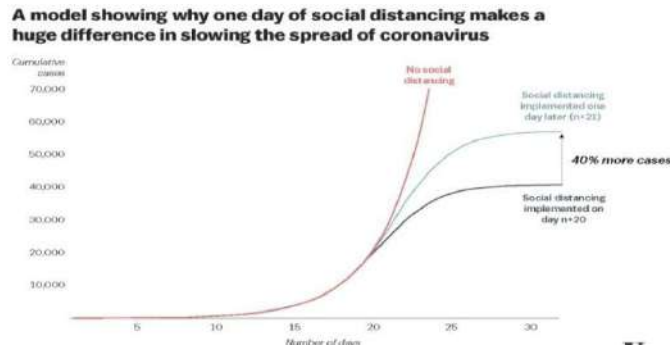


Fig 7: Effect of social distancing

Heads of states of Germany, Denmark, Taiwan, New Zealand, Finland, Norway, Iceland and Belgium all led by women have been fruitful in flattening the coronavirus curve. Utilizing testing, contact following, aggressive containment, quarantine and observing measures have been fruitful in restricting nearby transmission of the infection inside nations without a full national lockdown.

VI. THE MATHS BEHIND THE OUTBREAK (COVID-19)

COVID-19 cases has been multiplying in India at the slower rate than a couple of developed countries, for example, the USA, UK, Italy and Spain. As far as death rate, India fared better than these developed countries. Information reported by Worldometer that affirmed cases of infection and deaths of five countries have shown in following tables [<https://github.com/CSSEGISandData/COVID-19>].

TABLE 2: No. of infections and fatalities of different nations on May 14, 2020

Country	Infections	Fatalities
United States	1,389,935	84,106
Britain	229,705	33,186
Italy	222,104	31,106
France	140,734	27,074
Spain	228,691	27,104
Canada	71,486	5,209
Germany	174,098	7,861
China	82,929	4,633
India	74,281	2,415
Japan	16,079	687

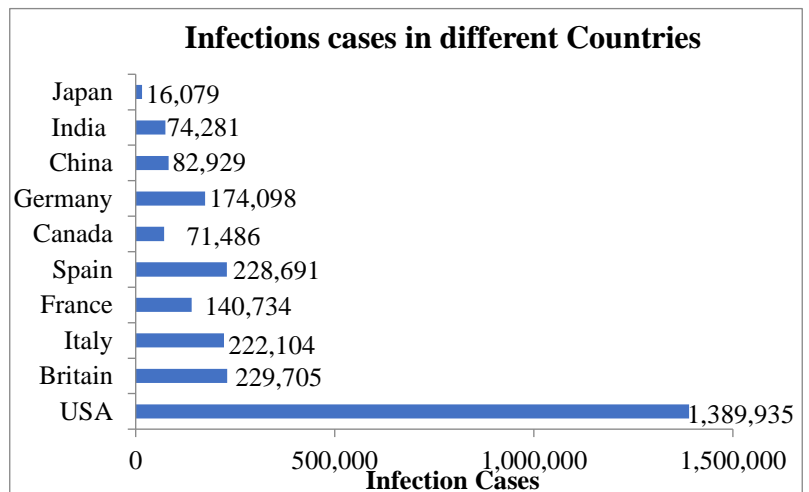


Fig 8: No of infections cases in different countries upto May 14, 2020.

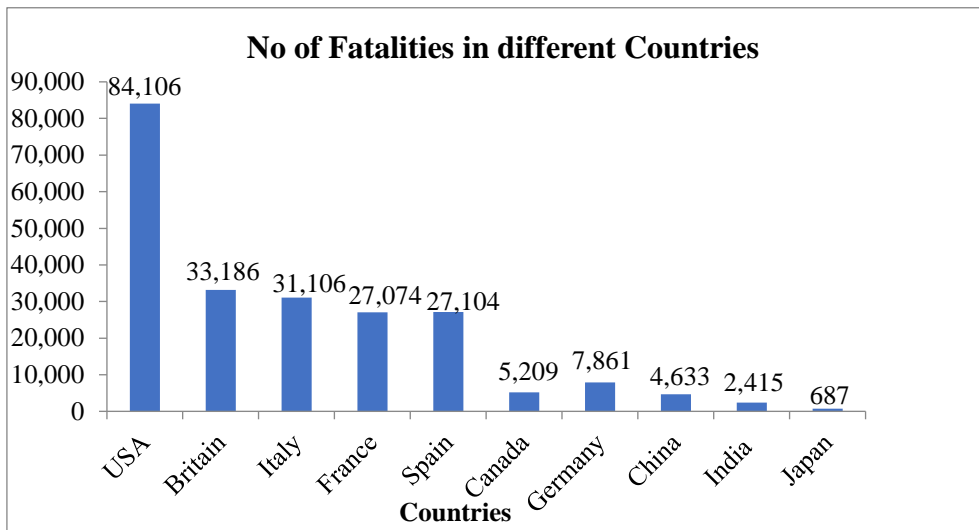


Fig 9: No. of fatalities in different countries.

TABLE 3: Cases double in no. of days in different countries updated on May 04, 2020

[<https://ourworldindata.org/covid-cases?country=USA>]

Country	Doubled in no of days
United States	27
UK	26
India	12
France	39
German	41
Spain	43
Italy	43
China	95

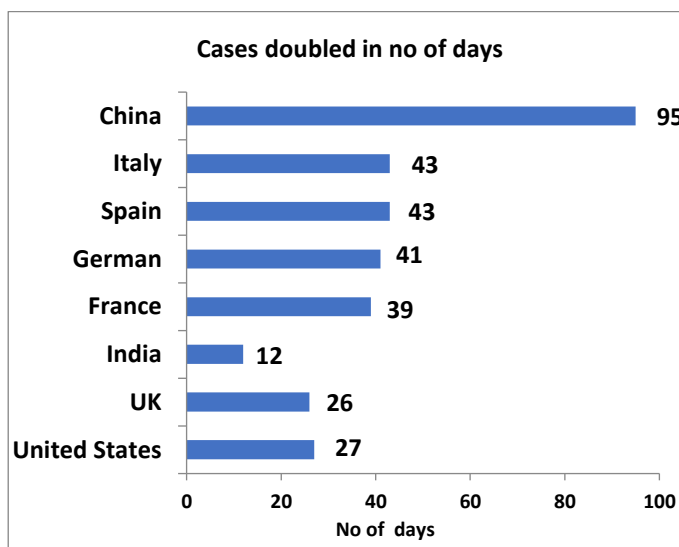


Fig 10: COVID cases doubled in no of days.

VII. COVID-19 TESTING FOR ALL OR TESTING FOR SOME?

COVID-19 is a RNA virus which enters and spreads through the respiratory framework from nose, sinuses, throat and lungs. It utilizes the genetic material of the human body to replicates itself. It is detected by an RT-PCR (real-time reverse transcription polymerase chain reaction) test which has become the gold standard method performed on a sample collected from the throat swab or, more recently, saliva or nose by a swab. If it shares the same genetic sequence as SARS-CoV-2 virus (new coronavirus), then it is considered positive.

Nations that fail to test a large or representative portion of their population might face extreme unfavourable impacts. In absence of sufficient testing, it becomes extremely difficult to predict the scale

of the infection and the resources like number of hospitals beds and ventilators for the patients [11]. There is a strong relationship between the number of tests performed and the number of cases identified across countries. This justifies the repeated calls by policy makers in all countries for “testing”. It also emphasizes the importance of conducting mass testing immediately after the first cases using samples that are representative of the population. India is also strictly executing test, trace, isolate, treat’ for COVID-19.

As of May 4, 2020, there were over 3.5 million worldwide cases of COVID-19. Over 1.1 million individuals had recovered from the infection, while there had been 248,000 deaths. The United States, UK, Italy, and Spain had been the four nations hardest hit by the pandemic. This number is most likely an undercount of all cases because the way a country tests for coronavirus can have a huge impact on the number of cases, they detected [John Hopkins University]. Countries have vastly different approaches to testing their populations, so it is very difficult to compare across countries. But the statistic of the different countries show that the complete number of tests for COVID-19 performed generally affected by the infection rate. Different testing reports propose that Norway best the Covid-19 testing rate with 14,537 tests for each million population followed by South Korea at 7,353, US 1,647 and India's 19 for per million appears terribly low.

TABLE 4: No. of total corona virus tests conducted by different countries up to May 04, 2020

Country	Total Tests
United States	7,227,693
Italy	2,153,772
Spain	1,932,455
UK	1,206,405
France	1,100,228
Germany	2,547,052
Canada	897,444
India	1,107,233

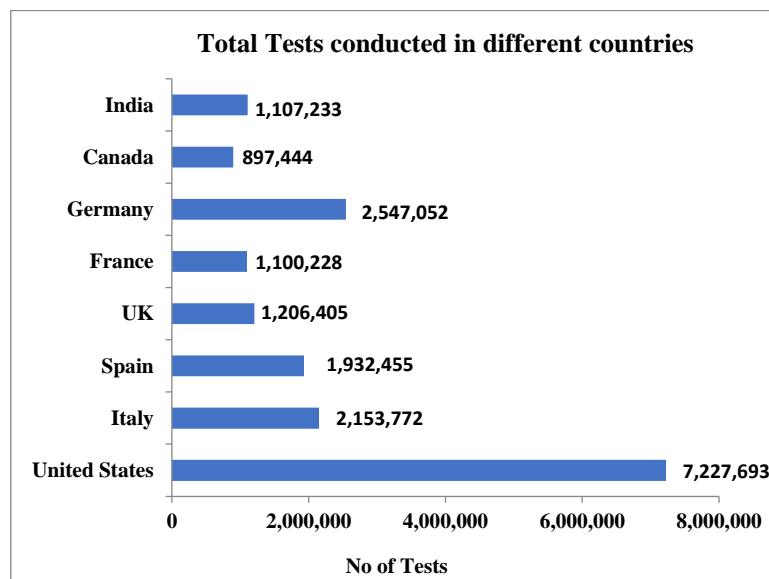


Fig 11: No. of total tests conducted in different countries.

Governments have to train a range of healthcare providers (including providers of primary care, and traditional healthcare systems) in respond to critical situation. As it is impractical to test everybody with symptoms of COVID-19. Those with mild symptoms should be encouraged to remain at homes. This practice will ensure that hospitals are accessible to the patients who truly need them.

VIII. HOW DOES DEATH RATE VARY ACROSS NATIONS?

Countries all through the world have entirely unexpected case of fatality ratios (the number of deaths divided by the number of confirmed cases) due to various reasons:

1. Differences in the number of people tested.

2. Variation of Demographic structure of all countries.
3. Characteristics of the medicinal services framework:

In the first place, researchers concluded in “The Lancet Infectious Diseases” paper that people between the ages of 40 and 49 have CFR (Case fatality rate) 0.4 per cent; for those 80 and older, it’s 13.4 per cent. This chance of survivability is declined in Italy with older populations.

Second, Covid-19 has been demonstrably deadlier for those with existing health conditions, including lung infection (regularly brought about by smoking), cardiovascular disease, severe obesity, diabetes, kidney failure, and liver infection. Third, the biggest factor here is poor testing. Tests are available regularly for the most ailing cases. Fourth, different factors likely a country's assets (particularly its health care capacity) and organization (for example, how effectively it can organize successful and widespread public health measures) influences the mortality rate.

TABLE 5: Fatality rate of different Countries up to April 20 (University of Oxford's Centre for Evidence-Based Medicine)

Country	Fatality rate (Per cent)
China	5.5
Italy	14.1
Germany	4.5
USA	6.1
India	3.2
UK	14.4
Spain	11.9
France	15.3

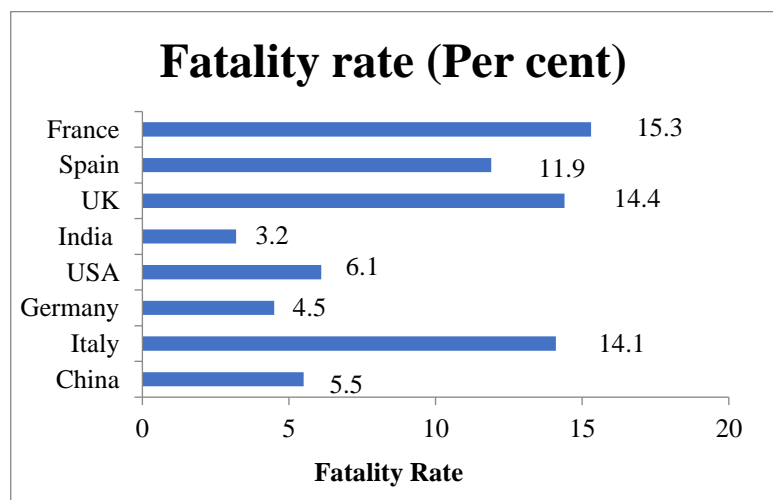


Fig 12: Fatality rate of different countries.

Italy had firstly the most noteworthy casualty rate for Covid-19. As indicated by the World Bank, Italy has a quarter of the country’s population is 65 or older, a higher rate than some other nations. Further a portion of Italy’s dire death rate may be because of the fact that it was so delayed to do far reaching testing. Germany, which likewise has a genuinely old population, had a generally low Covid-19 casualty rate. Their forceful early testing practice was also responsible for low causality. Germany and France, Europe’s two most powerful countries, have been hit by the coronavirus, with 150,000 confirmed cases. But as of April 17, France had close to 18,000 deaths, while Germany’s death toll had passed 4,000 due to covid-19. Differences in effect of the coronavirus in similarly sized countries were due to failure of the French government to made strategy executing social distancing or promote large-scale testing.

TABLE 6: Fatality rate of different age groups

Age, years	Case Fatality Rate, %
0-9	< 0.2
10-19	0.2
20-29	0.2
30-39	0.2
40-49	0.4
50-59	1.3
60-69	3.6
70-79	8.0
> 80	14.8

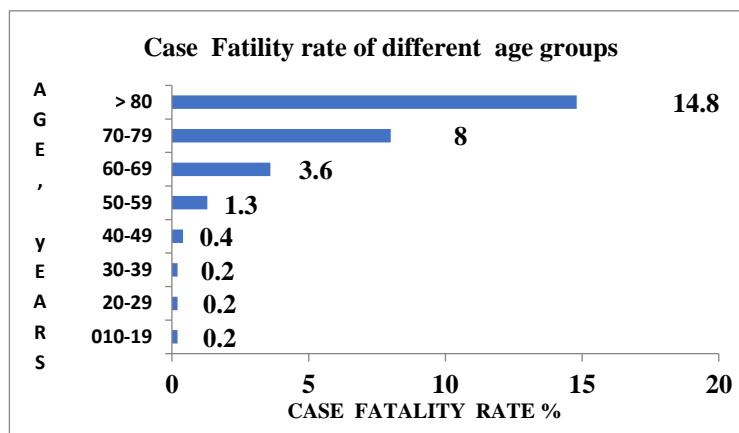


Fig 13: Fatality rate of different age groups.

The practices of various nations indicate that significant national riches and high quality health care systems aren't sufficient to protect residents from the horrendous coronavirus. Saving lives is also about how rapidly, completely, and successfully the administration reacts to the creating emergency. The Countries that have deferred to respond have to pay the price.

IX. WHY DOES INDIA HAD SO FEW COVID-19 CASES AND DEATHS UP TO MAY 2020?

There are various possible explanations regarding India's low mortality rate:

In the first place, it is reported that India was in an early stage of the pandemic. The first infected voyagers from Wuhan came to Kerala, southwest India, on January 29. The strategy of the Kerala was trace, complete quarantine, test, isolate and treat. The realities show that Kerala acted quickly and more carriers arrived at different states by early March. The first death was recorded on March 12 in Karnataka.

India took the right call by announcing a prompt lockdown in March in the wake of the COVID-19 pandemic. On 24th March 2020, the Government of India well-ordered a nationwide lockdown for 21 days, 2nd lockdown extended across the country from 14th April to 3rd May, 3rd lockdown extended from 4th May to 17th May and further 4th nationwide lockdown was extended from 18th May to 31st May 2020. These lockdowns may have effectively suppressed the epidemic. Physical distancing is probably the most ideal approaches to slow the epidemic.

India may have defensive attributes against Covid-19. Scientists have suggested that only 0.8% of the population is above 80 and nearly 75% are below the age of 40. The high temperatures and humidity in India, extensive BCG vaccination for tuberculosis, or domestic hydroxychloroquine use to combat malaria have helped Indian escape from the brunt of the pandemic. Moreover, researchers have written in research paper (funded by the government of India and the Indian Council of Medical Research) that Indians are less susceptible to novel coronavirus due to their special genetic makeup. The fatality rate

rises in India only if a person has cardiovascular disease, diabetes, chronic respiratory disease, or hypertension.

TABLE 7: Fatality rate due to different comorbid conditions

Comorid Conditions	Case Fatality Rate, %
Hypertension	6.0
Diabetes	7.3
Cardiovascular Disease	10.5
Chronic Respiratory Disease	6.3
Cancer(any)	5.6
None	0.9

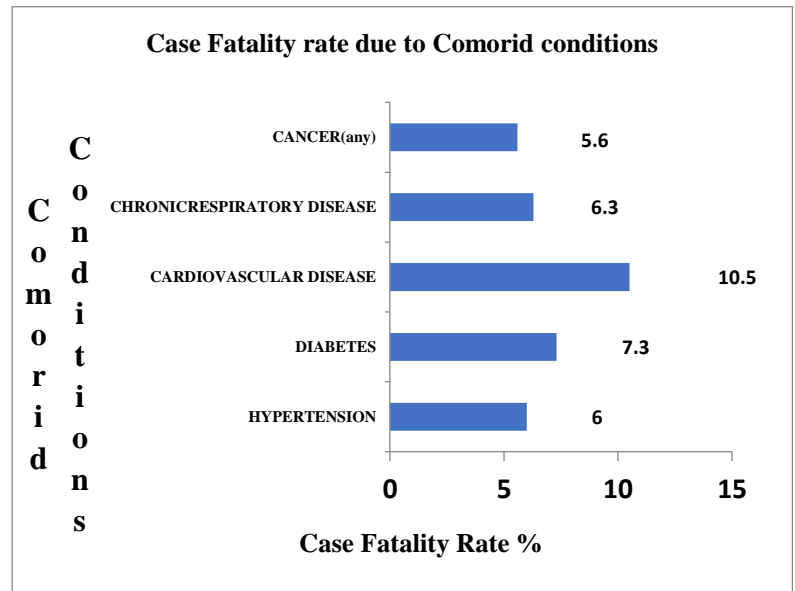


Fig 14: Fatality rate due to comorbid conditions.

X. VARIOUS HEALTHY STEPS TAKEN BY GOVERNMENTS

In spite of the large number of cases and countless deaths that have happened in this staggering coronavirus disease 2019 (COVID-19 pandemic). No peer-reviewed studies of specific therapies proven to be effective in reducing mortality and a vaccine are many months to years away. It was noted that out of infected patients, 20% to 30% required mechanical ventilation, with higher fatality rates in older patients and those with medical comorbidities [11]. So the Government of all nations should concentrate on the following:

1. All Countries focused on initial preparatory steps for e.g. increasing hospital beds capacity, building multiple hospitals and well-designed PPE.
2. Various nations have expanded staff in hospitals for caring the corona patients.
3. During the weeks of time created by social distancing efforts, ventilators accessibility in hospitals should increase.
4. It was reported that World Health Organization (WHO) had plans to launch Bluetooth-based contact tracing feature app.

Every nation depending on a different approach, Singapore, South Korea, and Hong Kong had effectively slowed the rate of infection. Singapore concentrated on a technique of severe regulation; it firmly controlled its fringes, forced a 14-day isolate on anybody coming back to the nation. The administration of Singapore utilized cell phone GPS information to ensure those under isolate remained inside endorsed outskirts. South Korea focused on mass testing (15,000 tests/days) and contract tracing. South Korea checked who came in contact with whom, utilizing data from Visas and surveillance cameras; the nation likewise observed lodgings and cafés with warm imaging cameras, and that way chosen febrile people from a group. Hong Kong, meanwhile, concentrated on ways to reinforce norms of

social distancing. In Taiwan, the administration set up a command center for virus-combating operations, checked temperatures of all arriving airline passengers and quarantined those with fevers, linked national health insurance and customs databases, and tracked citizens' movements. A highly centralized and authoritarian country China had deployed drones to monitor its citizens.

India, Australia and the United Kingdom have already released official virus apps to check the symptoms and contact tracing records. Several nations (Taiwan, South Korea, Hong Kong and Canada) are ramping up contact tracing, or the process of finding, testing and isolating individuals who crossed paths with an infectious individual. These nations (South Korea, Hong Kong, Taiwan and Canada) didn't lock down because they applied more precise anti-epidemic tools.

The WHO is promoting the Swedish Model and their way of doing things during Covid-19 pandemic. It has been planned by scientists and sponsored by government. Swedes are trusted to "self-control." Large public gatherings are prohibited, but restaurants, bars and schools have remained open, and social distancing is encouraged rather than enforced by police.

XI. DISCUSSION AND CONCLUSIONS

COVID-19 has caused extreme disturbance over the world. More than 76,98,803 coronavirus cases affirmed around the world, 4,23,868 confirmed deaths and nearly 38,43,221 recoveries are reported up to 12th June 2020 [www.coronatracker.com/analytics]. Due to the high degree of uncertainty about the exact route of transmission, treatment and prospects of recovery, Europe and U.S. have borne the brunt of the infection, while Asian and African nations have been moderately less affected. India's coronavirus cases overtake the UK to become fourth largest in the world (as estimated on 12th June 2020). Its number of affirmed cases is behind just the US, Brazil and Russia.

As the COVID-19 pandemic advances, countries are dynamically executing a wide scope of reactions. Currently no vaccine is accessible for COVID-19. Globally, social distancing and lockdown are being tried to stem the spread of this highly contagious disease. The spread of pandemic can be decreased by staying at home when sick, covering mouth and nose with mask, washing hands regularly with cleanser and water; and cleaning frequently touched surfaces and objects. As case numbers fall, it becomes more feasible to adopt intensive testing, contact tracing and quarantine measures. Technology – such as mobile phone apps that track an individual's interactions with other people in society will be more effective and scalable. It is also verified that applying various steps like mandated lockdown, social distancing can reduce R0 (reproduction number) as well as flatten the curve.

RT-PCR is the most useful test and currently the only reliable one. The development of vaccine against the SARS-CoV-2 is in full swing. India has also started clinical trials on the effectiveness of four antiviral drugs against Covid-19 as part of the World Health Organization solidarity trial. The Indian Council of Medical Research (ICMR) reported that potential anti-viral agents, Remdesivir, Chloroquine/Hydroxychloroquine (anti-malarial drugs), Lopinavir-Ritonavir (HIV) and Lopinavir-Ritonavir (Hepatitis C) with Interferon (β 1a) will be assessed as part of the solidarity trial. There could be a better chance of recovery in terms of Covid-19 affirmed cases if there is early detection of the infections. Primary health care officials could be trained to provide care to the elderly and chronically ill at home, to reduce the burden on health infrastructure at designated Covid-19 hospitals. The government is in the process of increasing the stock of testing kits and personal protective equipment for the health professionals.

The COVID-19 pandemic has taught us many important lessons. Most importantly, future pandemics are unavoidable because we cannot anticipate as well as their severity. Second, the significance of improved exploration and transparency is paramount for every country of the world. Third, governments must develop coordinated responses including stockpiling essential supplies and formulating plans to dispense them rapidly where they are most needed. Finally, research in basic virology, cell biology, immunology, biochemistry, and other relevant areas must proceed apace, even in inter pandemic intervals. These studies provide the necessary head start to conquer new viruses before they overtake us and wreak havoc on our health system, economy, and society.

DATA SOURCES

Data is extracted from verified sources such as John Hopkins University [21], WHO and DingXiangYuan, a website authorized by the Chinese government.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

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APPLICATIONS OF INDUSTRY 4.0 TECHNOLOGIES IN FISH PROCESSING INDUSTRIES IN WAKE OF COVID 19

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ABSTRACT

The world has been hit by a pandemic called COVID 19 since December 2019. India is struggling with this unprecedented situation in all aspects. This worst-hit extends its arm to the processing industry side also. Abiding by the government regulation viz., social distancing, reduced workforce, minimal movement between states, and across countries put forth the challenges and damages to the typical fish processing industry framework. The operational strategy and types of machinery are well established for its purpose to maintain biological security measures along with profit rise for the company. Hence, this study was conducted to mitigate the damages and challenges caused by COVID with the help of state of the art Industry 4.0 technologies. Industry 4.0 techniques are more comprehensive and problem oriented to address the management level issues, marketing issues and workman concern also. These techniques will helps in increasing sustainable production process and also reduce the work – life dilemma of the employees. The technologies such as Bigdata, Artificial Intelligence (AI), Internet of Things (IoT), Enterprise Architecture (EA), Cyber-Physical system, Machine Vision system helps in conducting the operations and maintaining the business on the positive side always. The suggestions made in this study can be extended even after the pandemic to increase the viability and profitability by making Fish processing industries smarter than the way it is right now.

Keywords: *Fish processing, Industry 4.0 technologies, COVID – 19.*

I INTRODUCTION

India is a peninsular country with a vast coastline length of 7516.6 km (4670 miles). The Indian Fisheries, having copious resources on its own, achieved the status as the highest fish producing country next to china with a global share of 7.58%. The Indian Fisheries economy comes from three different ventures viz., culture fisheries, capture fisheries, and processed seafood. The Fish process industries serve as the connecting tool for Indian fisheries and foreign exchange with a total production capacity of 14,886.60 Metric tons[1]. It signifies the importance of Indian Fisheries in Nations GDP. The Fish processing industries, in particular, are spread all along with coastal cities viz Chennai, Kochi, Kolkata, Mumbai, Veraval, Vizag, Ratnagiri, Bhimavaram, Goa, Mangalore, Porbandar, Tuticorin to export the fish and fishery products after processing as soon as possible.

Industry 4.0 is a set of techniques that integrates digital technologies which allow the industries to assess the real-time performance and behavior[2]. The term industry 4.0 was coined in 2011, which induces all the industries to be computerized[3]. It brings out a perfect technology framework for industry and will increase the production level both at intra and inter-organizational levels[4]. Industry 4.0 techniques would alternate the relationship between suppliers, manufacturers, wholesalers, retailers, and customers in a more comfortable way[5]. The manufacturing models that are formed using technologies like robotics, AI, IoT, and Machine Learning will be more efficient[6]. Industry 4.0 techniques serves the purpose not only act as a significant management tool for the industry but also make enough relaxation to the practitioners of the industries and also gives an enormous rise in their social life.

Hence, this paper deals with the application of industry 4.0 technologies in Fish processing sector in its strategic operations. It gives the ideology and intuition on the future improvements in a food processing industry would experience by Industry 4.0 technologies adoption.

II Methodology

This section describes the detailed descriptions of basic structure of Fish processing industry and Industry 4.0 technologies, having enough scope in Fish processing sector to improve its productivity and optimization in its activity amid pandemic.

Fish processing Industry – an overview

Processing is a transformation of raw fish or ingredients by a set of activities that interact with the raw material to produce a processed food. Processed food results in food which contains zero toxin, zero microbes and well preserved from spoilage indicators. It is done by either physical or chemical means such as drying, extrusion, pasteurizing, uses of preservatives etc.

Fish processing

Fish is a highly perishable food which needs proper handling and preservation. Fish processing refers to the process which eliminates all the unwanted conditions and parameters in fish from the fishing ground to customer. The harvested fish should be cleaned and cooled properly as soon as possible to prevent fish spoilage, off flavor and color. The main objective of fish processing is to prevent fish from spoilage and maintain its freshness for a longer time.

Fish processing is divided into primary and secondary processing. Fish handling is the primary or preliminary processing of raw fish and also for the manufacturing of value added fish products. Secondary processing produces chilled, frozen and canned or value added products for the retail.

The primary fish processing activities includes cutting, beheading, evisceration, cleaning processes and the secondary processing operations includes

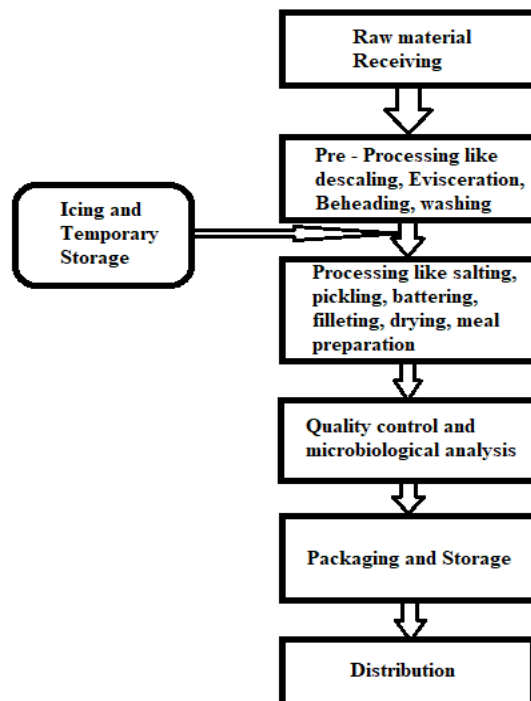
- By making value added fish products (cooking)
- By controlling the temperature of the fish by using ice (freezing)
- By controlling the water activity (drying, smoking, salting, freeze drying)
- By physical control of microbial loads (ionizing irradiation)
- By chemical control of microbial loads (adding acids)
- By packing without or little amount of oxygen (vacuum packaging)

Equipment involved in fish processing are of pre-processing equipment such as beheading machine, descaling machine, evisceration machine etc. And the processing equipment such as extruders, filleting machine, plate freezers, smoking chambers, flake ice machine etc.

Artificial Intelligence

The term Artificial Intelligence (AI) refers to the process of making a machine or a device which have self ability to access the data and have to decide on its own in that specific situation. This is a system that can perceive the existing environment and respond to it [7]. It imitates human's cognitive functions, like learning and problem solving[8]. AI is an industrial application that can do descriptive, predictive, and prescriptive work[9]. AI has vast industrial applications, including image and language processing, robotics, and Machine Learning[10].

Fish Processing line of flow



Potential technologies for implementation

Big Data Analytics

Big Data Analytics is collecting data from various sources, including business, Social media, etc. and processing of collected large data beyond the capabilities of standard tools. The size of this big data varies in different periods. However, commonly refer to a size that is above the computer's data size[11]. Big data analytics method was tested in the oil industry and has been reported that this method can increase the efficiency of the operation and also gives precise decision for the workplace[12]. Big data analytics is a method that can process the data, which is beyond the capabilities of standard tools[13]. The process of dealing and analysis with many data that are impossible to manage is called big data analytics[14]. Big data analytics can also improve the quality of the product and services from batch to batch, product design and customer service[15]. Big data analytics is a supporting system in real-time decision making[16].

Cyber-Physical System

The Cyber-Physical system (CPS) is a computer system in which physical components will be interlinked with the computer for computations. A transformative technology which compiles an extensive system in it is called a Cyber-Physical system[17]. CPS is a combination of computer, communication, and physical processes[18]. It is a combination of computation and communication systems with sensors and other components, respectively[19&20].. This system mainly uses a feedback loop symbol, which sometimes relies on human intervention. CPS could enable smart transportation systems, smart factories, smart vehicles, and smart homemaking[21]. Intelligent manufacturing procedures like a predictive production system can be achieved and equipped in industries with the help of CPS[22]. CPS paves the way to achieve new manufacturing procedures for Industry 4.0 revolution[23].

Enterprise Architecture

Enterprise Architecture (EA) is a structure that relates the business components and their external mirror properties. EA is a technique that binds business strategies and Information Technology[24]. The function of EA is to analyze business status, architecture, contents, and technologies and to make development plans[25]. EA will identify and optimize the business area, which requires improvement[26]. EA's adoption in Malaysian Railway supply chain provided better and high technical procedures in [27] and improvements in e-commerce[28].

Machine Vision System

The process of recognizing targets with the Machine's camera or eye and inspecting and recognizing the target is called the Machine vision system (MVS). MVS can be used for Digitalization, automation and cyber-physical system[29]. The functionality of MVS is determined based on image acquisition from the machine's eye and how it is processing the image through an algorithm[30].MVS is an industrial technique that can detect and count objects. So it can be used in a more massive industry in which the assembly and production rely on manual work[31].

Internet of Things (IoT)

Internet of Things(IoT) is a concept that can connect the physical objects, types of equipment with the virtual world. The networking of devices is the preliminary step for digitalized industry formation[32]. Industrial Internet of Things can detect failures easily and check and speed up the maintenance process by gathering continuous information from sensors[33]. Functioning and making a decision by IoT is based on the combined hardware and software which used[34]. It can give the best solutions for supply chain management industries[35]. Industry 4.0 is a new revolution that consists of a heterogeneous device working for the same goal. It can be achieved easily by implementing the Internet of Things in industries that will share the goal for specific devices for quicker achievement goals[36].

IV Discussion

TABLE 1: APPLICATION OF INDUSTRY 4.0 TECHNOLOGIES STRATEGIC OPERATIONS OF FISH PROCESSING INDUSTRIES

Processing Method	Techniques currently in practice	Replaceable with Industry 4.0 Technique
Traceability	Manual preparation and maintenance	Data warehousing and Big Data Analytics
Material Handling	Manual movements	Artificial Intelligent Robots
Large equipment processing viz., drying, heating, IQF	Machine operation with manual supervision, operation and inspection	Cyber Physical System

Quality control	Manual sampling and analysis by skilled labours	Machine Vision System with trained Machine Learning model
Waste water treatment	Treatment operations often requires manual screening, scratching and other tedious operations	IoT, Machine Vision system and Robotic systems
Packaging and transferring to storage area	Manual handling and usage of pallet trucks	Machine Vision system, and Robots
Worker safety	Prerequisite programs like GMP, GHP	Robots and Chat bots

Besides COVID – 19, Food processing industries suffer low workforce per task and also bio safety measures maintained by the individual at workplace. The operational strategies of industries are also constantly affected because of less raw material input caused by poor logistic and supply chain management of harvested aquaculture produce and capture produce. Hence, these issues can be addressed by the implementation of such techniques, which are playing vital role in developed Multi-National companies into our Fish processing Industries.

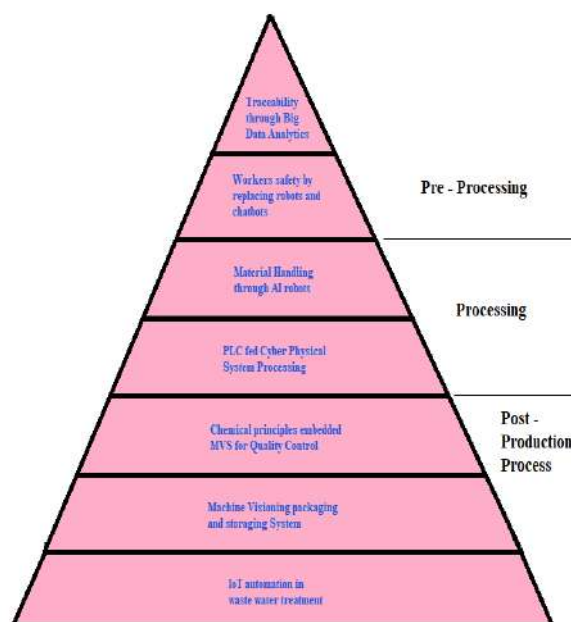
Traceability

Traceability is the process of documenting intent about the nature of raw material and its final expectations. It includes type of processing, mode of raw material production viz., culture and capture, and type of finished product to be produced from the fish. This includes the major operations of food surveillance and recall throughout the operation until the final stage of reaching the customer in terms of marketing. The data warehousing and Big data can be employed to this extent to make the data available online and easy identification of lot of our interest. Quick response coding system can be actually used at this operation to enhancing the monitoring aspect thereby reducing the time and energy consumption at this process.

Material Handling

This stage requires the large number of labors to pass on the raw material to further processing. The equipment’s used for this operation is conveying system viz., screw conveyor, bucket conveyor. However, the material transmission to work place is usually done with the help of labour. Hence, this can be eliminated by making use of AI Robots, which would be developed in the way to actually handle and stack according to the remaining quantity of previous lot in an intelligent way. AI robots will reduce the labour cost as well as the machine maintenance cost required for the conventional material handling about 2/3 percent.

Larger equipment processing



Larger capacities equipment viz. boilers, dryers, pulverizers requires manual attention and inputs such as time and temperature combination setting, revolutions per minute etc., This can be replaced by using Cyber Physical System which will combines physical equipment with computers through Programmed Logic Control (PLC). It helps in making the operations self-reliant to control and maintaining the critical limits under control.

Quality control

Fisheries industries are using certain procedure for sampling product for quality inspection. The boxes of samples taken after sampling cannot be reused and it is considered as waste. In order to avoid sample wastes in the name of quality inspection, one can introduce Machine Vision System. The chemical principles embedded quality tool can be used, helps to find out the presence of spoilage indicators in fish and those samples can be isolated from others products in the same batch.

Waste water treatment

Waste water treatment is an important and prominent strategy in food processing industries. This system is almost similar to the normal waste water treatment strategy but differs in the load and composition of waste water. It includes two processes in primary treatment such as sedimentation by screening and scratching requires manual input. This can be replaced by introducing Industrial Internet of Things as well as Machine Vision System. With the support of IoT, Screening can be automated by analyzing the waste load in water and with the help of Machine Vision System, make decision whether scratching process is required or not for a particular outlet.

Packaging

Before packaging, the processed foods are analyzed and ensured for hazard. But sometimes, foods can possibly contain the hazard components (usually physical hazard). This can find out and removed by implementing the Machine Vision System as this system has the ability to inspect the food through machine eye or camera. This helps solving the quality issues associated with the export commodity and ensuring the safety and health of consumer.

Worker's safety

Process of designing and arranging labours in the industry and also ensuring safety is called ergonomics. Every industry has to follow strict ergonomics principles. Use of robots/chat bots helps to avoid human loss in case of industrial burn or in some other emergency situation like equipment malfunctioning. This implementation not only makes advanced industry but also saves and reduces the labor and labor cost respectively.

V CONCLUSION

The strategic operations in the fish processing industries and the application of Industry 4.0 technologies were discussed. This helps in maintenance and smooth running of industries amid regulations-imposed by government because of COVID and challenges imposed by the COVID. The suggestions mentioned can be possibly implemented to make the processing industries prepared to the unprecedented challenges in near future or later. However, these techniques are implemented permanently for the better operational and maintenance strategy to improve productivity and worker wellbeing, as it is successful, in other potential ventures. The future scope of this work can include application of Industry 4.0 technologies over other such secondary operations involved in Fish processing industries and its proper implementation for better management practice in Fish process industries.

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MACHINE LEARNING MODEL TO PREDICT AND MAP HAPPINESS INDEX WITH GROWTH RATE

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ABSTRACT

Every human being in the world has a desire to live happily. Several psychological researches have been done to study the role of various psychological factors which help to predict the happiness. The terms happiness, wellbeing, quality of life is commonly used as synonym for each other. Meanings of these terms can vary by context over a period of time. There is no specific or universal definition of happiness, as happiness means different things to different people. It changes with time, age, place etc. Approximately 4.2 billion people in the world are billion people are likely to be shifted to urban areas which is more than half of the world's current population. This will have its own impact on the lifestyle of the human beings and the overall happiness level of the world. Some of the countries have started measuring growth rate on the basis of happiness index of their nation's population. In this research work we have applied machine learning model on the datasets available for the year 2018, 2019 to predict the happiness index for the coming years on the basis of global parameters available for 157 countries of the world. With the help of this model, we can predict and put the country in the class /cluster like excellent, moderate, average or below average. The abovementioned classes signify the growth of the country and the impact of various parameters on overall growth and happiness of its population.

I INTRODUCTION

In the last few years, the research towards happiness has attracted increased attention. The information about the happiness has exploded drawing attention of researchers from diverse backgrounds are contributing towards it. Attempts are being made to create, explore and document a wealth of knowledge about parameters that makes an individual happy. The world's happiness index was created by Piere Le Roy, the initiator of GLOBECO in the year 2000. The world happiness index helps to quantify the happiness of the nation's population which is then used to predict growth rate of the country. Growth National Happiness (GNH) index is used to measure the collective happiness in a country. This concept was first proposed and adopted by the Royal Government of Bhutan and implemented by it to protect human rights in the Kingdom of Bhutan [1].

The world happiness index is a modification to world human right index. It uses the same statistical aggregation method with the objective to measure the happiness of the country. For example, following parameters could be considered for the happiness of the residents of a country:

- Security and peace
- Democracy
- Human rights and Freedom
- Life style/ Living standards
- Education
- Research
- Communication
- Culture

II LITERATURE REVIEW

Happiness could be an important indicator for presenting how well the society is doing. Yang Hen et.al. [2] carried out a subjective evaluation of people's quality of life and demonstrated how various environmental parameters can impact an individual's well-being. He attempted to predict the happiness on the basis of air pollutions and the level of air index quality required to get the optimal happiness score. Hammad Ai jassami [3] applied a machine learning model to predict the happiness and life quality from the data received psychological tracking process.

The happiness score is prepared by interviewing random sample of population from individual country, to think about the ladder with best possible life for them and the worst possibility of living standard. The metrics supplied by each country affects the happiness score. A linear regression and multiple linear regression with a number of parameters are applied to predict the happiness score of the country. This is completely an artificial exercise where multiple linear regression model of machine learning is used for experiment. This study evaluated the effectiveness of automating happiness tracking as a leading indicator of construction workers' productivity. Ed. Bullen [4] et.al. presented a supervised machine learning model to predict the life satisfaction score of the country based on various parameters. He applied the models on dataset of 187 countries, the applied algorithm identified the various parameters needed to be improved by various countries to improve the happiness index of the citizens.

From the above discussion it is evident that no comprehensive machine learning model covering all factors affecting happiness has been developed to help predict happiness index for the world.

Proposed Machine Learning Model: The proposed unsupervised machine learning model uses K-means clustering method to predict happiness. The K-means algorithm is used to make the clusters of unlabeled data. The datasets of 156 countries are downloaded from the website Kaggle, which show the happiness index based on the different parameters like GDP, corruption, social support, life expectancy etc. The K-means algorithm is applied to divide the datasets into number of clusters. We have made five clusters to group the data into similar classes. Choosing an appropriate of value of k is a challenging task, iteratively changing the value of k and performing the different number of iterations can help to get the optimize value of k with proper partitioning of datasets into clusters. Clusters are labeled to check the accuracy of system. Datasets are further partitioned into training data and testing data. K-means algorithm provides the accuracy where we have a similar type of dataset available and troubles in creating the clusters with varying size of dataset. Outliers can be identified and tracked by retrieving the centroid of the clusters formed [5-7].

Process

After getting all the datasets from the sources, in the very first step, data is partitioned into two separate partitions, where happiness index could be classified into two different sections of happiness. While in the next step data is partitioned into training and test datasets[8-10]. Following python libraries are used to apply and visualize the machine learning model. `Import matplotlib.pyplot as plt; Import numpy as np; Import pandas as pd; From sklearn. Linear model import Linear Regression`

Matplotlib is used for visualizing the required information; numpy is used for manipulating the high dimensional arrays, for creating the data frames. pandas and scikit libraries are used to perform statistical operations required to apply machine learning algorithms. In the next step, we are going to load and read the dataset for further operations. Data frames are created for applying the further operations on the required set of attributes.

III Prepare Data

To apply the ML model, firstly data set must be normalized, scaled and applied feature transformation according to requirements. The process is called data wrangling/ data cleaning. Data preparation helps to accurately analyses and process the data. A similarity metric must be created for to form the clusters

Figure 2- Applying K-Means Machine Learning model

Source-Author Own

In Figure 2, K-Means module is imported from sklearn, all the machine learning models are prebuilt in the sklearn library and according to the objective and type of dataset, the desired machine learning model can be applied. In the above process we have applied total 3000 iterations to train the model and check the accuracy of the proposed system.

The clustering process is based on the similarity of the dataset and the centroid of the cluster is used to map all the elements. In figure 3 all the centroids are calculated, five different centroids and their mapping neighboring elements are combined and kept into class/ cluster.

```
In [54]: kModel.cluster_centers_
Out[54]: array([[ 16.          ,  6.98058065,  1.33774194,  1.47235484,
                0.9653871 ,  0.50932258,  0.22751613],
               [109.5       ,  4.7239375 ,  0.6479375 ,  1.03221875,
                0.5784375 ,  0.3665    ,  0.1715625 ],
               [141.        ,  3.879    ,  0.45545161,  0.88016129,
                0.43819355,  0.28567742,  0.20951613],
               [ 47.        ,  6.05580645,  1.10996774,  1.39416129,
                0.86303226,  0.44248387,  0.15535484],
               [ 78.        ,  5.41819355,  0.98293548,  1.27087097,
                0.78590323,  0.35970968,  0.16070968]])

In [36]: y_kmeans = kmeans.predict(inp_data)
         y_kmeans
```

Figure 3- Calculation of centroid and applied prediction on input data frame

Source-Author own

In Figure 3 the centers of all the five clusters are computed through which neighboring elements are placed together in to five individual clusters. Clusters are defined by various parameters which are not specifically based on the happiness, they are measurement of GDP, health life expectancy, generosity, social support, freedom to live life and corruption etc.

```
In [13]: pd.crosstab(out_data, kModel.labels_)
Out[13]:
```

col_0	0	1	2	3	4
Score					
2.853	0	0	1	0	0
3.083	0	0	1	0	0
3.203	0	0	1	0	0
3.231	0	0	1	0	0
3.334	0	0	1	0	0
...
7.488	1	0	0	0	0
7.494	1	0	0	0	0
7.554	1	0	0	0	0
7.600	1	0	0	0	0
7.769	1	0	0	0	0

155 rows x 5 columns

Figure 4- Matrix distribution of all total rows into 5 cluster
Source-Author Own

In Figure 4 visualization of the clustering/classes is presented with five different clusters, the centroid of each cluster pointing the cluster. If we “pretend” that we don’t have survey happiness scores for the countries listed in the test data-set, we can use our K-Means model created in figure 2 to predict their happiness based on the metrics GDP, Social Support, Life Expectancy, Freedom, Generosity, Corruption.

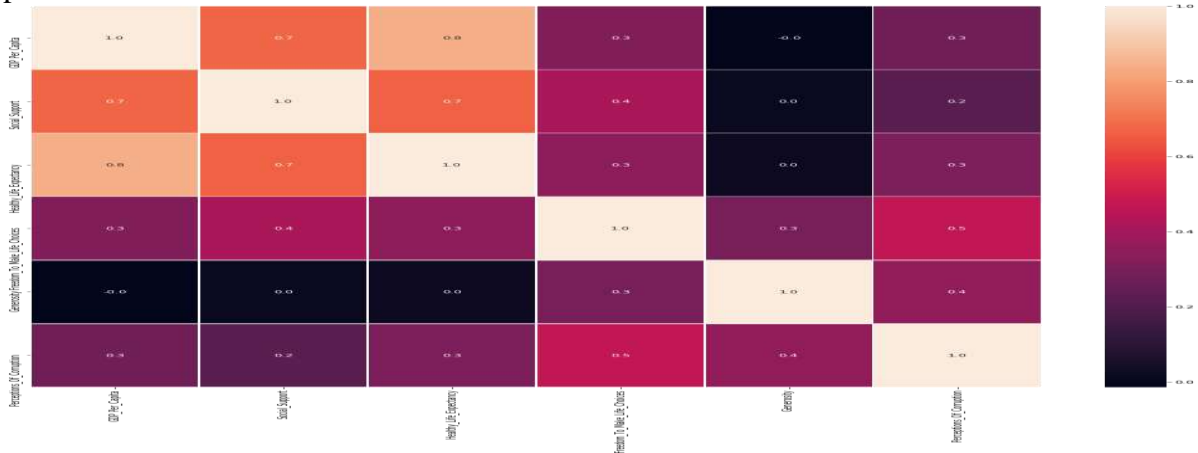


Figure 5. Correlation matrix of the various parameters of data set of 2018

Source- Author Own.

In Figure 5, the correlation between all the parameters used in the dataset is described. From the above figure we can easily identify parameters influencing the overall score as well as the parameters which are more interdependent.

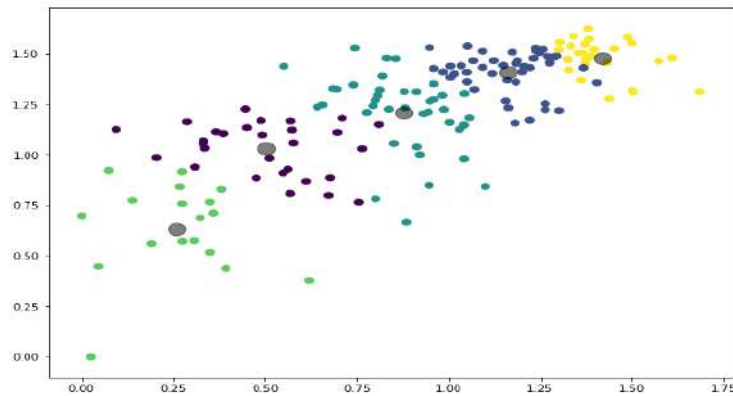


Figure 6- Visualization of Cluster (Datasets 2018)

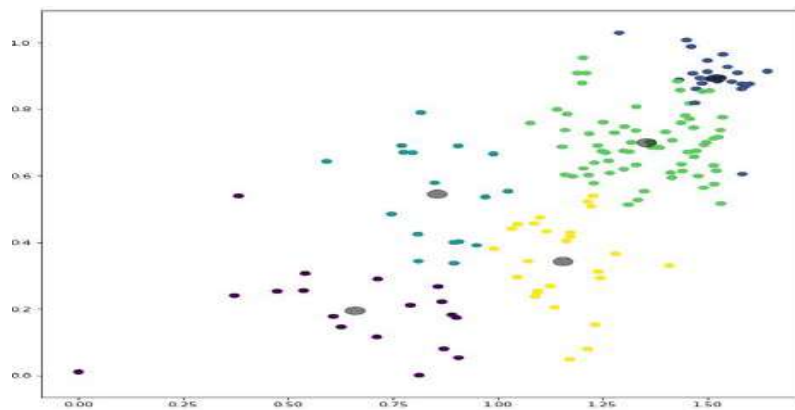


Figure 7- Visualization of cluster (Datasets 2019)

Source-Author own

In Figure 6 and 7 it is clearly visible that all the individual clusters are isolated. No overlapping and intersection of the clusters is found. It is evident that the applied algorithm has given accurate clusters/classification on the basis of similarity features detected by algorithms.

Cluster 0- Excellent

Cluster1 – High

Cluster 2- Moderate

Cluster 3 - Average

Cluster 4 - Below Average

Above clusters are classified on the basis of happiness index rating. Based on this countries are distributed in different classes/clusters. Any of the country could be identified within the defined classes.

IV IMPLICATIONS OF THE STUDY

Happiness could be related to various parameters, somewhere is related to economic growth, somewhere it is related to safety and security of the citizens or freedom to live life and take decision. Happiness is not bound to some specific type. In this paper, we have proposed a model which is working on some of the few global parameters that can compute and provide overall happiness indexing. The statistical evaluation relates the growth with the happiness index and on the basis of happiness score retrieved the growth in terms of classes/ cluster mentioned can be predicted. This model will help agencies responsible for the happiness index. It can be used to achieve the desired level by improving parameters which will positively impact the overall index.

V Conclusion

The proposed model is working with total 156 countries of 2018 and 2019 dataset. The concept of happiness index and dimensions that effects the happiness index of the nations is always the matter of discussion and contradiction. There is no such comprehensive work done on the global parameters of happiness index in the machine learning field. There are several classification models available to train and test the dataset, K-means clustering algorithm provides optimal results without any overlapping.

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LOCKDOWN IMPLICATIONS ON VARIOUS ENVIRONMENT COMPONENTS DURING COVID-19

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ABSTRACT

India is trying hard to fight the COVID-19 on the ground level. Being the 2nd most populated country globally, India is suffering play a major role in controlling the spread. A big question on to manage the pandemic and the possible areas affected due to this virus. From lockdown to social distancing and ensuring special rules to secure its population, these actions have a specific impact on various factors of the environment that may seem short-term and affect the generations. The pandemic should be considered as a wake-up call, as the situation demands to bring the right strategies to avoid the future outbreaks. While addressing this global pandemic, factors like healthcare, awareness, and surveillance medical care and testing facilities is still unanswered as the peak is not getting any closer while other waves of this pandemic are well predicted. The paper focuses on different aspects of such impacts and their contribution to the Sustainable Development Goals (SDGs) that India has targeted to achieve by 2030.

I INTRODUCTION

THE human civilization has fought against many pandemics to survive for the future. Pandemics like H1N1, polio, Ebola, and Zika were a lesson for many countries to make the right changes and to prepare themselves against future pandemics. COVID-19 is officially identified as an emergency of international concern and is now reaching almost every part of the planet. It has affected millions of lives, and millions of cases are being confirmed every month since its spread in China. The virus has shown its highest potential by Breaking the healthcare systems of many developed countries in terms of the highest death tolls and morbidities. The present virus comes under coronavirus 2 (SARS-CoV-2) and directly affects the respiratory systems in living beings. Like any other viral infection, this novel virus has various symptoms, out of which dry cough, myalgia, fever, dyspnea, and fatigue are the most common ones. Other symptoms like hemoptysis, diarrhea, pleuritic chest pain, and headache, are also reported in patients[1].

There was no scientific strategy planned to fight against the virus in the beginning. Until now, no cure available, and many vaccines are under the development stage, and some passed the final trails too. The resources and literature coming out from different corners of the world and strict measures are employed to control its effect as much as possible. India is learning from friend countries and implementing the plans in both the medical and social fields. From lockdown to social distancing, the country and its people look for the best way possible to survive during the health crisis[2]. This pandemic and controlled measures have affected the social, economic, and environmental aspects of human lives. Different researchers are trying to predict the impact of the contamination using different models by comparing it with other affected and recovered countries[3]–[5].

Human existence is already fighting with global environmental challenges such as urbanization, pollution, ozone layer depletion, water crisis, soil degradation. These pandemics are another advanced threat to humans. The virus has halted social-economic activities in countries like China, UK, Italy, and India, emerging as the hotspot for new cases. Although the recovery rate is commendable compared with other nations with more advanced medical facilities, the testing and reporting of COVID-19 are questioned by many reputed authorities [6]. The overall objective of the study is to spot the significant findings of different reports emerged regarding the impact of COVID-19 on various components and subcomponents of the environment. The study also focuses on the social-economic burden caused by the outbreak of Coronavirus in the country, affecting its GDP and SDG targets in a long run.

The paper targets the impacts of Lockdowns, which were happened as a controlling measure to mitigate the virus. The lockdown period was extended for 68 days, which began with the Janata curfew or solidarity curfew for the whole country. Further lockdowns were imposed by the state governments to save its people and prevent the spread. The impacts of the novel Coronavirus on various components and subcomponents of the environment were studied briefly, and final comments were made based on the findings from these studies.

The pandemic for India and the world

Reported by the WHO website (accessed on 25th September 2020), there have been 32,110,656 confirmed cases of COVID-19, and 980,031 deaths have been reported from various parts of the world [7]. The virus is spread over 200 countries/regions, and India is one of the biggest hotspots with the maximum number of cases being reported in the month of September. The first confirmed case of COVID-19 was reported from Kerala with and International travel history. The Ministry of Health has now confirmed 59,04,392 cases, with 93,424 deaths.

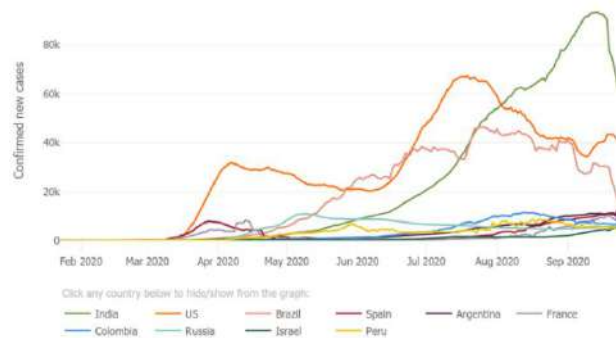


Fig. 1 Graph showing a weekly average of confirmed cases in 10 most affected countries on 25th September 2020 (source: John's Hopkins [8])

Since its early detections in China's Wuhan province, the virus confirmed its higher transmission rates. It was found to spread in the air through tiny droplets, which made the wearing of Masks a compulsion during the lockdowns and unlock. Studies confirm that inhalation can lead to the penetration of aerosols in the respiratory system [10], [11]. Due to high infection and death rates, the pandemic is a major concern to public health worldwide.

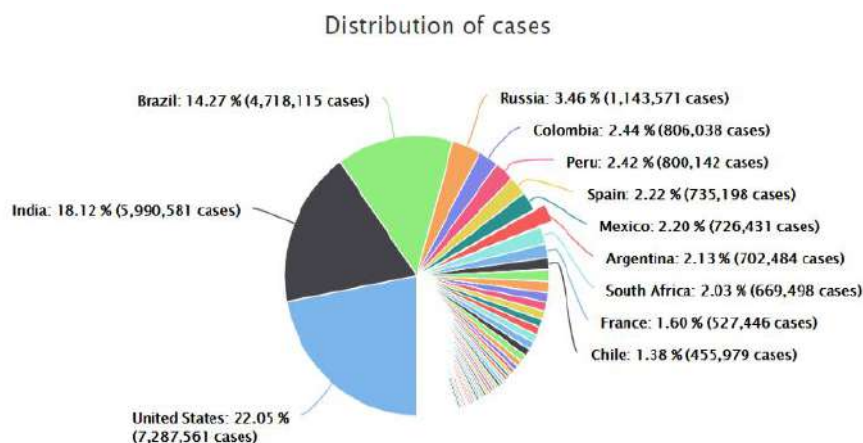


Fig. 2. Distribution of COVID-19 cases on the global map.
(Source: worldometers.info, Accessed date: 27th Sep 2020 [9])

India under lockdown

India, like other affected countries, went under complete lockdown during COVID-19. Beginning with a voluntary lockdown known as the Janata Curfew, people were advised to follow the lockdown rules strictly. Strict implementation of the lockdown was used to close the movements within the nation, and the international movements were prohibited. Public transport was stopped to stop the migration of people and also of the active cases so that the unaffected areas can be secured. The lifeline of India, Indian Railways, is not fully operational yet, but special trains are now running on important routes compulsory Standard of Procedures (SoPs). WHO has praised the timely action of the Indian government but early unlocks have caused a spike in the active cases. With a considerable increment in the number of weekly tests, more positive cases are being recorded in September, which is under the 4th phase of unlocking.

Lockdown/ Unlocks	Dates/ Period
Janata Curfew (voluntary public curfew)	22nd March (14 hours)
Lockdown Phase 1	25th March 2020 – 14th April 2020 (21 days)
Lockdown Phase 2	15th April 2020 – 3rd May 2020 (19 days)
Lockdown Phase 3	May 2020 – 17th May 2020 (14 days)
Lockdown Phase 4	18th May 2020 – 31st May 2020 (14 days)
Unlock 1.0	1st June 2020 – 30th June 2020 (30 days)
Unlock 2.0	1st July 2020 – 31st July 2020 (31 days)
Unlock 3.0	1st August 2020 – 31st August 2020 (31 days)
Unlock 4.0	1st September 2020 - 30th September 2020 (25 days)

Table 1.1 Showing the Lockdown and Unlock happened in different periods

II IMPACT OF COVID-19 AND LOCKDOWN

Effect on Indian Economy

Before the pandemic, the country was already striving badly due to the economic slowdown. The pandemic and the lockdown implementation made the situation worst for both small as well as large-scale industries. From an 8.2% GDP growth rate (January–March 2018), a massive fall to 3.1% in growth rate was observed for January–March 2020. During the first quarter of FY, the growth rate was -23.9%. The reason behind this negative GDP was construction, trade, hotel, manufacturing industries, which were worst hit during the lockdown [12]. The slowdown led to thousands of layoffs, and further future recruitments both in the private and government sectors were on an indefinite break. According to Indian Industrialists, the layoffs and salary cuts were necessary to prevent the shutdown of their firms. The fuel demand of the country decreased by 46% in the mid lockdown period [13]. It suggests industrial units were not operational as industries producing essential goods could operate during the lockdown according to rules. The demand for fuel was decreased significantly, as primary transport operations were stopped for indefinite periods [14]. This affected the tax collections by the states and the center. To generate revenues, the government imposed higher taxes in the name of COVID cess on non-essentials.

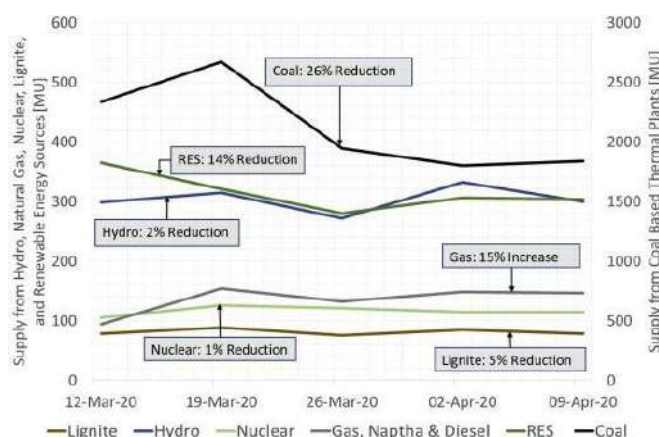


Fig. 3. Source-wise Fuel Supply during Weekdays (between March and April 2020)[14].

Mass migration

The country has seen the biggest mass migration drive after the partition of 1947, and there are no official records of deaths that happened during migration. The insecurity related to food, money, and employment made many people travel back to their hometowns when the lockdown was extended without any relief to the needy. A report by World Bank claims that the pandemic affected the lives of more than 40 million migrants [15]. There were plenty of stories in the tabloids, social media, and newspapers covering the journey of the poor to their homes in the heavy summer period. The migration was a setback for industries both small scale and large scale as the faith of workers in their job was gone. From running special trains and buses for the migrants to arranging food and shelter for the people, governments and private entities tried their best to make the journey less miserable [16], [17]. With the ending of lockdown, a phased unlock has begun, many returned to their jobs, but the exact numbers are yet to be confirmed.

Impact on air quality

Study-related to impact on air quality during the period of crisis is the most common area of interest for the researchers. Various studies focused on the period of lockdown and post lockdown, where the pollutant concentrations were studied. The human activities were on halt during the first lockdown, and hence the concentrations of these pollutants decreased drastically in the open environment[18]. In a different study, the maximum reduction in AQI, i.e., 49%, was observed in the capital. A drop of 31% in PM₁₀ levels and a 43% reduction in PM_{2.5} levels from different parts of India during the lockdown period was also confirmed by the same[19]. In a further study, the effect of halting of anthropogenic activities was studied by satellite-based data of NO₂ emissions[20]. It has been noticed that the lockdown led to a significant reduction in NO₂ emission comparing to last year's data of the same duration all over the country. There were reports of clear visibility in the sky, which led to the sighting of Himalayan peaks and mountain ranges by the people residing in the cities of Saharanpur and Jalandhar during the lockdown [21], [22]. With upcoming phases of lockdown, there was ease in restrictions, and hence the pollutant concentrations increased.

COVID-19 is an airborne disease, and therefore the indoor air quality is also a big concern for people. During the lockdown, people were struck in a limited space, and hence they were prone to indoor pollutants, which are very common in an Indian household. Exposure to unburnt carbons, cleaning products, smoking, and various other components was a reason of worry for both children and old age people. The situation was better in villages than the metro cities as the population density and less space for a living makes it tough to follow the rules of social distancing during the pandemic.

Impact on waste generation trends

The indefinite break on industrial and manufacturing units lead to less production of Industrial wastes. All the workplace buildings, including offices, shops, malls, and major markets, were closed to control the spread, and people were asked to stay home. During this period, a study confirmed significant changes in the amount and variety of waste being dumped at the final sites. The study focused data of 10 major landfill sites situated in different cities and confirmed that the amount of dry waste significantly reduced during the Lockdown period. It was due to no contribution of trash from the workplace and also the low collection operations by the frontline workers in the field. Lack of recycling was observed as the ragpickers were not allowed to do their share. In industrial towns, the lack of laborers and non-operational units other than the essential manufacturers were the reason behind the least waste production and collections. The study also confirms that the construction activities were also stopped, which caused almost no construction and demolition waste reaching for disposal [18]. The contamination was real, but the frontline workers did a commendable job in the cities by ensuring daily collection of the Household wastes from the townships and localities. The only concern here was that according to reports, households are contributing a significant share in total bio-medical wastes (BMW) during the pandemic[23]. The recent trend is a cause of worry as the country is already suffering from a lack of daily disposal facilities and the further burden getting out of the hands of disposal facilities[24]

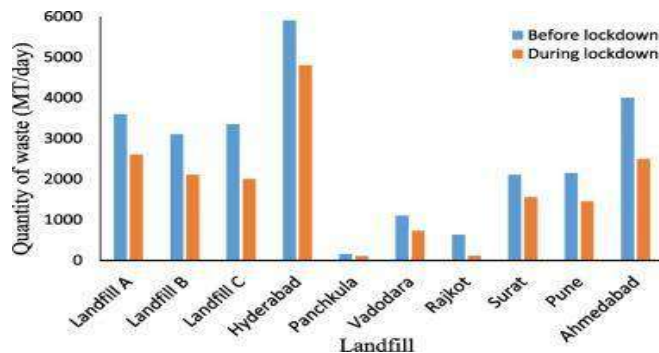


Fig.4. Graph showing the difference in waste dumped at landfills Before lockdown and after lockdown [18].

Social Impact of COVID-19

Like other developed nations, India was in denial mode until the first case of COVID-19 was confirmed in Kerala. Studies have shown an Unhygienic lifestyle and lack of precautions were the reasons for massive outbreaks in the past. It is the reason of India behind being the second most infected country in the world. The lack of healthcare facilities, low hospital bed ratio, low doctor to patient ratio, and over that non-availability of permanent cure made this the situation deadliest in the advanced world. To prevent the spread and to prepare the medical facilities for upcoming cases, the government needed strict implementation of lockdown.

People were trapped in their houses, and a shortage of essential items for survival made them storing more food items from the stores in one go. The increments in Lockdowns made citizens restless. Children and old aged people became dependent on their near and dears. There were fear and rumors which caused the social boycott of the infected families. Although NGOs, private players, and religious bodies are trying to help the needy in the best way possible, the government used police force, volunteers, and army units to make people stay home. These people worked with the government in implementing social distancing and proper lockdowns in all cities. The excess screen time and idleness caused restlessness among people, and the worry of future survival caused mental stress.

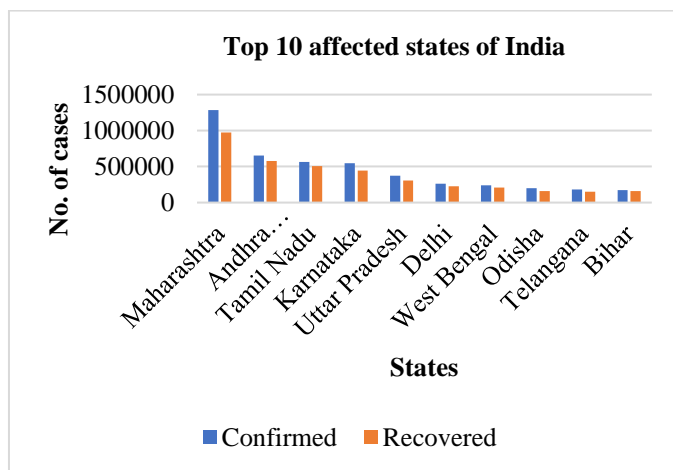


Fig. 5. Top 10 states in India with the highest COVID-19 cases. (Source: MoHW.gov.in, Accessed date: 25th September 2020 [25])

Social gatherings in huge numbers were not strictly prohibited. Therefore, many religious and cultural activities were canceled to avoid any mishap. The further Unlocks allowed the gatherings in a limited number but wearing masks and maintaining social distancing is still mandatory. The easement of lockdown was a relief to many, but this also led to a hike in confirmed cases. People are still waiting to send their children to school and colleges, but many are concerned about their health first over education.

Impact on Sustainable development goals

The crisis generated due to Covid-19 has left no nation untouched. From high-income to low-income countries, the socio-economic crisis can be noticed in different forms. One measure to check the impact is to study the performance of SDG's to compare the situation among various nations. Due to the lockdown, a report published online mentioned the following SDGs, which are now off tracks due to the lockdown period. It includes

- SDG 1 (no poverty)
- SDG 2 (zero hunger)
- SDG 3 (good health and wellbeing)
- SDG 8 (decent work and economic growth)
- SDG 10 (reduced inequalities)

India is already behind his Asian neighbors to reach these goals in time, and goals like good health, zero hunger, and gender inequality among the 17 SDGs are nowhere reached on the ground level. However, relief was observed on 12 to 15, which are related to responsible consumption and production, climate action, and protection of biodiversity [26]. The relief seems temporary as the final effects are yet to be reported by the authentic sources. The situation demands International support to reach the vulnerable countries. India is providing medical and economic aid and also getting the attention of the developed ones.



Fig 6. List of 17 sustainable goals [27]

Environmental sustainability and future perspectives of COVID19 lockdown restrictions

Like any other natural or anthropogenic emergency, COVID-19, too, has taught us many things. We, as humans and our activities, are the reason behind the environmental crisis being faced by the planet today. The major findings regarding the sustainability under this pandemic era are:

- Due to the halting of industrial operations, the lockdown in the early stages caused restrictions on pollutant concentrations, and the air quality index improved significantly. But it harmed indoor air quality, which was a threat to young and old generations living with certain medical conditions.
- There was a significant control on the noise levels, and also the river water quality was improved. These positives are on one side, but the economic Graph due to non-operational industries is a reason to worry and needs a broader study.
- The drastic increase in the production of MSW and BMW cannot be ignored. There is an urgent need to address this issue, and the implementation of better recycling and reuse facilities is the requirement of these times.
- Due to complete lockdown, human interference with the natural environment has given a chance to nature to recover. There were a smaller number of human-wildlife conflicts reported, and the ecological balance got a positive response. Lockdowns are not a permanent solution to save nature and biodiversity. There is a need to plan human and animal interference so that the biodiversity of the space remains intact.
- The GDP growth rate and migration of labor due to less food and shelter opportunity tell a different story of this lockdown proceedings. Many lost lives due to denial of the healthcare facility, and studies are predicting how COVID-19 prevention measures are reason to worry among TB and other medical conditions which need equal attention.

The innovations led many to work from home, but it cannot be possible in a longer run. With the ease in restrictions, the COVI-19 cases have been increased in the country drastically. The unaffected states are now reporting cases in thousands, which are the cause of worry as India is known as the second-highest populated country globally. People should be more responsible in following the SOP's and maintaining social distancing until a vaccination or effective cure is not out. We were treating this crisis as an opportunity to work with advanced technologies so that future healthcare problems can be tackled.

III Conclusions

After studying various outcomes of lockdowns and unlocks during COVID-19, it can be concluded that this pandemic should be a lesson for all the countries. The present study gives a brief view of the pros and cons of lockdown measures on the environment. The positives include better air and water quality indexes, healing of nature, and biodiversity, whereas the negatives can be summarized as the Migration crisis, high BMW generations, socio-economic setbacks. These impacts are almost common for every other developing nation, but a proper and phased implementation could have bought a different scenario.

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EMERGING TRENDS IN SOFTWARE ENGINEERING POST COVID-19

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ABSTRACT

The onset of the year 2020 has witnessed the sudden outbreak of COVID-19 which has been declared a ‘global pandemic’ by the World Health Organization (WHO). This pandemic has turned the daily routines and work lives of people upside down, as they are struggling every day to keep up with the new challenging situations. Millions of organizations were forced to operate remotely as a precautionary measure for maintaining social-distancing; and hence, majority of the employees had to make a shift towards online modes of working. In face of such a crisis, the need and popularity of software has also increased more than ever. On the other hand, when it comes to the development of a worthwhile information processing system, most software development organizations are faced with more than one alternative to choose from. This paper will examine the emerging trends in the field of software engineering that are not just helping software industry grow even in the times of global crisis, but are here to stay for a long time in the wake of increasing demand from end-users for advanced software.

Keywords: Trends in Software Engineering, SDLC, DevOps, Covid-19, Artificial Intelligence, Cloud platforms

1. INTRODUCTION

The sudden outbreak of Coronavirus pandemic, which originated in Wuhan, China at the close of 2019 has not only affected the societies at large, but also changed the way organizations belonging to various sectors are operating. It would be right to say that certain behavioral patterns have been changed forever because of the pandemic. Students are now taking classes online from the comfort of their homes, people are ordering food and groceries using apps instead of going out to the markets and stores, and employees of several organizations are collaborating and holding meetings virtually – all is being done to ensure physical distancing with the goal of preventing the spread of the communicable disease that has already taken millions of lives around the world. Though this pandemic will subside at some point of time in the near future, given that the countries from all over the world are putting in their best efforts to find a cure against the deadly disease, but the dependency on software will continue to rise. Digital dependency is no longer a choice. It has become a necessity which has brought about a shift in the paradigm for most enterprises. Today, virtually every industry is relying heavily on an increased use of robust, efficient and flexible software in order to support its day-to-day operations and processes. Consequently, in order to provide such high quality and cost-effective software solutions that meet the changing business requirements of the customers, software engineers are focusing on adopting newer software engineering practices. The rest of the paper is divided into following sections – the next section will give some background details on traditional software engineering methodologies. The third section will analyse how software is being used as a response to the current pandemic situation by various sectors. The emerging trends in the discipline of software engineering will be explored later.

II BACKGROUND

Software Engineering is defined as: The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software. The study of approaches as in [1][2]. In general, Software Engineering discusses the principles, practices and approaches that must be followed for the development of a quality software.

Every software product is built over a number of stages, which consist of gathering and analyzing business requirements, designing, and implementing the software solution and testing it to ensure that the quality standards are met at all times. These stages together form the Software Development Life Cycle (SDLC). In order to streamline the software development process, a software development methodology is required, so that a high-quality software product can be created in a timely, systematic and disciplined manner [1]. Before discussing the latest trends in Software Engineering, it is important to understand the underlying concepts of traditional software engineering methodologies. Some of these are discussed below:

Traditional Waterfall Model

The purpose of the waterfall model of systems development is to divide the development process up into a series of manageable parts that relate to each other in an organized way [3]. The model works best when the requirements are clearly laid out and well understood by all parties involved [4]. Fig. 1 shows the diagrammatic representation of waterfall approach which consist of six distinct phases:

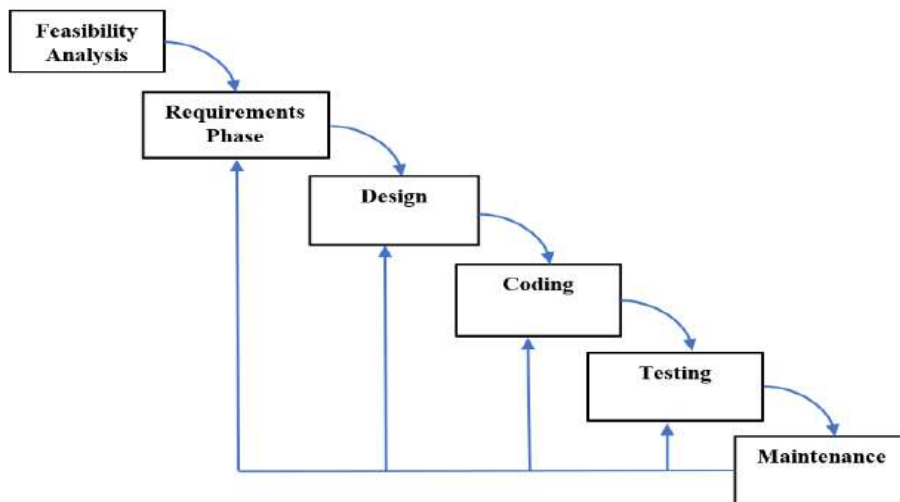


Fig. 1. Waterfall Model

Feasibility Analysis: Here, very high-level decisions are made regarding whether the project should be taken up or not considering the scope, business goals and constraints.

Requirements Phase: The system analyst gathers and validates all the requirements of all stakeholders.

Design: It involves designing complete system architecture, component level design, their interconnections and interfaces.

Coding: Different programmers write source code for various modules making up the system.

Testing: It is an important stage wherein the design and the programming errors are identified and rectified with a view to build a robust software [5].

Maintenance: The goal here is to rectify any errors that earlier went unnoticed and/or to enhance system functionalities and capabilities after its use begins under real working conditions.

The waterfall model serves as a base for many other SDLC models. However, it lacks flexibility, as newer requirements cannot be easily incorporated during later stages of development. That would call for huge amount of rework.

Iterative Methodologies

The problem with traditional methods of development, as in the case of Waterfall model, was that there was often a huge lag between the specification phase and the final delivery of the system. In many cases, this time gap would result in customer frustration and dissatisfaction, or perhaps, the business

requirements would change altogether by the time the software was ready for delivery. As a response to these shortcomings, iterative methodologies, such as RAD and Rational Unified Process, were introduced.

Rapid Application Development (RAD)

RAD is an integrated set of techniques, guidelines and tools that facilitate deploying a customer's software needs within a short period of time [6]. This incremental model to system development allows for the rapid development of relatively simple applications that can be built by a small team of people [7]. RAD makes use of a flexible, "timebox" approach where once all the business requirements have been gathered from the customers and other business-related sources, the prototyping approach is immediately undertaken without detailed planning. Often, several modules are constructed in parallel and delivered within short time periods of about four weeks, called "timebox". The biggest benefit here is that a new version of the system is released at the end of each timebox period, resulting in customer satisfaction. System developers also incorporate various interactive visual programming tools that allow faster development.

Rational Unified Process (RUP)

Created by Rational Software Corporation, a division of IBM, Rational Unified Process, or RUP, is a process framework focusing on object-oriented software development [8]. In this methodology, a software product is developed iteratively with the help of various modelling techniques, such as Unified Modelling Language (UML) tools, in order to develop high-risk components first. Each iterative version is then thoroughly tested which allows developers to verify product quality, and control and manage all forms of changes that might occur during development.

Software as a response to COVID-19

The pandemic has brought about shockwaves of crisis for millions of organizations worldwide. Under such difficult circumstances, most enterprises are already reimagining to build their business models around some kind of software that will benefit them in the long run, particularly in terms of automation of business processes and better decision-making. From retail to education, from customer relations to healthcare, there is no such sector which is not turning to the use of one variety of software or the other. Post Covid-19, how penetration of software is increasing across different sectors can be observed through following examples:

Ecommerce: Amid lockdown regimes and faced with the closure of shops, customers switched to mobile apps and online shopping for buying groceries and other essential commodities. A recent study revealed that Tesco has a large presence in West Europe (accounting for 78.4% of sales in 2019) and the severe impact of COVID-19 in this region causing stockpiling early on, has driven sales for the grocer [9]. Though the stores will reopen once the lockdown is over, but it is highly expected that customers will prefer to continue shopping online for daily essentials.

Banking and financial sectors: The Covid-19 epidemic has led to an impressive acceleration of the digitalization process in the banking industry. For instance, the industry has started operating almost entirely remotely quickly – online banking, remote working, e-commerce and electronic payments are on the rise and these trends are here to stay, particularly if social (physical) distancing has to remain in place in the medium term [10].

Education Sector: Institutions across the world are offering online classes to ensure continuity of education for their pupils. During lockdown, students are using popular social media tools like WhatsApp, Zoom, Google meet, Telegram, YouTube live, Facebook live etc. for online teaching learning system [11]. Moreover, numerous resources are also available for students and researchers on various online platforms.

Telemedicine and Healthcare Services: Telemedicine is the practice of offering medical consultation services to patients remotely using technological tools such as video-conferencing. Many healthcare systems have already implemented telemedical innovations as a response to Covid-19. Rather than expect all outpatient practices to keep up with rapidly evolving recommendations regarding Covid-19, health systems have developed automated logic flows (bots) that refer moderate-to-high-risk patients to nurse triage lines but are also permitting patients to schedule video visits with established or on-demand providers, to avoid travel to in-person care sites [12].

Collaborative Virtual Teams: The trend of virtual teams is also on the rise nowadays. In order to maintain a social distance, members of several organizations are working with a new mindset where they are making use of latest innovative solutions, particularly video-conferencing tools such as Zoom, Google Meet, Cisco WebEx Teams, to collaborate in a virtual manner and exchange their ideas and documents even from remote locations.

III FUTURE OF SOFTWARE ENGINEERING

In post Covid-19 era, the inclination of enterprises towards software will continue to see an upward trend. Software engineers are already working on a plethora of new technologies, designs, models, approaches and standards to meet the ever-increasing demands for advanced software. In this section, some of these trends will be analyzed.

Product-centric development approaches

As demands and expectations of users have expanded, so has the need for newer software engineering practices that continually bring value to them. Consequently, software engineers have moved from traditional software engineering methodologies to modern, customer-focussed and product-centric approaches, such as Agile, Lean and DevOps. These approaches are characterized by their capabilities of developing a software in an iterative fashion, with accelerated release cycles, and team members continually making use of highly productive and automated tools, which greatly reduce the time invested in development, thus preventing problems such as schedule slippage and budget overruns. Moreover, continuous testing throughout all phases, from development to delivery, helps to resolve all associated risks and achieve a high-quality product.

The emphasis of these modern approaches is also on building a collaborative environment where various members of development team and operations team work together with end-users, frequently asking for their feedback, to continually build things that are worthwhile for them and in alignment with business goals, and discarding anything that does not bring value.

Cloud Platforms

Cloud computing, put simply, allows users to access various types of services over the Internet (or Cloud), such as storage, utility programs, application development programs, and analytics tools. The idea here is to lessen the computational burden on client devices and using them just as input and output terminals to access these services, which are either hosted by the organization itself or by some third party.

Even though the concept of cloud computing is certainly not new, many enterprises are now building their own business model around the plethora of services offered by different cloud platforms including Google Cloud, Amazon Web Services (AWS), Microsoft Azure to name a few. According to a survey conducted by *Flexera2020 State of the Cloud Report*, 93 percent of enterprises already have a multi-cloud strategy and more companies are planning to migrate more services to cloud due the emergence of Coronavirus pandemic.

Cloud storage system architecture mainly includes storage layer, basic management layer, application interface layer and access layer. The microservice architecture, on which cloud platforms are based, allows for quick development and deployment of software applications as a set of service components that communicate using well-defined APIs. Continuous improvement is made by monitoring performance and resource usage patterns.

The benefits of cloud platforms are manifold - speed of access, flexibility, efficiency, scalability, high performance, high availability, backup and faster rates of recovery from failures. But its biggest advantage is in terms of cost savings as organizations or end-users are not required to make heavy investments for purchasing additional hardware or software. Instead, they simply pay for the services that they are using or hosting which reduces capital expenses to a great extent.

On the whole, the future of cloud engineering looks highly promising as not just the start-up companies but also big corporate sectors of the society have started to realize both the necessity and the power of cloud environments, especially in the times of Coronavirus outbreak.

Internet of Things (IoT)

IoT is becoming one of the fastest-growing areas in the field of computer science and networking, and with the availability of the revolutionary 5G wireless technology, IoT is expected to take a huge leap with over a billion IoT devices across the globe over the next two years. Whether in wearables, smart cars, smart gadgets, smart homes, or manufacturing, IoT is finding a place everywhere. Subsequently, with the growing demand for IoT devices, software engineers are already in the process of exploring new opportunities in this business.

Artificial Intelligence (AI)

Artificial Intelligence has been around for several years, and now its use is tremendously increasing across the Internet. For instance, many companies are using AI based Chatbots on their websites to enhance customer experiences and to answer their direct questions. Software engineers realize the power and beauty of AI and are trying to explore many more avenues in the realm of Artificial Intelligence. It is now also being applied to various project development and management tasks, like for identifying what components of a software product can be reused and how automated testing can be applied to test various parts of a software.

IV DATA ANALYTICS

As most businesses are trying to get free from the clutch of Coronavirus, they are increasingly becoming dependent on data science and data analytics. No matter, how small or large a company is, it can ensure business continuity as well as growth even in the times of economic crisis by investing in data science and streamlining the way in which it operates based on the results of the analysis of its data.

Data analysis is also proving useful for software developers as the data collected from their customers can be evaluated to understand user sentiments about a latest app or software and make optimal changes to improve the performance and quality of the developed product.

V OUTSOURCING

In an attempt to reduce the operational and business risks amid the Covid-19 crisis, companies are increasingly looking to outsource at least one business function. Following the coronavirus crisis, outsourcing market is expected to grow at a double or even triple rate because of the growing demand for IT products and services across all sectors. Technology firm NTT's recently released '2020 Global Managed Services Report' based on a survey of 1,250 executives in 29 countries said that 45% organisations will outsource more than insource in the next 18 months, with 57% citing security risks as a key challenge of managing IT in-house [12].

VI CONCLUSION

It is an undeniable fact that Coronavirus pandemic has been a huge blow for the global economy which resulted in a major shift in the work cultures and operating styles of millions of enterprises across the globe. Consequently, in order to maintain growth and continuity of their businesses, organizations are restructuring their business models around one or more software. Keeping in view the unprecedented growth in the demand of a variety of software systems and applications, software engineers are in the process of exploring new trends in the fields of Cloud computing, Artificial Intelligence, and Data Science among others. In the presence of endless opportunities in these areas, it can be concluded that digitalization is the future and Software Industry will continue to see a boom in the coming years even after the pandemic subsides.

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OPPORTUNITIES AND MITIGATION STRATEGIES FOR BIOMATERIALS : TO COMBAT THE CHALLENGES OF COVID-19 OUTBREAK

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ABSTRACT

In the past several months, "Coronavirus Disease 2019" (COVID-19) has intensified to a global pandemic at an unprecedented extent. This COVID-19 pandemic has disclosed major flaws in our abilities to mitigate transmission of infectious viral disease and provide treatment to patients, leading to a public health crisis. Various Clinical views are discussed, considering the mitigation tactics and scope for novel biomaterials involved diagnostics, treatment strategies and surface coatings for virus deactivation. Call for multidisciplinary approaches in disease detection and management by biomaterials community are expected to play a major role to combat the challenges of current and future outbreaks.

Keywords: Biomaterials, Antiviral, Diagnostics, Pandemic.

I. INTRODUCTION

With the advancement in vaccination, public hygiene and antibacterial development, humanity is far less susceptible to any type of infectious diseases. In the past several months, "Coronavirus Disease 2019" (COVID-19) has intensified to a global pandemic at an unprecedented extent. Identified as a novel beta-coronavirus having similarity with other zoonotic SARS-coronaviruses, it is said that SARS-CoV-2 invaded into human populations from bat host via a wet-market in Wuhan City, China [1]. It has abruptly diffused to almost every corner in the world. This COVID-19 pandemic has disclosed major flaws in our abilities to mitigate transmission of infectious viral disease and provide treatment to patients, leading to a public health crisis [2]. A cursory search on PubMed reflects that much of the biomaterial community has focused their research on antibacterial work as 90 articles were having the keywords "biomaterial and antiviral" but over 3,500 results for the same search with "biomaterial and antibacterial" in the last 5 years as of May 2020.

In order to facilitate rapid problem solving and scientific progress during this viral pandemic, our goal is to explore the current clinical practices against COVID-19 and how biomaterial work can contribute in current and future pandemics.

II. CHALLENGES

The SARS-CoV-2 virus was first spotted in December 2019 in Wuhan Province, China as a cluster of pneumonias [3]. Since then, this virus has spread globally at an alarming rate and is expected to cause millions of infections and lakhs of deaths in the next two years [4]. Some interesting insights we get when we briefly compare SARS-CoV-2 with viruses SARS coronavirus (SARS-CoV) and MERS coronavirus (MERS-CoV). Even though all the three viruses are transmitted zoonotically, but COVID-19 differentiates itself significantly from others by -

- how widespread and rapidly it can spread,
- its low mortality rate as, compared to the other two viruses [5,6].

A. Transmission Mechanism of SARS CoV-2 and infection

Basically, the main way of transmission of a zoonotic virus is human-to-human via. droplets , close contact and fomites [7]. But it becomes a matter of great concern when – a patient who had been exposed to the virus for a weeks before the onset of symptoms (asymptomatic carrier) [8]. Moreover, the growing evidence of SARS-CoV-2 for its highly contagious nature due to its ability to move in aerosols, which are widely defined as small respirable droplets (<5-10µm in diameter) and are capable of long-range airborne transport [9,10]. In the Journal of the American Medical Association, the Center for Disease Control (CDC) has briefly classified patients on the basis of symptoms into :

- mild (81%),
- critical (14%),
- life-threatening infection (5%) category [11].

Major Symptoms that has been observed for those critically life-threatening infected people are headache, cough for little infection and gastroenteritis, sepsis and multi-organ dysfunction (MOD), ventilator-dependent respiratory failure [3,12].

B. Indicators for Mitigation Effectiveness of COVID-19 and Pandemic Severity

Most countries generally tried different strategies and waited for the results. The response strategies get changed with time if it is before the peak of the pandemic and achieve stability after attaining the peak.

At the early stage, the mitigation effectiveness (E_e) is measured by time spent to reach the peak and at the latter stage, mitigation effectiveness (E_f) is measured by the maximum drop rate during the peak and the final observation point. A scatter diagram can be sketched based on E_e and E_f for determining the overall mitigation effectiveness (E_o) where the subscripts e , f , and o denote the early stage, the latter stage, and the whole period. Pandemic severity S_i is measured by the proportion of total confirmed cases N to population P each day, expressed as-

$$S_i = N_i / P t_i \quad \dots \dots \dots (1)$$

where t signifies days covered by the early stage ($i = e$), the latter stage ($i = f$), or the whole period ($i = o$).

The mortality rate d of the whole period is also assigned to get the measure of pandemic severity, calculated by the proportion of total deaths D to population P each day, expressed as-

$$d = D / Pt \quad \dots\dots\dots (2)$$

where t represents days covering the whole period [13].

III. MITIGATION STRATEGIES

After the outbreak of COVID-19, the SARS-CoV-2 has become one of the most salient focus areas in biomaterials research. In the following sections, a brief outline of current clinical standards is shown and then current opportunities for biomaterials intervention are also discussed.

A. Diagnostic techniques

Nucleic acid testing via **R**everse **T**ranscription **P**olymerase **C**hain **R**eaction (RT-PCR) has emerged as the most common means of screening patient samples for current SARS-CoV-2 infection globally [12,14]. Following the outbreak of COVID-19, the international collaboration has led to the rapid advancements of these RT-PCR-based SARS-CoV-2 detection kits which is a major worldwide achievement. Most of these tests perform the same following steps:

(1) The Biological samples go through a Chemical treatment for RNA extraction and purification.

(2) It is known that, thermocycling consists of following steps in a sequential manner :

- denaturation,
- annealing
- extension phases.

Thus, thermocycling can precisely amplify the target sequences of cDNA corresponding to the custom-designed primers.

✓ *Point-Of-Care Nucleic Acid Testing:*

Several limitations are faced in RT-PCR testing for the contemporary SARS-CoV-2 in: sample collection and processing stages, several congestions in testing workflows, Lack of PCR instrument infrastructure which led to the limited access to testing in those regions. Thus, point-of-care (POC) strategies have emerged as an alternative domain of research in present-days. Preferably, POC tests provide diagnoses without any requirement of off-site laboratory for processing of samples and its solutions eliminate the need for specialized equipment, allowing tests to be conducted in the field or even self-administered at home.

· *Advantages:*

- i) During centralized testing and processing, the risk of disease spread gets reduced.
- ii) Testing throughput and capacity can be increased.
- iii) In the less/under developed areas where the income limit of people is low, access to more testing can be possible.

· *Role of Biomaterials:*

- a) Biomaterials laboratories can assist in the

fabrication of key disposables comprising of test swabs for collecting samples. For example, Formlabs has designed and approved 3D printed nasal swabs for collecting respiratory samples [15].

b) Biomaterials also plays a vital role in the formulation of POC tests. Emerging POC nucleic acid tests combine modern molecular and synthetic biology inventions with advanced biomaterials advances to simplify low technology disease detection [14].

✓ *Application of Isothermal RT-PCR Tests:*

Biomaterial scientists can contribute important technologies to facilitate next-generation diagnostic test development. In [16], the development of a magnetic nanoparticle-based system is shown, that performed isolation of RNA and DNA quickly from biological samples after a magnetic field is applied to help in nucleic acid purification. A chemiluminescent reporter system based on magnetic nanoparticle, has also been illustrated for the detecting target sequences with a comparatively simple instrument. Biomaterials allow for the elucidation of assay results on the basis of colorimetric analysis without any use of specialized optics, making them a prototype for POC detection.

· *Advantages:*

i) According to aggregation property, surface chemistry, size, shape, the biomaterials-based surface plasmon resonance biosensors such as quantum dots or gold nanoparticles have been demonstrated for changing colour thus making them excellent optical probes [17, 18].

ii) This can be manipulated to produce simple colorimetric readouts from complex molecular reactions. Efforts to apply this technology (and other similar ones) to develop COVID-19 tests are underway [3,19].

· *Strategies:*

a) **SHERLOCK (Specific High-sensitivity Enzymatic Reporter unlocking)** - a novel nucleic acid test, has received authorization from US Food and Drug Administration Emergency Use Authorization (FDA EUA) for COVID-19 detection in clinical samples.

b) For doing test in a single step of clinical samples, test reagents (including ribosomes, enzymes buffers, substrates) could be lyophilized in a single paper disc. Moreover, this platform was shown to be highly economical and also exceeded expanding access to testing for lesser instrument requirement. To extend this technology for COVID-19 patients, the work is underway [12,20].

✓ *Use of Nucleic Acid Biosensors:*

A day will come when emerging biosensors with extremely low limits of detection, may allow for faster and simpler one-step detection, which would lead to the complete elimination of reverse transcription as well as cDNA amplification steps.

· *Advantages:*

i) An large number of nucleic acid biosensors and transducers are found which includes nanostructures having surface-functionality and DNA-responsive smart materials with programmable features[21, 22]

ii) Nanoislands become functional with complimentary DNA that allows for encapsulation of target RNA. Detection of changes in localized surface plasmon resonance can be observed in response to RNA binding.

- Strategies:

- a) Biomaterials strategies can be utilized to enhance existing sensor technology.

- b) To escalate this signal amplification by reducing the requirement for cDNA amplification, the development of a cationic copolymer has been explained in [23], that assisted in the assembly of MNAs, dramatically increasing the catalytic ability of the enzyme to yield a 200 times faster rate of substrate conversion to detectable product.

- ✓ Viral Antigen Testing:

Nucleic acid testing is the prevalent method of diagnosing the COVID-19 patients. But, designing of biomaterials can help in the detection of viral antigens present at the surface of an undamaged virus.

- Advantages: Such diagnostics would prove immensely beneficial, as –

- i) They require little or no sample pre-processing that can directly sense the existence of virus in complex biological fluids.

- ii) Extremely low detection limits are required to confer clinical relevance without any amplification involvement. In addition, as detection limits decrease, pathogen selectivity is utmost and to maintain excellent specificity.

- Strategies:

- a) Biosensors such as electrochemical or optical biosensors, piezoelectric - for the detecting minute changes in mass, electrical activity and optical features, play a vital role in biomaterials research [24-26].

- b) Emerging biomaterial sensors should reveal the ability to surpass the susceptibility and specificity of conventional nucleic acid tests for replacing current standards.

B. Therapeutic Facilities

- ✓ Nanodecoys:

Nanostructures are fabricated to mimic living cells, as an alternative of nanomaterials centered strategy, known as nanodecoys. These are produced from or contain derived materials from cell membrane to capture and isolate viruses. Current progress in entry routes used by SARS-CoV-2 could be utilized to trap virus for creating nanoscale cell-mimicking decoys. Particularly, the fusion of SARS-CoV-2 with host cell membranes is proceeding through interactions between viral S proteins, proteases and ACE2 such as the transmembrane protein TMPRSS2 [27-29]. Decorating cell-mimetic nanoparticles with the ACE2 protein or related peptide fragments could provide an even more biomimetic presentation of the protein.

- ✓ Extracorporeal Blood Treatment:

The employment of extracorporeal blood treatments acting as one of the therapeutic strategies would play a vital role in the mitigation of the most damaging aspects of COVID-19. Extracorporeal membrane oxygenation (ECMO) devices are clinically used for most critical ill patients but are found typically at specialized centers as these machines are in lesser supply than ventilators and are very costly to operate [30,31]. So, as an alternative, emerging nanoparticle and microparticle oxygen carriers may develop more accessible extracorporeal blood oxygenation tactics [32]. For severely ill patients however, oxygenation alone may not be sufficient to reduce mortality rates. A recent analysis in [33] shows that most of the COVID-19 patients died from multi-organ failure or septic shock when treated with ECMO. ExThera Medical with the Seraph® has approached for hemofiltration. They used a

heparin functionalized polyethylene(having high molecular weight) bead-based filter . This technology has helped for isolating a variety of pathogens starting from *Staphylococcus aureus* (methicillin-resistant) to cytomegalovirus without any filtration of anti-infectious drugs, and has been granted an Emergency Use Authorization(EUA) for the treatment of COVID-19 patients [34-35].

D. Ex Vivo Antiviral Strategies

✓ *Usage of Surfactants:*

Surfactants are the commonly used as household disinfecting agents possessing high antiviral activity [36] The use of surfactants to inactivate virus acting as sanitizing agents is shown in [37]. Surfactants are-

→ Cationic: present in fabric softeners, hair conditioners, antiseptic hand wash, and mouthwash.

→ Anionic: present in detergent and Personal care products.

→ Non-ionic: present in foaming and also as emulsifying agents.

→ zwitterionic species: present in laundry as well as cosmetic products [38-40].

Though, surfactants are beneficial as sanitizing agents but are rarely used for the construction of virus inactive surfaces. A remarkable research advancement is in the use of these antiviral factors for biomaterials applications. This approach has the potentiality to decrease the lifespan of viral particles on surfaces resulting in the minimization of transmission. A quaternary ammonium compound N,N-dodecyl methyl-polyethyleneimine (DM-PEI) recognised as cationic surfactant with an antibacterial property having envelope of antiviral polymer for its ability to rupture the cell membranes by interaction with the polycationic chains [41].

✓ *Designing of Face Masks:*

The viral filtration devices most commonly used are face masks. Masks are necessary component for the health and safety of individuals. However, not all masks are designed for virus filtration [42]. Generally, the masks commonly used are –

- Surgical masks which are capable of filtering 98% of 3 μm particles with its effectivity for blocking large-particle droplets, but unable to filter aerosolized particles transmitted by sneezes or coughs.

- Performance level face masks such as N95 masks are capable to filter 95% of 0.1-0.3 μm particles [43-45].

Designing masks having minimal porosity threshold of a virus particle(20nm -300 nm) is very important to reduce spreading of viruses [46,47]. Current researches are focusing on modifying masks with viral deactivation properties and of multiple uses, higher PPE production and biodegradable waste generation. As, most of the masks are produced from petroleum-based polymers having non-biodegradable and non-renewable property causes a huge environmental pollution [48,49]. Thus, to reduce environmental impact in this and future pandemics', it is necessary to tailor masks using biodegradable materials or from materials for multi-use.

Implementation of copper oxide into N95

respiratory masks to mitigate viral titer recovery of influenza virus; and incorporating sialic acid, which mimics human cell receptor sites, to create an affordable, easy-to-produce filter capable of removing viruses such as influenza [50-52]

E. Application of Vaccines

The progress in SARS-CoV-2 vaccine development holds the most potential for controlling COVID-19 spread encouraging a swirl of research in vaccine development as shown in [3, 53]. Previously, SARS vaccine development focused on live attenuated whole virus vaccines and S protein subunit vaccines. An inactivated virus MERS vaccine was also developed. [16,54] Biomaterials strategies to augment conventional vaccine design and development have been extensively reviewed [55,56] It is known that, polymeric materials may act as adjuvants (substances that enhance the antigenicity of an antigen).

But, multiple biomaterials-based solutions have been suggested such as nanoparticles, microneedles, scaffolds and liposomes. To protect antigen cargo, antigens present in biomimetic formats which allow for specific immune cell targeting, nanoscale structures can be fabricated which can be executed by doing some modifications in nanoparticle size, shape, surface chemistry (particle charge, hydrophobicity), and material composition [56,57].

IV. CONCLUSION

In this paper, the opportunities and mitigation strategies of biomaterials for addressing the challenges of COVID-19 are explained. Specific opportunities that are discussed for the biomaterials community to contribute significantly, will help not only to fight against the COVID-19 outbreak but also to restore from the adverse socio- economic impacts. Various recent advances and future directions for biomaterial research have been illustrated to combat the challenges of COVID-19.

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REVIEW ON APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN BRAIN COMPUTER INTERFACE

Debrupa Pal

ABSTRACT

BCI is a device that enables translation of neuronal information into commands capable of controlling external software or hardware. These devices can be surgically implanted in the brain, or they can be external devices. Typical paradigms include permitting a user to control an actuator or keyboard, permitting a device to send sensory data to the user, or bilateral communication engaging both sensory data and motor control. Brain-computer interfaces (BCIs) have shown broad prospects as real-time bidirectional links between human brains and actuators. Artificial intelligence (AI), which can facilitate the analysis and decoding of neural activity, has boosted the field of BCIs. In the past ten years, various BCI applications with artificial intelligence assistance have emerged. These “smart” BCIs consisting of motor and sensory BCIs have shown remarkable clinical success, improved the quality of paralyzed patients’ lives, expanded the athletic ability of ordinary people and accelerated the development in the field of robotics and neurophysiological discoveries. In this article, the author reviews the application of BCI in the current state of AI, their challenges and future directions. The fusion of BCI and AI gives a powerful tool to study brain function by providing knowledge and the control of neurons in nature, which will help scientists to learn more about the human brain and contribute to the development of rehabilitation medicine. One of the biggest advantages of using machine learning in BCI is the possibility of real-time or near real-time modulation of training parameters and subsequent adjustments in response to active real-time feedback. Algorithms extracted from previous data guide end users to make decisions based on their past work. Adaptive machine learning procedures can help participants suffering from BCI illiteracy to control the system, incorporating supervised techniques and unsupervised adaptation. However, in spite of technological advancement, there are still challenges with respect to technical progress, long-term training, real-time feedback and monitoring of BCI. The growth of this technology will bring a revolution in medicine.

Keywords: Brain Computer Interface (BCI), Artificial intelligence (AI), Machine learning.

I INTRODUCTION

With the explosive growth of technology, the borderline between human and machines has begun to shrink. Our magnificent science fictions describing "mind control" have slowly turned into reality with the help of BCI. Brain-computer interfaces (BCIs) and artificial intelligence (AI) are the frontrunners of these new technologies. Preliminary framework for BCIs and AI were usually evolved and applied independently from each other. However, researchers now prefer to amalgamate BCIs and AI, which makes effective use of the human brain's electric signals to manipulate external devices. However, researchers now prefer to amalgamate BCIs and AI, which makes effective use of the human brain's electric signals to manipulate external devices [1].

In last few decades, the development of BCIs is probably the most important technological advancement for severely disabled persons [2]. BCIs, which stands for technologies designed to interact with central nervous system and neural sensory organs can produce a muscle independent communication channel for patients with neurodegenerative illness like amyotrophic lateral sclerosis, or acquired brain injuries [3]. The gaining popularity of BCIs is closely related to the attempt of developing new electrophysiological techniques to record extracellular electrical activity, which is created by potential divergence in electric potentials carried by ions across the membranes of each neuron [4]. As shown in Fig.1 [5], techniques of detecting various types of brain signals can be identified as invasive or noninvasive [6].

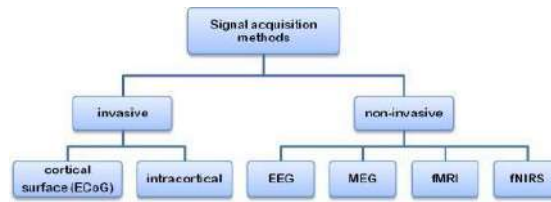


Fig.1 Techniques of detecting brain signals

Invasive technology consists of electrocorticography (ECoG), microelectrode arrays (MEAs), and so on [7]. Electroencephalography (EEG), magnetoencephalography, functional magnetic resonance imaging (fMRI), and functional near-infrared spectroscopy are included in noninvasive BCIs. They do not carry possibilities of tissue damage and can be implemented rather effortlessly [8]. By using these electrophysiological technologies, BCIs can be applied to the brain to record its activity and decode its meaning and to ‘write’ to the brain to handle activity in specific areas and affect their function [9]. The development of BCIs has restrictions. From multiple extracellular electrodes several information have been gathered, this large information cannot be transmitted smoothly [10]. Neuroscientists cannot clearly determine a person’s objective from the background electrical activity recorded in the brain and match it to the working of robotic arm [11]. This limitation is due to the reason that the neural correlates of psychological phenomena are imprecisely and not well understood [12]. Latest developments in AI methodologies have made great progress, proving that AI performs much better than humans in decoding and encoding neural signals [13]. This gives AI a great opportunity to be to a perfect assistant in processing signals from the brain before they reach the prostheses

AI is a set of general methods that uses a computer to model intelligent actions with minimal manpower intervention, eventually reaching and even exceeding human performance in job specific applications [14]. Electrical properties of the neural tissues, stimulation or recording densities, pulse durations and amplitude simulations, stimulation frequencies, energy utilization by the device are supplied to the algorithms continuously when AI is applied in BCIs [15]. After receiving the information, AI algorithms will determine useful components and logic within the information and then at the same time generate the specified functional outcomes [16]. Although most of these studies are still in the preclinical research stage, the continuous development may emphasis on clinically prominent changes in BCIs. At the dawn of technological transformation, combination of BCIs and AI has grabbed my attention. Hence, I review current applications highlighting state of the BCIs and the role of AI in future development of AI based BCI as shown in Fig.2 [17].

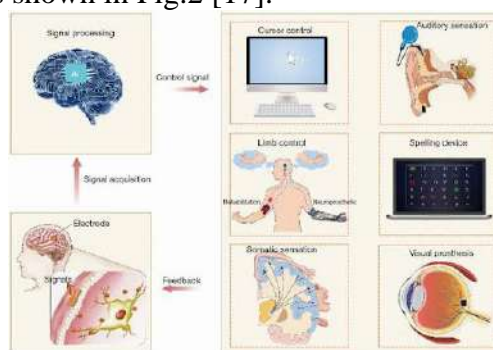


Fig.2 BCIs based AI

Application of BCIs based on AI Applications in cursor control

Early researches targeted on controlling the mouse cursor of a personal computer for paralyzed patients through BCI with high feasibility [18][19]. The fundamental elements of a cursor control BCI embrace a sensor for recording neural signals, a decoder for interpreting movement intentions, and a computer

cursor that interacts with the external surroundings [20]. The ground-breaking study revealed by Kennedy and colleagues in 2000 first established that an invasive BCI equipment with a special electrode ingrained into the outer layers of the human neocortex can be decoded to drive a cursor on a computer monitor [21]. Research studies in anthropoid primates have established that cursor control BCIs can achieve multidimensional neural integration with two or additional degrees of freedom [22]. Using EEG with event-related desynchronization one dimensional (1D) cursor control is attainable [23]. Using fMRI or EEG techniques two-dimensional (2D) cursor control can be obtained [24]. Latest work in 2017 established the evolution of a high performance, invasive BCI used for communication, applying two algorithms to convert signals into point and click commands; the ReFIT Kalman filter used for continuous two-dimensional cursor control and a Hidden Markov Model based state classifier for clicking [25]. By providing a minimum of 2D neural control of the computer of the computer and a parallel choice technique like a click, the user cannot only type the characters of their choice but also use native computer application with the cursors, just like a healthy person can with a mouse [26]. BCI improved the communication speed to 32 letters/min making cursor control more effective [25].

Several BCI systems for cursor control have been developed, like the P300 matrix speller and the speedy serial visual presentation method which are based on scalp EEG, ECoG and synchronous evoked potentials. [27]. First investigation of a motor BCI was conducted in June 2004 on a human where signals from a Blackrock 96-channel MEA was implanted in the arm area of M1 in a person affected with tetraplegia after cervical spinal cord injury was guided by the Brain Gate group [28]. Two-dimensional movement of a cursor on a screen is accomplished and later this "neural cursor" is used to control the movement of a robotic limb [28].

Applications in neuroprosthetic and limb rehabilitation

BCI task complexity has quickly transformed from 2D and 3D control of a cursor on a computer screen [29] to the management of natural behaviours like grasping [30], self-feeding [31] and bimanual arm movements [32]. To watch a patient with tetraplegia lifting up a cup of coffee with the help of a BCI-controlled robotic arm is amazing. This quickly evolving technology executes by inserting an array of electrodes either on or in a person's motor cortex, which is the brain region responsible for planning and executing movements [33]. Then the agility of the brain is noted whereas the individual gets engrossed in cognitive tasks, such as visualizing that they are moving their hand and is used to command a robotic limb [33]. In addition, several therapeutic methods have been developed to assist stroke patients restore some functions in the affected limb. However around 80% of patients who survived stroke with upper limb motor deficits do not benefit from these techniques [34]. In [35] the process of lower limb rehabilitation by applying BCI has been explored. Early studies of neuroprosthetics inserted electrodes into a monkey's brain and measured the signals from the electrodes. The monkey used a joystick to regulate a robotic arm. Finally, the researchers modified the controls so that the robotic arm was being controlled only by the signals coming from the electrodes, not the joystick [36]. To enable neural control of a robotic arm in humans invasive and noninvasive BCI systems are used [37],[38]. Patients regulate movements with several degrees of freedom by using implantable electrodes enabling them to make more complex and functional movements. Procedures that use noninvasive systems provide restricted control, and most complex movements depend on the AI of the robot [39]. Nurse and colleagues developed a generalized approach that takes advantage of a stochastic machine-learning method for classifying motor related signals specially for BCI applications [40]. The classifier does not need to depend on the use of large amount of a priori data to train BCI. Their algorithms performed better than other strategies on the Berlin BMI IV 2008 dataset and demonstrated high levels of classification accuracy once tested on datasets derived from EEG signals [40].

Research have shown that the application of BCI can be helpful in chronic stroke motor rehabilitation and have exhibited that stroke patients without residual movement can be benefitted from BCIs for their

cortical and subcortical reorganization as well as from functional and structural connectivity [41]. Step by step decoder modifications [42] can be made by Machine learning algorithms and a powerful neuroprosthetic performance that can be maintained in spite of nonstationary neural inputs and changes can be produced [43]. The growth of AI and deep learning will give a new way to decrypt neural signals with extraordinarily quick and unprecedented speed.

II APPLICATIONS IN SOMATOSENSATION

For treatment of paralytic patients, movements are mostly determined by somatosensory feedback, especially proprioceptive and tactile feedback [44]. Information about the location of contacts [45] as well as the forces applied on the skin while grabbing an object [46] is conveyed by mechanoreceptive afferent signals. The ability to plan the dynamics of limb movements is eliminated by loss of proprioception [47]. Given the importance of somatosensation, the growth of bidirectional BCIs is crucial. Activation of sensors on the prosthesis could be moved to operate neurons with the corresponding receptive fields [48]. The link between the pressure exerted on objects by the prosthesis and the applicable magnitude of intracortical microstimulation (ICMS) pulses can be explored more effectively with the help of AI [49]. In noninvasive sensorimotor rhythm BCIs random forests have been established as practical and convenient nonlinear classifiers [50]. somatosensory invoked potential-based BCIs have been widely explored using the FukunagaKoontz transform-based feature extraction technique with a performance enhancement from 70% to 75% [51]. Somatosensation through BCIs is reestablished by learning items such as ICMS and trying to mimic the nervous stimulation of healthy beings. [48],[52]. Tucker Tomlinson and Lee E. Miller discovered that by delivering ICMS coincidentally with force pulses applied to a monkey's hand, its perception was changed in an expected way [53]. It is currently impossible to trigger large numbers of neurons individually and independently, so the perception was not precise [53]. To achieve restoration of the somatosensation of humans with BCIs more combined technologies are required.

Applications in auditory sensation

A Cochlear implant is the most common and oldest technique to use a BCI [54]. According to the U.S. Food and Drug Administration since December 2010 the cochlear implant is a successful example of an afferent interface, used to restore hearing in over 200,000 patients across the world. (<https://www.nidcd.nih.gov/about/strategic-plan/2012-2016/sciencecapsule-cochlear-implants>). Conversion from sound waves to electric signals is done by cochlear implant which directly stimulates the sensory epithelium of the basilar membrane to simulate auditory stimuli bypassing the non-functioning part of the ear [55]. By providing sensory input to the cortex rather than cranial nerve a better resolution of sensory input is attained [56].

The outcomes of cochlear implantation are highly variable between patients and are difficult to predict though it helps to restore hearing and accomplish age-appropriate speech development after sensory loss in some children [57]. To provide the missing information links between each of the surgical variables to their effect on the excitation of the nerves based on μ computed tomography images, a computational model combined with a complete finite element model and synthetic structures has been developed. In [58] the metric for the utility of the stimulation protocol was evaluated and it is used to rerun the simulations with stronger parameters. For predicting word recognition scores in postlingually deaf adults with a high accuracy of 95.2%, a random forest regression model using clinical information was used [59]. For building and validating predictive models of speech-perception improvement after surgery presurgical neural morphological data obtained from fMRI have been used [60]. In [60] research reveals that neural systems that are unaffected by auditory deprivation revealed best postsurgical speech perception outcomes.

Applications in speech synthesizers

With the assistance of neural point-and-click control derived from intracortical neural activity, patients with tetraplegia and anarthria can interact in real-time [61]. With the evolution and rapid growth of mobile devices like smart phones and tablets scientists have succeeded to make several types of virtual keyboards with more efficient text entry capabilities, including DASHER, which is motivated by movements and has been tested as a BCI communication instruments based on one-dimensional EEG control [62]. These tools interpret neural activity that occurs while people silently mouth words and then synthetic speech sounds are generated from this information [63].

Patients with amyotrophic lateral sclerosis can manage the alterations in their slow cortical possibilities to utilize an electronic spelling device at a rate of roughly two characters per minute [64]. Different strategies for decoding speech directly from the cortex should be investigated to further refine the communication rate. The accuracy of one of the researches that investigated the potential to decode words from an ECoG recorded from Wernicke's area was modest [65]. In [66] two stage decoder is used to accurately reconstruct a speech spectrogram. In the first step decoder is a bidirectional long short-term memory (bLSTM) recurrent neural network, decrypting articulatory kinematic properties from continuous neural activity and in the next step a separate bLSTM for decoding acoustic features from the decoded articulatory features from stage 1 is used. Later the audio signal is produced from the decoded acoustic attributes [66]. Converting neural activity into speech directly is more effective as compared to using a cursor to spell [63]. This technique is a giant leap towards speech restoration for patients with paralysis.

As compared to the speed of normal speech, the speed of communication using this electronic spelling device is much slower [63]. On the other hand, patients with even negligible muscle control still considered communicating with more conventional assistive instruments such as eye gaze trackers or binary switches that can yield higher communication rates [66]. However, the two-stage bLSTM-based decoder has been a quantum leap in BCI.

Applications in optical prosthetics

In the biomedical engineering field visual prosthetic development has one of the highest priorities. Diseases such as Leber's congenital amaurosis causes complete blindness or age-related macular degeneration which causes dystrophy of photoreceptor cells [67]. The procedure of visual prostheses can be depicted as follows. In the first step the prosthetic device recognizes light emerged from sources or reflected from surfaces in the physical environment of the implant patient. Second light is transduced into an artificial stimulant. Third, the retina give rise to a response when the artificial stimulus is delivered to it [68]. By transforming images into binary pulses of electrical signals and delivering them to the visual cortex basic vision can be obtained [68].

The electrode array is critical for visual prosthesis design. In various optimal stimulus locations, stimulus patterns, and patient illness states prosthesis electrode arrays need to adapt itself [69]. BCIs based on AI is essential to derive the best prosthesis electrode array for a patient. With the help of a generalized nonlinear model framework and autoencoder a new electrical system is built and it was proposed to evaluate electrical stimuli equivalent to a given natural visual stimulus [70]. In [71], NeuroLink developed a new type of thin, flexible multielectrode polymer probe and a robotic insertion approach for placing flexible probes. This breakthrough in technology is appropriate for visual prosthetic device and may give perfect retinal stimulating techniques that have the adaptability to match the curvature of the retina without putting considerable mechanical pressure on the retina [72].

However, there are several noticeable things about the development of visual prostheses. So far, sensation produced has always appeared in the form of bright spots which are mentioned as phosphenes or patterns of visual perception [73]. Artificial neural networks which are robust learning tools that produce a good deal of flexibility and expandability may furnish new methods for imitating the natural visual system.

III RESULT AND CONCLUSIONS

This review emphasizes modern research in the BCI based on AI, which has expanded quickly over the last 15 years [74]-[76]. The amalgamation of BCIs and AI provides a robust tool to investigate brain function by delivering knowledge and control of neurons controlling nature, that will facilitate scientists understand more about the human brain and help in evolution of rehabilitation medicine [8]. One of the greatest advantages of using machine learning in BCI is the potential to attain real-time or near-real-time modulation of training parameters and latter adjustments in response to active realtime feedback [44]. In addition, algorithms assimilate from previous data and guide end users regarding decisions on the basis of what they have done in the past [77]. Enormous variability or may be inability of brain self-regulation for BCI control is shown by patients and healthy subjects, termed as BCI illiteracy [77]. Adaptive machine learning procedures can aid participants suffering from BCI illiteracy to regulate the system, incorporating supervised techniques and unsupervised adaptation [78].

In spite of the reported successes and advancements in this field, there still exist some challenges. First almost all studies have focussed on the betterment of motor ability, and the utilization of BCIs and AI for cognitive training is still at a very primitive stage [79]. Second, before BCIs can be regarded as an effective rehabilitation system in a clinical setting some important issues need to be solved. For example, stimulating electrodes with smaller diameters are required [80]. Third, machine learning algorithms learn to investigate data by generating algorithms that can seldom be predicted and understood in the real world, which results in issues of unknown process between a person's thoughts and the technology functioning on their behalf [81].

As technologies that directly integrate the brain with computers become unprecedentedly advanced, numerous moral and social challenges that benefit further examination and discussion will arise. For example, some forms of BCIs may be expensive, which brings affordability issues and feasibility for severely disabled people to approach them as assistive technology [82]. In addition, BCI and AI software with adaptive functions introduce decision-making devices into the human brain, which raises questions about human autonomy [83]. Digitally stored neural data obtained from brain information can also be utilized by others with adequate processing power to make conclusions regarding our memory, intentions, conscious and unconscious interests, and emotional responses [84]. Additionally, reports have emerged about a minority of individuals who become hypersexual or develops various impulse control problems due to deep brain stimulation for Parkinson's disease [83], [84].

In short, BCI based on AI is a quickly developing area of collaborative blending of medicine, neuroscience and engineering. The objective of these devices is to boost the level of function and quality of life for paralytic patients, spinal cord injury, amputation, acquired blindness, deafness, memory deficits, and other neurological diseases. The ability to strengthen motor, sensory or cognitive function is also progressing and will need attentive regulation and control. Before widespread introduction of these devices into clinical practice further technical development of BCIs, clinical trials and regulatory approval will be required. The evolution of this technology must generate a revolution in medicine.

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Track name- Any other allied topic- Novel Drug Delivery system

FORMULATION AND EVALUATION OF NANOEMULSION FOR NON-STERIODAL ANTI-INFLAMMATORY DRUG

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ABSTRACT

Mefenamic acid, the newest member of the oxicam class, is a nonsteroidal anti-inflammatory drug (NSAID). It interferes in the synthesis of prostaglandins from arachidonic acid by the inhibition of the cyclooxygenase isozymes. It is classified as BCS class-II drug having high lipophilicity and poor solubility. A nanoemulsion was prepared using aqueous titration method composed of capmul oil as the oil phase, tween 80 as surfactant and Polyethylene glycol 400 as cosurfactant and evaluated. The spontaneous emulsification method was employed for constructing the existing zone of nanoemulsion in pseudoternary phase diagrams representing three axes of the aqueous phase, oil, and mixture of

surfactant and cosurfactant. The prepared nanoemulsions were placed in tightly closed glass vials and stored at ambient temperature. These drug-loaded formulations were subjected to appearance, percent transmittance, refractive index, Electrical conductivity. In conclusion, nanoemulsion of mefenamic acid was developed to a satisfactory level in terms of physical stability tests, appearance, percent transmittance, refractive index, Electrical conductivity, lower surfactant concentration. The main objective of the investigation is to formulate nanoemulsion of mefenamic acid in order to overcome the drawbacks associated with the other dosage forms and in order to improve the overall efficacy of the drug.

Keywords: - Mefenamic acid, Tween 80, Polyethylene glycol 400.

I INTRODUCTION

Mefenamic acid, the newest member of the oxicam class, is a nonsteroidal anti-inflammatory drug (NSAID). It interferes in the synthesis of prostaglandins from arachidonic acid by the inhibition of the cyclooxygenase isozymes. Mefenamic acid is absorbed rapidly and almost completely from the gastrointestinal tract. The absolute bioavailability of Mefenamic acid is 90 to 100 % and almost 99.7 % strongly binds to serum albumin. Unlike other oxicams, it has relatively short half-life (3–5 h). Mefenamic acid undergoes extensive hepatic metabolism in humans, and as many other NSAIDs, the cytochrome P450 2C9 appears to play a major role in the metabolism of Mefenamic acid. Moreover, because Mefenamic acid has potent anti-inflammatory and analgesic activities, low dose therapy is possible and this results in less risk of the side effects of classical NSAIDs [1]. The main objective of the investigation is to formulate, optimize and stabilize SMEDDS containing Mefenamic acid with suitable surfactants and co-surfactants. Mefenamic acid, which is poorly soluble in gastric fluid through conventional dosage forms (tablet), nanoemulsion are prepared to increase their solubility in gastric fluid and improve bioavailability by increasing gastrointestinal absorption through passive diffusion[2].

II MATERIALS AND METHODS

1. Preformulation study

A. Procurement of drug and excipients

a) Physical characteristics

In physical characteristics drug physical parameter such as colour, odour and surface nature were checked by visual observation for color and odor checked by sensing a smell of drug and surface texture checked by visual observation [3].

b) Melting point

The melting point of the pure mefenamic acid was measured by open capillary method. For that the small amount of drug was filled in capillary and tied to thermometer, placed it in the heating Thiele's tube, the temperature at which the drug get melt was noted as melting point[4].

c) FT-IR spectral analysis

Mefenamic acid was confirmed by FT-IR spectroscopy Fourier transform infrared (FTIR) spectrum. The drug sample was dispersed in the KBr (200-400 mg) using a mortar, triturated the material into fine powder, and compressed the powder bed into the holder using a compression gauge with 140 mps pressure. The pellet was placed in the light path and the spectrum was recorded. The characteristic peaks of the functional groups were interpreted and compared with FT-IR spectrum as given in pharmacopoeial requirements [5,6].

B. Determination of drug solubility in the various oils, surfactants and co-surfactants

Drug was added in excess amount into 2 mL of each component in vials and stirred for 48 h at 25 °C on magnetic stirrer and equilibrated samples were removed from stirrer and centrifuged at 3000 rpm for 15 min to remove the excess drug. The supernatant was taken and filtered through a 0.45 µm membrane filter after which the concentration of drug in supernatant was measured by UV spectrophotometric method after appropriate dilution with methanol and then drug solubility (mg/mL) was calculated [7,8].

C. Drug - excipients compatibility study

Physical compatibility and chemical compatibility of the water-insoluble drug with oil, surfactants, co-surfactants should be used in oil, surfactants and co-surfactants selection procedure. Physical compatibility may include phase separation and color change in the drug surfactant solution during course study. Chemical compatibility is primarily regarded as the chemical stability of the drug with oil, surfactants and co-surfactants. Oil, surfactants, co-surfactants was considered for further development only if it was physically and chemically compatible with drug. Following study consider for drug - excipients compatibility study [9].

a. Visual observation (Appearance study)

In visual observation study mefenamic acid mixed with excipients (Oil, surfactant, and cosurfactants) and then after same time interval checked a physical compatibility and chemical compatibility by observing were phase separation and color change in the drug excipients (Oil, surfactants and co-surfactants) solution during course study [10,11].

b. U.V. Spectroscopy

In U.V spectroscopy study mefenamic acid mixed with excipients (Oil, surfactants and co-surfactants) and then after same time interval checked a physical compatibility and chemical compatibility of drug with excipients by appropriate dilution of mixer with methanol and calculates the percentage drug content form drug excipients mixture [12].

c. FT-IR Spectroscopy

Mefenamic acid and excipients compatibility was confirmed by FT-IR spectroscopy-Fourier transform infrared (FTIR) spectrum. The drug and excipient sample was dispersed in the KBr (200-400 mg) using a mortar, triturated the material into fine powder, and compressed the powder bed into the holder using a compression gauge with 140 mps pressure. The pellet was placed in the light path and the spectrum was recorded the characteristic peaks of the functional groups were interpreted and compared with standard drug and excipient FT-IR spectra as given in pharmacopoeial requirements [13,14].

2. Formulation of Mefenamicacid nanoemulsion

Spontaneous Emulsification Method

In this method, surfactant was blended with co-surfactant in fixed weight ratios i.e. 1:1, 2:1, 3:1, 2:1 and 3:1 for the formulation of mefenamicacid nanoemulsion. Aliquots of each surfactant and co-surfactant mixture (Smix) were then mixed with oil at ambient temperature in vial then drug was added in these oil smix mixtures. For each phase diagram, the ratio of oil to the Smix was varied as 5:5, 4:6, 3:7, 2:8, 1:9 (% v/v). Water was added drop wise to each oil-Smix mixture under vigorous stirring. after equilibrium, the samples were visually checked and determined as being clear nanoemulsion [15,16].

3. Characterization of mefenamic acid nanoemulsion

a. Appearance

The appearance of the nanoemulsion formulations was determined by visual examination of the formulation under light alternatively against white and black backgrounds and turbidity were checked. The nanoemulsion was clear transparent, easily flowable liquid [17].

b. Percent transmittance (Clarity)

Percentage transmittance was checked against distilled water using UV-visible spectrophotometer at 650 nm (Double beam UV spectrophotometer, V-630 Jasco, Japan) by dilution of 1 mL of the formulation with distilled water up to 100 mL (100 times) and as such, and percent transmittance of all formulations was determined in triplicate [18].

c. Refractive index

Refractive index (RI) being an optical property is used to characterize the isotropic nature of the nanoemulsion, RI was determined using an Abbe type refractometer and it was observed that the nanoemulsion formulations were chemically stable and remained isotropic in nature, thus having no drug excipient interactions. The observation of formulation shows that as the concentration of the oils increases in the formulation, the RI of formulation increases. Refractive index of all formulations was determined in triplicate[19].

d. Electrical conductivity

Type of nanoemulsion (O/W or W/O) and the stability of the nanoemulsion (Phase inversion on storage) can be determined by electrical conductivity (σ). Electrical conductivity of nanoemulsion was measured by using Digital conductometry by placing a conductivity electrode in the nanoemulsion formulation which calibrated by using NaCl solution. If nanoemulsion formulation show conductivity that indicate given nanoemulsion formulation was o/w type nanoemulsion because in these type of emulsion, oil was small oil droplet phase and water was continuous phase that reason electrical conduce pass through the continuous phase but nanoemulsion formulation does not show conductivity that indicate the given nanoemulsion is w/o type nanoemulsion because in these type of emulsion water was small oil droplet phase and oil was continuous phase that reason electrical conduce does not pass through the continuous phase. Electrical conductivity is directly proportional to the percentage of water. Higher the electrical conductivity more will be the percentage of water, which allows more freedom for mobility of ions. Electrical conductivity of all formulations was determined in triplicate [20,21].

III RESULTS AND DISCUSSION

1. Preformulation Study

a. Physical characteristic of Mefenamic acid

b. Melting point

Melting point of mefenamic acid was found in the range of 230°-231°C , while as per standard literature it is reported to be 229°C so it can be concluded that mefenamic acid was in a pure state

c) FT-IR spectra of Tween-80

Fig no 2 as attached in seperate file

d) FT-IR spectra of PEG-400

Fig.no. 3. FT-IR spectra of PEG400

Fig no 3 as attached in seperate file

e. Drug solubility determination in the various oils, surfactants and co-surfactants

2. Drug -excipients compatibility study

a) Appearance study

Percentage transmittance

IV DISCUSSION

In an attempt to enhance solubility and penetration that will be effective in inflammatory disorder in patients suffering from rheumatoid arthritis, nanoemulsion of mefenamic acid was formulated. Nanoemulsions have emerged as one of the most interesting novel delivery systems. Drug delivered through nanoemulsion has better adhesion on the surface on the surface of the skin and high solubilizing capacity which leads to larger concentration gradient towards the skin hence influences better skin penetration. The aqueous phase titration method was used for the development of nanoemulsion formulations by using probe sonicator. The solubility of the drug in the oil phase is an important criterion for the selection of oils for the ability of nanoemulsion to maintain the drug in the solubilized form which is greatly influenced by the solubility of the drug in the oil phase. Usually, the oil which has the maximum solubilizing potential for a selected drug candidate is selected as an oily phase for the formulation of nanoemulsions. This helps to achieve maximum drug loading in the nanoemulsions.

V CONCLUSION

In conclusion, nanoemulsion of mefenamic acid was developed to a satisfactory level in terms of appearance, percent transmittance, refractive index, Electrical conductivity. The present study endorsed nanoemulsion of mefenamic acid to be a promising choice over conventional formulations for the treatment of rheumatoid arthritis.

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CLOUD BASED AND MACHINE LEARNING INTEGRATED TELE MEDICAL APPROACH FOR PATIENT CARE DURING COVID-19 PANDEMIC²

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ABSTRACT

In this pandemic situation due to COVID-19 people are bound to stay at their homes to avoid getting in contact with any infected person or area. Hospitals have large number of corona patients hence patients suffering from other diseases or having some symptoms might fear visiting hospitals. This period has taught us that we need to be very conscious about our health. People are adopting new healthy habits and every industry is making several adjustments to cope with the new normal, post COVID-19. In such a situation telecare medical services might play an important role. With Telecare medical systems and patient monitoring devices the advantage of telehealth services can reach directly to the patient's home. Patients and doctors can communicate and share data or reports easily through cloud technology. In this paper an integrated approach is proposed for virtual care of COVID-19 patients through tele medical approach. The approach uses the concepts of machine learning, and cloud-based technology, which helps the user in getting access to health care services from home, hence making the process easier and faster for patients.

Keywords: Tele Medical, Cloud Computing, Machine Learning, COVID-19.

I. INTRODUCTION

In this pandemic situation, people cannot move out freely and are supposed to maintain social distancing to avoid getting in contact with an infected person or area. This period is very critical for all of us as well as hospitals because all the responsibilities to get patients recovered from COVID-19 and other diseases, are on them. We have to be aware and alerted to ensure the safety of our families. So, here comes the role of telecare health services. A patient can access telehealth services using any mobile device with internet, there is no need to go out or visit hospitals with the fear of getting infected with corona virus. Patients and doctors with the help

of telecare health services, now can come across by the virtual platform and they both will get benefited with the service, especially in this COVID-19 situation.

A. Cloud Computing is backbone for Telehealth care

The very first technology which comes into picture while designing this approach, for helping doctors and patients, is cloud computing. Cloud Computing is the platform which is the backbone of this telecare health service where doctors can see patients and patients get their medical reports. All the tasks are performed with the help of a cloud-based server. The data of patients is stored on cloud and can be viewed or updated after authentication. Cloud is a back-hand service of telecare health services and from there only patients and doctors can easily communicate and share their data. The system is made efficient with the help of different cloud services. Cloud technology makes data accessible to both patients and doctors, at any time and from any geographical location, also, it can store and manage large amount of data.

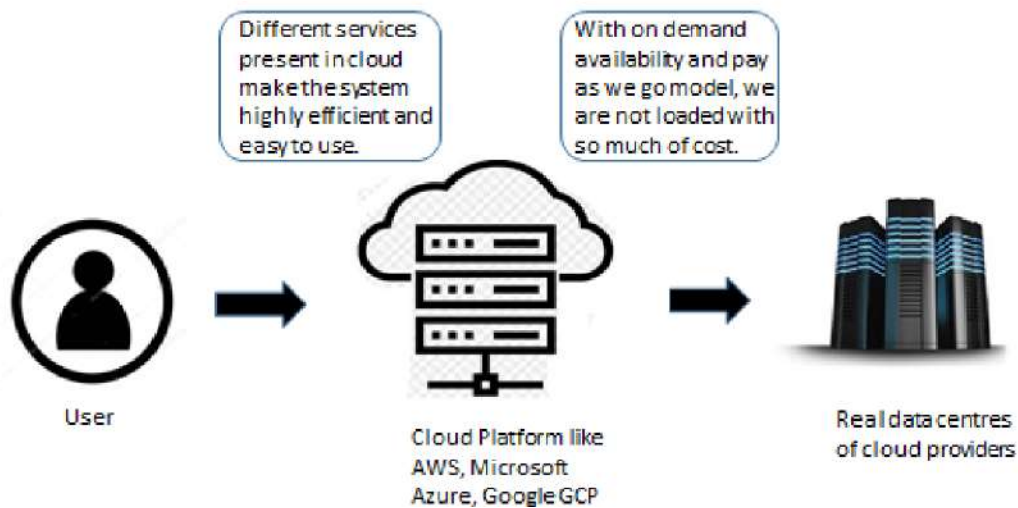


Figure 1: Cloud computing on demand to customer

With the help of cloud-based services, if there will be a case when demand for this telecare server suddenly increases, then the cloud can scale its services where this server is running and also whenever demand goes down, it can scale down the services [1]. Using cloud technology, it becomes easy to maintain and track the cost of our telecare health server. Cloud Computing, with its on-demand availability can help us reach out to users easily [2] as shown in Figure 1.

B. Machine learning in healthcare

The second vastly known technology which comes in the role of making the telecare health services the most efficient is Machine Learning. In case a patient is having some common disease, which is easily curable, then it would be a waste of time to go out and visit hospital. So, we have some machine learning algorithms by which we can make our machine intelligent enough to detect the new patients having similar symptoms of some disease and treat them with the previous treatment given to the patients having the similar disease. It saves patient as well as doctor's time because now there is no need to treat the patients with similar problems. It also makes the whole system more efficient. Machine Learning algorithms make the patient diagnosis and treatment process faster because of its ability to maintain huge datasets and afterwards according to the requirement, using that dataset for diagnosis of patient's disease [3].

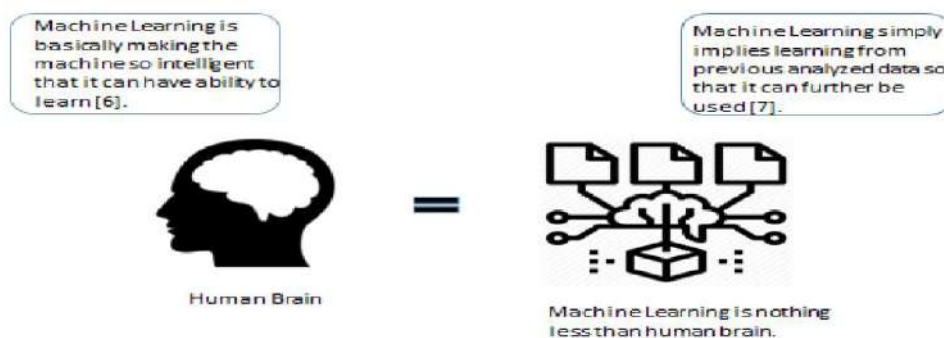


Figure 2: Machine learning for patient diagnosis

This may ultimately reduce cost and make the whole system powerful. Patient satisfaction is also the prime concern for telecare health services and because of machine learning algorithms, our system becomes capable of providing that to patients[4]. This is how the telecare health service plays an important role in providing health services without even having fear of going out of our homes. To cope with this post COVID-19 situation, we need to take some safety measures, and access to telehealth services is one of them. A patient doesn't have to move out for treatments, until and unless very necessary, as it can be seen that there is a lot of hustle in hospitals for treatment, so the two technologies discussed above – cloud and machine learning can be integrated together to develop an approach for providing telehealth services, which will ultimately reduce the need for patients to move out of their homes [5].

II. PROPOSED APPROACH

The objective of the proposed approach is to help patients get access to health care services from home. In this approach, patient's disease is diagnosed remotely, prescriptions and suggestions are given to the patients based on intensity of symptoms, age and their location. Also, patients showing symptoms of COVID-19 are filtered. In this model as shown in figure 3, we have a central cloud-based telecare server, telehealth service providers and patients (or users). Patients can easily access healthcare services using any mobile device with internet (phone, laptop etc.). A telehealth service provider, at any location, can be a doctor, a team of doctors, a clinic or a hospital. The approach is working in different phases as described below.

A. Registration Phase:

Patient Registration The patient can use any mobile device, for the registration, patient has to enter an ID, password along with user name, address, date of birth, and phone number. This data is masked, for security purposes, and then submitted to the server. Server verifies the user using OTP, checks the database and registers the user if the received ID is not already present in the server database. The process is explained in Figure 3.

Telehealth service provider registration

Registration of telehealth service providers is done through a secure channel. Verification is done and then ID, password is provided. After getting registered, the telehealth service provider can login using provided ID, password and check patients, view data shared by patients and communicate with them.

B. Login and Authentication Phase

The patient enters his/her ID, password and submits it to the server, with a timestamp. Server authenticates the user using ID, password, timestamp and OTP as shown in figure 3. After successful authentication of patient by server the patient also authenticates server and if mutual authentication is

done successfully then session keys are generated for further communication. The data is shared using security protocols to ensure secure transfer and access of data. We are not using biometric authentication for patient’s ease of use, an elder patient or patients belonging to rural areas may not have a fingerprint scanner. After successful login, a patient can view his/her report and can share data with telehealth service providers. A new patient, having some symptoms or disease, has to first fill a form. This form contains a list of all possible symptoms of COVID-19, patients can tick the symptoms he/she is having and write other symptoms which are not listed. Here we are using this form because a patient may miss out mentioning some symptoms while communicating with a telecare server. Patient submits the form to the telecare server.

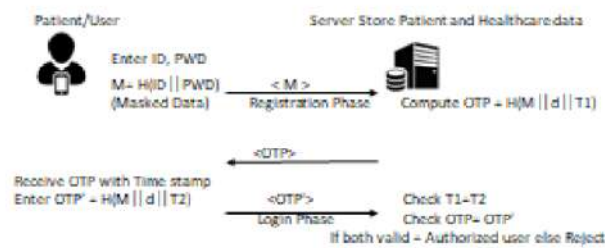


Figure 3: Registration and Login Phase

C. *Telecare Server* The cloud-based telecare server has a Machine Learning model deployed on it which is trained using previous patient data. This model is trained to predict disease and its severeness, based on symptoms. Continual learning can be applied to this ML model so that it keeps learning from new data sets and remains updated about new symptoms. The telecare server stores data (symptoms) submitted by patients

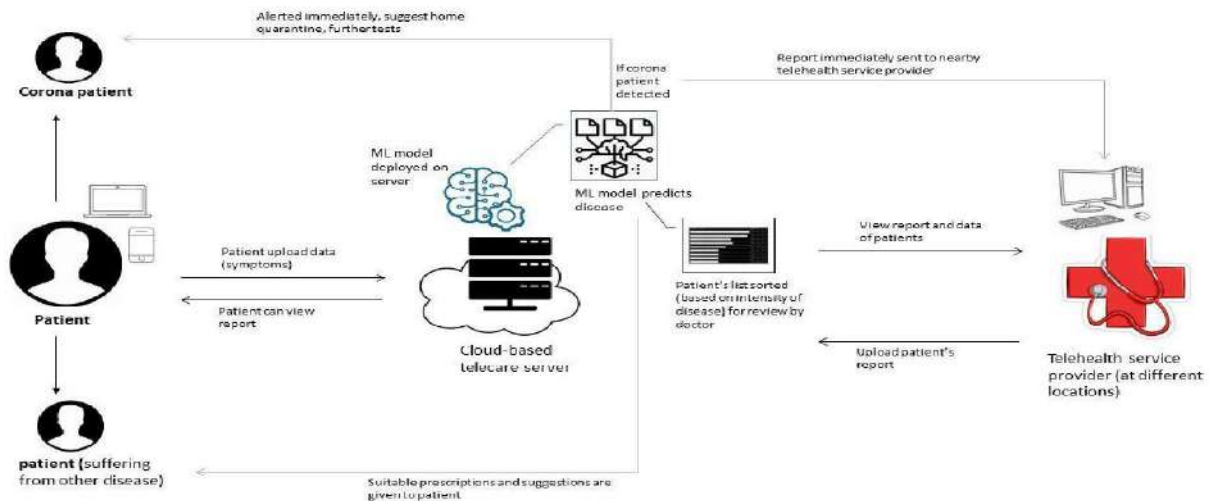


Figure 4: Proposed Approach

and predicts the disease as well as its severity. Based on the predicted disease and severeness, it gives suggestions and also prescribes medicine if the disease is easily curable like normal cough and cold. The patients are sorted according to intensity of disease, for review by a suitable doctor, the patients don’t have to search for a telehealth service provider by themselves. The patients showing symptoms of

coronavirus fever are suggested to remain home quarantined, take suitable measures and their details are sent to the telecare service provider nearest to their location (entered during registration).

III. APPLICATIONS OF PROPOSED APPROACH IN COVID-19

1. If patient with suspected COVID-19 is detected, based on symptoms shown by them, then it is immediately reported to nearby telehealth service provider for further action.
2. It takes measures and prescribe medicines after the disease is detected from symptoms. If the detected disease is easily curable, medicines are prescribed according to severity of disease and age of patient.
3. The medical history of patients is recorded. This may help in comparing and analyzing the pattern of COVID symptoms shown by patients at different levels.
4. Spreading awareness and alerting patients: If symptoms of COVID are shown by patient, he/she is alerted through the portal itself and is suggested to take proper safety measures.
5. This approach is not only helpful for COVID patients but it also makes it easy for other patients to get treatment at initial level and get reviewed by suitable doctor, without visiting hospital. This might be very helpful for elder patients as well.
6. Patients in rural areas: This approach gives easy access to health services to patients of rural areas with fewer health care resources.

IV. CHALLENGES AND SOLUTION OF PROPOSED APPROACH

1. Medical data is very confidential and sensitive. An attacker may access and manipulate the personal information of user and doctor, in the system. To avoid such attacks, an alpha numeric password with eight digits and special characters should be used. OTP is also required to increase the security of information of the user and the system.
2. Privacy Violation and unprecedented surveillance are major concerns. Data should be securely transferred in encrypted format. Protocol of HTTPS should be used.
3. Users must not share their authentication and personal information with anyone, they must keep their information saved with themselves. Even if someone has the credentials of user, without OTP authentication cannot be done.

V. CONCLUSION

Coronavirus disease is a widespread infectious disease which has affected many people worldwide and has been declared a pandemic. To control the spread of this disease, lockdowns were declared and travelling was banned. After a long lockdown period, now we are in the unlock phase but proper precautions are still necessary. Every industry has faced many challenges and are adopting new favorable work approaches. To avoid the spread of this disease, people are adopting new healthy habits and are suggested to stay at home. In this paper the proposed approach provides a patient an easy access to healthcare services without being physically present at hospitals. This approach is suitable for elder patients as well, a patient can easily login and submit their symptoms to a cloud-based server, through a portal. Patients do not have to search for a doctor or visit hospitals. After receiving patient's data, the telecare server, which has suitable ML models deployed, performs the task of predicting disease, giving prescriptions, filtering COVID patients and sending data to telehealth service providers (or doctors). This approach is favorable for patients as well as doctors. The task of doctors becomes comparatively easy, since at initial level, disease is predicted and sorting of patients is done by server, based on severity of disease. In this approach health services are provided over network, so it does have data security vulnerabilities and there may be chances of wrong prediction by ML model, we can try to overcome these problems by using efficient security protocols for all the tasks (authentication, data

transfer, data access) and training ML model with large, authentic data set, applying continual learning to ML model may also help.

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COVID-19 IMPACT ON FINANCIAL MARKETS: EVIDENCE FROM INDIA

Ms. Aparna Shukla

Abstract-COVID-19 outbreak worldwide has catastrophic effect not only on the country's social well being but on the economy as well. Putting it more precisely the aftermath of COVID-19 can be easily visible in the Indian Stock Market. The impact of COVID-19 on Indian Financial Market is not yet investigated. The study focuses on analyzing the impact of COVID-19 on the Indian stock exchange from the time period of 1st July 2020 to 25th July 2020 in India. Simple regression model is used to examine the impact of COVID-19 on Indian Financial Market during span of 1st July 2020 to 25th July 2020. The study applied time series data from Worldometer Statistics and Trading Economics from 1st July 2020 to 25th July 2020. The study employed BSE Sensex Index as a sample for India. To analyze the impact of COVID-19 on Indian stock market the study presumes that the COVID-19 Confirmed cases are the independent variable and while Bombay Stock Exchange is to be dependent variable. The findings of the study disclosed that the correlation coefficient is 0.89 and p-value is found out to be 0.00 which means there is a positive significant relationship between the COVID-19 cases and the Indian stock market from 1st July 2020 to 25th July 2020 in India. It tells that COVID-19 had a significant impact on Indian stock market from 1st July 2020 to 25th July 2020. This study concludes that the Indian Stock Market is heavily influenced by the increasing number of COVID-19 cases. The stock market is showing prompt changes in response to the COVID-19 active cases in India.

Keywords: COVID-19, Confirmed cases, Indian stock market

I. INTRODUCTION

The COVID-19 outbreak in India and rest of the world has left the whole world with catastrophic scenario where accepting it and moving forward becomes a necessity of life. It is the most unexpected crisis that took place in last month of 2019 and covering almost two quarters of the current year 2020. A smart action of lockdown taken by Indian government restricted the coronavirus spread all over the country but unfortunately failed in terms of economic aspects. It not only worsened the country's economy but also influenced the social aspects making individuals exposed to such crisis.

As said by International Monetary Fund (IMF) Chief Kristalina Georgieva, the world has entered a recession that will be worse than that of 2009. The impact of COVID-19 may differ on several sectors but not even one of them remained untouched; financial markets are one of them. Not only the Indian financial market but the financial markets of whole world got affected by COVID-19. The repercussions

of COVID-19 gave expeditious hit on financial markets at international level which consequently shook Indian financial markets. Moreover the anxiety and panic that prompted out among investors was because of COVID-19 and its potential impact on their stocks.

As per the RefinitivDatastream, 28 April 2020 stock market volatility has led the NIFTY 50 and BSE Sensex to lose 23% in March only. Share prices have fallen considerably due to the pandemic outburst. In the latest report of Congressional Research Centre of 19 May 2020 revealed that “Foreign investors have pulled an estimated \$26 billion out of developing Asian economies and more than \$16 billion out of India”. Businessworld in an article said that “Following the strong correlation with the trends and indices of the global market as BSE Sensex and Nifty 50 fell by 38%”.

The most recent action taken by Securities Exchange Board of India that will substantially change the way trading market of India isto allow Direct Market Access (DMA) to the retail investors. In an article of Business Insider India on 27 July 2020 it is evidently mentioned that the most opportune and benefited will be BSE (Bombay Stock Exchange) and NSE (National Stock Exchange). This report of SEBI was good enough to raise the BSE stocks by 9%. This will all help the markets to uplift but the sole cause that made authorities to review the trading of stocks is COVID-19. There is thus needed to be studied how the pandemic is affecting Indian financial markets. This paper is an attempt to study at what magnitude is the impact of COVID-19 on Indian financial markets.

The trends that India is witnessing now when compared with Global Financial Crisis of 2008 by RefinitivDatastream, they found the same trend of fall down and rise as that of crisis in 2008(Figure 1).

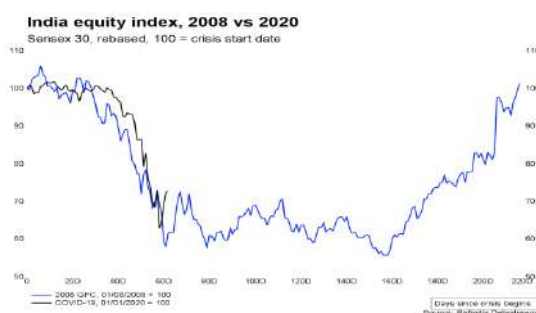


Figure 1: Source: RefinitivDatastream

II OBJECTIVE OF THE STUDY

The study is conducted to analyze the impact of COVID-19 on the Indian Financial Markets referring the time period from 1st July 2020 to 25th July 2020.

I. Significance of the Study

COVID-19 economic impact is globally considered as more dangerous than that of global crisis 2008. The COVID-19 cases are increasing substantially influencing personal, social and economic lives of individuals. Financial markets across the world suffered sudden shock due to the pandemic outbreak. There are very few researches on COVID-19 repercussions on financial markets such as in China and U.S. and other leading markets globally. However, the impact of COVID-19 on Indian financial markets has not been researched yet. The study is thus relevant in context of India as it will construct new realm of knowledge regarding COVID-19 impact on financial markets of India during the specific time period taken for evaluation.

III LITERATURE REVIEW

Baker, S.et.al. (2020) had worked distinctively on evaluation of potential explanations for unpredicted stock market reaction of U.S. due to COVID-19. They inferred that U.S. markets reacted to the COVID-19 more strongly in comparison to the previous pandemics of 1918-19, 1957-58 and 1968. Ramelli, S. and Wagner, A. (2020) investigated the stock price effects considering the market participants expectations concerning future economic consequences. They concluded that market responds to the future economic impact of novel coronavirus. Investors also became bothered about potential effects of the COVID-19 on their stocks.

Sansa, N. A. (2020) examined the impact of COVID-19 on the financial markets taking evidence from China and U.S. from the period dated 1st March 2020 to 25th March 2020 and founded that there is a significant impact of COVID-19 on the financial markets in China and USA. Liu, H. et.al. (2020) evaluated the short-term impact of COVID-19 on 21 eminent stock market indices of most affected countries. They ascertained that stock market fell down exponentially after the COVID-19 outburst and Asian countries experienced negative abnormal returns in comparison to other coronavirus affected countries.

II. Hypothesis of the Study

H₀ = There is no significant relationship between COVID-19 and Indian Financial Markets.

H₁ = There is a significant relationship between COVID-19 and Indian Financial Markets.

IV RESEARCH METHODOLOGY

The study is an approach to find and analyze the impact of COVID-19 on the Indian financial markets from the period dating from 1st July 2020 to 25th July 2020. Simple Regression Model is used to analyze the impact of the COVID-19 on the financial markets of India during 1st July 2020 to 25th July 2020. The study is based on secondary data. Data has been extracted from Worldometer Statistics and Trading Economics 2020 from 1st July 2020 to 25th July 2020 and is applied in the study. The study used the Bombay Stock Exchange (BSE) Sensex Index as sample for India. For investigating the impact of COVID-19 on Indian Financial Market the study considered COVID-19 Confirmed cases as the independent variable and the Bombay Stock Exchange (BSE) Sensex as dependent variable in India. The study employed Log Log and Semi Log Linear Regression Models to examine the impact of COVID-19 on the Financial Markets in India during 1st July 2020 to 25th July 2020. Basically it is not possible for one to calculate accurate results by the data that is collected because the change in the variables was minute change on which correlation and regression techniques are unable to give interpretable results. Simplifying the methodology the study considered the natural log of both the variables to get more reliable data for interpretation. Natural log of variables helps in getting the amount of change that is happening on each day. This has increased the linearity in the regression models that are applied in the study.

The research design is descriptive as well as investigative by applying quantitative techniques through MS Excel (MS Office 2007) application.

Following equation is used in the study to assess the impact of COVID-19 on Indian financial markets:

$$Y_t = \beta_0 + \beta_1 \text{CNF/Ct} + e_{1t}$$

Where in Y is the natural log of Dependent Variable, CNF/Ct is the natural log of Confirmed Cases of COVID-19, β_0 is constant and β_1 is coefficient parameter.

Following equation is applied to study the correlation between COVID-19 Confirmed Cases and BSE Sensex:

$$\text{BSESt} = \beta_0 + \beta_1 \text{CNF/Ct} + e_{2t}$$

Where in BSE_{t} is the natural log of Bombay Stock Exchange Sensex , CNF/C is the Confirmed Cases of COVID-19, β_0 is constant and β_1 is coefficient parameter.

III. Empirical Results and Analysis

The figures of Confirmed Cases of Covid-19 and BSE Sensex were extracted from the sources Worldometer and Trading Economics 2020 on which Log Log and Semi Log Linear Regression Model was applied. The figures that were considered ranged from 1st July 2020 to 25th July.

The Correlation between Confirmed Cases of COVID-19 and Bombay Stock Exchange Sensex:

The regression results of the work showed that there is significant positive relationship between COVID-19 Confirmed Cases and Bombay Stock Exchange Sensex for the time period dated from 1st July 2020 to 25th July 2020 in India.

The correlation coefficient for COVID-19 Confirmed Cases is 0.89 or 89% which here by implies that for every additional increase in COVID-19 Confirmed Cases is giving the equal amount of impact on the Bombay Stock Exchange Sensex (Table 1).

Table 1: Regression Results between the Covid-19 Confirmed Cases and Bombay Stock Exchange Sensex from 1st July 2020 to 25th July 2020 in India.¹

Multiple R	0.89
R Square	0.79
Adjusted R Square	0.78
Standard Error	0.12
Observations	25.00

Where Multiple R is the correlation coefficient, R Square is coefficient of determination, Standard Error is the estimate of standard deviation of the error μ , and observations are number of observations.

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-97.21	11.91	-8.16	0.00	-121.85	-72.58	-121.85	-72.58
Lsensex	10.55	1.13	9.32	0.00	8.21	12.90	8.21	12.90

Where in coefficient is the least square estimate, standard error is the least square error of the estimate, t statistic of null hypothesis and alternate hypothesis, p value is value for hypothesis test, lower 95% is lower boundary for the confidence interval and upper 95% is the upper boundary for the confidence interval.

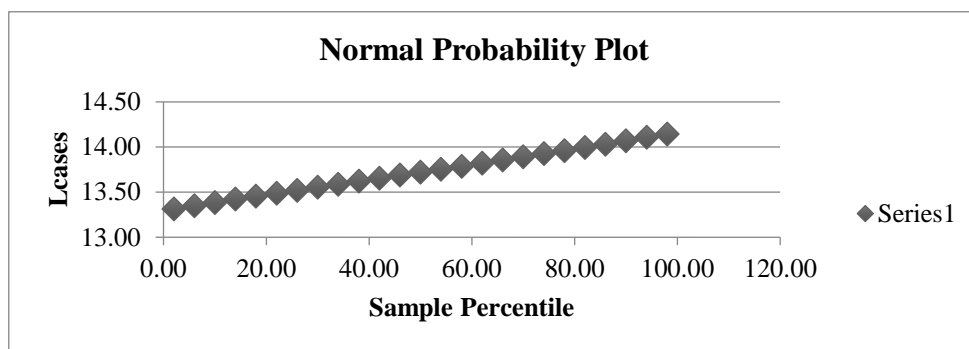


Figure 2

Normal probability plot is also constructed to check the normality of the data. The normal probability plot in the study is showing almost normal distribution (Figure 2).

As shown in the Table 1(b) the p-value is absolutely 0.00 which means that the null hypothesis is remarkably rejected and alternative hypothesis is accepted. Moreover, this implies that there is strong positive correlation between COVID-19 Confirmed Cases and Bombay Stock Exchange Sensex for the time period dated from 1st July 2020 to 25th July 2020 in India. Briefly stating, every one percent increase in the confirmed cases of COVID-19 there is impact of 0.89% in the BSE Sensex.

Appendix 1 COVID-19 Confirmed cases in India from 1st July 2020 to 25th July 2020 in India

Date	Confirmed Cases	Date	Confirmed Cases
7/1/2020	605220	7/14/2020	937487
7/2/2020	627168	7/15/2020	970169
7/3/2020	649889	7/16/2020	1005637
7/4/2020	673904	7/17/2020	1040457
7/5/2020	697836	7/18/2020	1077864
7/6/2020	720346	7/19/2020	1118107
7/7/2020	743481	7/20/2020	1154917
7/8/2020	769052	7/21/2020	1194085
7/9/2020	794842	7/22/2020	1239684
7/10/2020	822603	7/23/2020	1288130
7/11/2020	850358	7/24/2020	1337022
7/12/2020	879466	7/25/2020	1385494
7/13/2020	907645		

¹Origin: Appendix 3

²Source: Worldometer Statistics, From 1st July 2020 to 25th July 2020.

Appendix 2: The table shows the Daily marginal change in the COVID-19 Confirmed cases in India and the other column shows the Bombay Stock Exchange Sensex from 1st July 2020 to 25th July 2020 in India³

E- International Conference on Socio-Economic and Health Challenges due to COVID-19 and Mitigation Strategies

Date	Confirmed cases	BSE Sensex	Date	Confirmed cases	BSE Sensex
7/1/2020	605220	35414	7/11/2020	850358	36594
7/2/2020	627168	35844	7/12/2020	879466	36594
7/3/2020	649889	36021	7/13/2020	907645	36694
7/4/2020	673904	36021	7/14/2020	937487	36033
7/5/2020	697836	36021	7/15/2020	970169	36052
7/6/2020	720346	36487	7/16/2020	1005637	36472
7/7/2020	743481	36675	7/17/2020	1040457	37020
7/8/2020	769052	36329	7/18/2020	1077864	37020
7/9/2020	794842	36738	7/19/2020	1118107	37020
7/23/2020	1288130	38140	7/20/2020	1154917	37419
7/24/2020	1337022	38129	7/21/2020	1194085	37930
7/25/2020	1385494	38129	7/22/2020	1239684	37872
7/10/2020	822603	36594			

³ Source: Appendix 1 and Trading Economics, 2020

Appendix 3: Regression between the Covid-19 the Covid-19 Confirmed Cases and Bombay Stock Exchange Sensex from 1st July 2020 to 25th July 2020 in India.⁴

Date	Confirmed cases	BSE Sensex	Lcases	Lsensex
7/1/2020	605220	35414	13.31335	10.47486
7/2/2020	627168	35844	13.34897	10.48693
7/3/2020	649889	36021	13.38456	10.49186
7/4/2020	673904	36021	13.42084	10.49186
7/5/2020	697836	36021	13.45574	10.49186
7/6/2020	720346	36487	13.48749	10.50471
7/7/2020	743481	36675	13.51919	10.50985
7/8/2020	769052	36329	13.55291	10.50037
7/9/2020	794842	36738	13.58597	10.51157
7/10/2020	822603	36594	13.62023	10.50764
7/11/2020	850358	36594	13.65341	10.50764
7/12/2020	879466	36594	13.68707	10.50764

7/13/2020	907645	36694	13.7186	10.5103
0			1	7
7/14/2020	937487	36033	13.7509	10.4921
0			6	9
7/15/2020	970169	36052	13.7852	10.4927
0			3	2
7/16/2020	1005637	36472	13.8211	10.5043
0			3	
7/17/2020	1040457	37020	13.8551	10.5192
0			7	1
7/18/2020	1077864	37020	13.8904	10.5192
0			9	1
7/19/2020	1118107	37020	13.9271	10.5192
0			5	1
7/20/2020	1154917	37419	13.9595	10.5299
0			4	3
7/21/2020	1194085	37930	13.9928	10.5435
0			9	
7/22/2020	1239684	37872	14.0303	10.5419
0			7	7
7/23/2020	1288130	38140	14.0687	10.5490
0				2
7/24/2020	1337022	38129	14.1059	10.5487
0			6	3
7/25/2020	1385494	38129	14.1415	10.5487
0			7	3

IV FINDINGS OF THE STUDY

The findings of the study were quite interesting. It revealed that there is strong positive relationship between COVID-19 Confirmed cases and Indian financial markets (Bombay Stock Exchange Sensex) for the period of 1st July 2020 to 25th July 2020. This implies that there is significant impact of COVID-19 Confirmed cases on Indian financial markets (Bombay Stock Exchange Sensex) for the period of 1st July 2020 to 25th July 2020. It means that COVID-19 is influencing the Indian financial markets considerably.

V LIMITATIONS OF THE STUDY

The sample taken in the study only considered Indian financial markets that too for a very short period of time collecting data only from 1st July 2020 to 25th July 2020. Further researches can be conducted taking large samples of other countries with a long time span for in-depth analysis. Other stock indexes of India can also be preferred such as NIFTY 50.

VI CONCLUSION

The COVID-19 outbreak in china and its outburst at global level belatedly resulted in major injuries to developed economies and put the developing economies as of India on a ventilator situation. The whole world is now under the sway of COVID-19 pandemic. It shook the world's biggest economies including Indian economy as well. Indian financial markets experienced high degree of volatility during the novel coronavirus outbreak. Hence the study was conducted in order to find out the impact of COVID-19 on Indian financial markets. The time period taken into consideration was from 1st July 2020 to 25th July 2020. The above study gives a new literature in the realm in context of COVID-19 impact on financial markets in India. The study is really helpful in guiding investors and their investment decisions; and will aid the policy making of government. Results inferred that there is positive relationship between COVID-19 Confirmed cases and Indian financial markets (Bombay Stock Exchange Sensex) for the

period of 1st July 2020 to 25th July 2020. The study concludes that there is significant impact of COVID-19 Confirmed cases on Indian financial markets (Bombay Stock Exchange Sensex) for the period of 1st July 2020 to 25th July 2020.

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FUTURE OF MANUFACTURING SECTOR AFTER COVID 19

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ABSTRACT

About 20% of GDP is in production, with the car sector taking up 50% of that. Just before the lockdown, revenue decreased by over 15% and volume cuts of between 5 and 10%. The problem was even worse in the unorganized sector, as the instability would impact smaller companies with fewer retentive control. Throughout specific ways, the corona effect has influenced the vehicle market. The manufacturing has been limited because of decreased offtake. Most stores offer then bill for a prolonged duration of late payment—the cascading effects of organizational complications. Carriers fail to pack vehicles because their performance is often small. Primary producers have intense single or low double-digit PAT to

Revenue Levels (profitability ratio). It could take, say, two months to heal and return to work. The Corona effect negatively influenced the company's productivity by nearly 30%. The time of lock-down can be an advantage for well-managed businesses. Better businesses will formulate strategies for growth, whereas not so successful firms create plans for preservation. Industries would seek to recover about 3 to 4% of their PAT/sales. Organizations that hold their system in service would profit, and more of their profits will be recovered. These goods are likely to be in high demand, particularly in connection with health care. The consequence may be a cascading impact by increasing competition in associated goods and contributing to an aggregate pick up in production. This article briefly lists the challenges and opportunities facing our country if it wishes to embark on a journey to boost its manufacturing industry.

I. INTRODUCTION

The intensity of the COVID-19 crisis spread has disturbed countries around the world. Deteriorating healthcare infrastructure worldwide has stopped other nations, and the authorities can not stop people from moving outside. The coronavirus catastrophe is also a severe blow to the global economy, which is already in difficulty. Börsengrowing worldwide has fallen to the lowest level, people are losing jobs, and economic activity has stalled. (Lewis 2020). This is clear that the pandemic has ravaged and threatens to take lives as we read this. We will work on reducing casualties and designing potential plans following the increasingly evolving global landscape. -- crisis presents its collection of possibilities, as the expression goes, "there is light at the end of any tunnel." New figures indicate that production in India has fallen to close to nil. On the opposite, however, the pandemic might pave India's long-awaited path into the manufacturing industries. (Chain, Bernard, and Way 2020). Our neighbor China has been the global factory for decades now, representing approximately one-third of the world's products. India has also sought in the past to lure international investment to develop the manufacturing industry, but our sincere attempts in development have been modest. The global dynamics now changing because of the new coronavirus crisis mean that conditions are right, and India can dramatically reverse fortunes in the coming decades if India plays its cards right away. (Brewin 2020).

THE WORLD'S DEPENDENCE ON CHINA

The possibility of the new epidemic on the coronavirus industry now being the main source of raw materials and manufactured goods right over the globe. Over several years China has maintained a hegemony, and the production chains across the globe have been seriously impacted because COVID-19 has brought China in at the start of January this year (Guan et al. 2020). Japan became the first government to accept this over-reliance and offered to Japanese producers a \$2.2 billion plan to help evacuate and to send them home, its overseas factories. Many countries are projected to thrive in the immediate future, with India getting the golden chance to develop manufacturing facilities in India. (Ivanov 2020a)

BATTLES IN COMMERCE

Until recently, China was involved in a brutal trade war with the United States, leading to a dramatic spike in its product prices in the United States. As a reliable ally of the United States for so many years, India needs of taking this opportunity to encourage American businesses (many of whom were also hard hit by the recent changes in the supply chain) to manufacture in India, which would generate big employment in many fields of manufacturing. (Hobbs 2020).

LABOR INEXPENSIVE

The first explanation that China was the world's honeymoon when it came to development is because it had inexpensive jobs. The Chinese industry thrived as their employees were employed at relatively low salaries, along with other factors, such as tax regulations and the flexibility of importation and export. Chinese employees have seen significant raises in salaries during the past few years. Throughout China, the output levels have already fallen significantly more than before, as firms have drastically reduced their operating margins. It is assumed the world has seen a decrease in the demand for the Chinese economy for the first time in 2016, the first in the country's recent past, accompanied by trade wars in 2018.. (Ivanov 2020a). India already has relatively low labor costs relative to China, and its highly trained workers will continue to disrupt its manufacturing industry.

WORK WORKFORCE DECREASE IN CHINA

The structural experiments carried out by the one-child policies over the years have witnessed a drastic decrease in the working-age demographic in recent years. The divisive program was scrapped in 2015, which contributed to a decrease in the working-age adult population with fewer men. China is already searching for robots and factory technology, and India wants to take the chance to move its big young people as early as possible. (Ivanov 2020b)

DIFFICULTY

There are several hurdles to rising potential, and India does not have a hunky-dory on the way to being the world's farm. If India intends to exploit this chance, the following difficulties will emerge.

ENHANCED PEER PRESSURE

In this financial ethnicity, India is not the only one, and few more other emerging economies have seen their manufacturing sectors speed up and economic boom in recent years quietly. One is Vietnam, whose booming manufacturing industry has seen phenomenal development over the last few years. Vietnam has succeeded as a country with a shift from extremely poor to middle-income. Within 20 years, this transition has made it one of the fastest-growing economies ever in history and is likely to outperform Singapore, the United Arab Emirates, and Singapore shortly. Mexico is another nation that has suffered tremendously (in particular in the past two years) from the industrial slowdown of China. Mexico still has a direct benefit in its proximity to the United States, which is now the largest market in the world. Of course, these developed countries have done an excellent job of enticing businesses to construct production facilities, and they must undoubtedly do their best to leverage mostly on new chance. It is worth noting that these are a few, and many may be en route; if India wishes to lead the way in manufacturing, it will realize its distinct advantage over its peers and move quickly.

EFFICIENT SYSTEM OF GOVERNMENT

The biggest democracy in the world is India. Central and state governments must agree on business-friendly policies to render India a global player. Each democratic structure comes with its own set of challenges.

WEAK SERVICES

India's weak infrastructure has been "the most significant hurdle until now and has been commonly portrayed as the last missing connection in the history of Indian economic development. Although India, with relatively low labor costs and strong labor forces, may render it a desirable investment destination, given the uncertainties associated with infrastructure problems, for individual businesses, it would be

challenging to maintain them in the future if we struggle to achieve this. (Siche 2020). It is clear that India (as well as the rest of the world) suffered greatly from the recent COVID 19 crisis, but more can be learned by becoming sensitive to the demands of the evolving environment. A proactive and pragmatic solution thus will contribute to tremendous economic growth and development that will be powered up by its thriving manufacturing sector in future years.

SECTOR OF PRODUCTION

The manufacturing sector is one of the most hit segments of COVID-19. In China, where most of the factories supply raw materials to various production units in the world, the new coronavirus originated. Measures to stop the virus spread have been taken. (Rizou et al. 2020). Following this lock, the production facilities stopped, and the entire global supply chain was destroyed. More than 75% of businesses have "one or two primary or level 1 vendors" from China in order to bring this into context, and 938 of the Fortune 1000 firms hold Tiers 2 suppliers. This led to a chain of events, including a sharp drop in global FDI inflows and a decline in global economies. UNCTAD forecasts that the outbreak of COVID-19 would result in global FDI declining from 5 to 15 percent, due to the decline in the manufacturing sector and a factory shutdown. (Baker et al. 2020)

PRODUCTION SECTOR

COVID-19's effect on the global producers of vehicular, electrical, and telecommunications goods, machinery, aircraft, and process development such as food & drinks, additives, pharmacy, and medical devices, painting, and decoration, and personal care & cosmetics, etc. may be divided into distinct manufacturing. (Bonaccorsi et al. 2020). Let us examine the effects of COVID-19 on the manufacturing processes and on the general financial year 2020 through this blog. We will examine the processing as mentioned above industries, highlight the impact on them of COVID-19, and finish with collective measures to help the processing industries to find their feet again.

INDUSTRY OF PHARMACEUTICALS

The adverse consequences of COVID-19 have placed enormous strain on the global market of therapeutic goods, creating the issue of shortages. The US and other major manufacturing countries for pharmaceuticals and medical devices rely heavily on material from China, where the virus has originated directly and indirectly. They now face a high risk of supply shortages owing to reduced operating capabilities in China.

The USA, for instance, is produced in China for 13 percent of its therapeutic goods. India also relies on China, the world's top manufacturer, and exporter of APIs by production for around 80 percent of active pharmaceutical ingredients (APIs). Since the start of the pandemic, pharmaceutical firms there have been severely impacted.

However, the export of 26 widely used ingredients in pharmaceuticals to ensure uninterrupted usable essential APIs is limited by India, another leading producer of APIs. Often research trials are impacted, with about 20% of the studies in China. Clinical Trials.gov, according to the US clinical research website, carries out nearly 500 studies at sites in Wuhan Town, the COVID-19 fountainhead. Also, COVID-19 pressured several pharmaceuticals producers to concentrate on caps, fans, and associated device production, sanitizers, and other products. Throughout this scenario, the effect of the pandemic was, to a considerable degree, reduced. However, this can not be their long-term survival plan, since they need to rely on creativity and the need to adjust market practices to solve the pandemic.

MANUFACTURING OF FOOD AND DRINKS

The existing situation has contributed to substantially decreased demand as well as supply chain problems for food & drink producers. In supermarkets and wild stockholders, there is a growing shortage that struggles to keep things from the derailment of the supply chain, apart from necessity. There has been a significant effect on the supply of raw materials and products to manufacturing facilities, hampering manufacturing, and causing factories to abandon operations. The supply of workers became another big problem in periods of social isolation. A study by French trading group ANIA suggests that food and beverage companies have suffered a 22% loss in worldwide turnover. The out-of-home consumption, which historically produces the higher-margin, has come to a halt while domestic usage has been seen to rise.

THE INDUSTRY OF COLOR & COLORING

There is also a risk of a severe contraction in the world paint & coatings industry, as significant markets stay closed to delay the spread of the latest coronavirus. Once, the global paint and coatings industry was hit hard by China, which is the leading exporter of many necessary paint & coatings raw materials such as pigments and other additives. If something like COVID-19 happens, the cumulative impact is immense. That can also be seen by the paint and lacquer industry, as their primary retail clients – including manufacturers and building sites – also stopped briefly in several nations, as well as their production companies, which also contributed to a significant decline in demand. However, the recent rise in the global price of petrochemicals has seen an improvement in the prices of petrochemicals, which are heavily reliant on the industry.

MANUFACTURING OF SPECIALIST CHEMICALS

In February 2020, the COVID-19 pandemic contributed to a decrease in worldwide chemical production by 2.4% and 1.3% in April 2020. Nearly all forms of chemicals have seen their production decrease. However, there was a 9.4% decline in the output of specialty chemicals. The ongoing recession has pressured large chemical producers worldwide as a consequence of labor shortages, lowered competition, potentials credit rates, and a shortfall in the availability of raw materials to limit their manufacturing activities to 40 - 60 percent. The epidemic of coronaviruses has culminated in several manufacturing plants from different end consumer sectors, such as chemicals, fertilizers, drugs, packaging goods, etc. being stopped. It is, therefore, growing the market for chemicals used in such facilities. Manufacturing business for personal treatment & cosmetics owing to the closed-off shops in various locations across the world, the multinational manufacturing sector of personal care & cosmetics, which can be classed as skincare, hair services, scents & fragrance, and other cosmetics, witnessed a decline in revenue during the COVID-19 epidemic. Most countries already remain in shutdown mode across the globe, and because of labor shortages and decreased competition, factories in the area of personal care and cosmetics have needed to close down their manufacturing units to pursue places where products can be shipped. The personal care & cosmetics business was, like many companies, severely impaired at the front of the supply chain. The principal cause for this disturbance was halted manufacturing production in China. The success of non-important retail companies, like the ones from Cosmetics, including Amazon and Flipkart, will presumably continue to be affected by such developments.

CONCLUSION

It would be challenging to buy big-ticket greenfield projects, both locally and abroad. Few local businesses have the potential to spend significantly in the long term; domestic developers are concerned about affordability. "Big players," a task that includes regional strategies, fair offers, and large concession allocations, are an entirely different phenomenon overseas. Ravi Agrawal writes that a 'Perle line' solution is more straightforward, more complex, and oriented. To overcome Covid 19, it requires carefully selecting a few or reasonably capable businesses, bringing their value chains together, and generating medium-sized strategic investments in specific essential and desirable value chain components. Such expenditures are generally limited in scale, and capital needs are weak. If the business is regulated, it can be easily integrated into an established supply chain. Such value-chain-related ventures for borrowers are more viable and appealing. Medium-sized businesses generate more workers per investment device, which is a significant post-Covid-19 trend in India. These companies may be distributed across the world, decongesting towns, growing economic opportunity diffusion, thereby promoting the expansion of service and social sectors and allowing them to expand dispersed. Over the next five years, India needs to build a realistic plan in order to increase its total domestic added value by at least 500 to 600 Bps. All of it will come from a 'per line,' i.e., technology-driven, medium-sized firms.

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IMPACT OF COVID-19 ON GLOBAL SUPPLY CHAIN

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ABSTRACT

As COVID-19 tragically broke out, the lives of individuals were not only seized, but the country was still severely paralyzed. The limited lockout hindered the production and sale and impacted the demand and supply of different goods because of restrictions on store owners and distributors. Throughout any form of a device from various fields, the impacts of COVID-19 are widely found. Through this study, three separate scenarios were built to demonstrate disturbances to the food supply chain in the Community distribution network Model. Increasing situations of contaminated case development and recovery also expanded the problems of balancing supply and demand in a vast network of distributions. This article further underlines the value of a supply chain robust during a pandemic. Our suggested modeling model will help build a stable and flexible food supply chain to satisfy differing criteria and then assist decision-making in moving vehicles in areas subject to travel restrictions. The article outlines essential details and provides potential study possibilities for creating a more comprehensive network of food supply chains.

I INTRODUCTION

Interruptions in the supply chain can happen due to disruptions caused by people and natural catastrophes. Many other prior incidents have taken place worldwide, including Gujarat in 2001, Japan in 2011, the Indian Ocean in 2004. Likewise, the contagious disease epidemic Corona Virus Disease 2019 (COVID-19) triggered not only a natural life catastrophe but also industrial operations such as construction, the manufacturing, and distribution chain, and many other industries) (Lewis, 2020). COVID-19 Pandemics have had a significant effect on travelers, transportation, energy, electronics, food, and safety industries Early cases were recorded in December 2019 and had been known as influenza in Wuhan Wet Markets in the state of Hubei (China) and subsequently as the COVID-19 (Chain et al., 2020). New cases were identified in December 2019. For a couple of months, since the virus spread, there was a significant degree of panic and insecurity in the persons, and it also has a psychological influence on mental wellbeing. The World Health Organisation (WHO), since the extent of the risks posed by the high intensity of the virus is known, declared a global health emergency of January 30, 2020 (Brewin, 2020).

In fact, in 114 countries worldwide, the WHO has declared this virus a COVID-19 pandemic on March 11, by witnessing the risk of severe and unchecked transmission of more than 118,000 cases. To date (June 15, 2020), there have been 435,600 fatalities globally, and even more, lives will take as the number of COVID-19 infections has checked 7.9 million people for active and continuous growth. Across India, in the third week of June 2020, COVID-19 incidents increased to 368,705 (Guan et al., 2020). Currently, the healthcare supply chain is being pushed by an immediate need for personal protection equipment (PPE), helmets, and medications. Governments in different countries are concerned with stopping and regulating the spread of the COVID-19 to the population, which can reduce serious harm but is rendered a problematic challenge by a complex transition of coronavirus infection. The lack of treatments and the imbalance in vaccination production make the condition higher than ever before. The diagnosis is symptomatic, and oxygen therapy is the primary care method for

severely compromised patients. Throughout the event of the inability to receive oxygen care, mechanical ventilation could be required, and hemodynamic assistance is equally important to the control of septic shock. There is still a minimal supply of such services, so it is tough to meet this need, mainly when a lockdown is carried out across half the planet (Hobbs, 2020). The shutdown has been introduced in different nations in order to monitor deaths and lack of physical wellbeing, and about 2.6 billion residents have been subordinated under quarantine in China, the USA, South Africa, Philippines, and other European countries in March and April 2020. However, competition in the food supply chains has unexpectedly risen as a consequence of people's panic purchasing and hoarding. Lockdown represents a crucial short-term decision to delay the development of infection and that rather than population dissemination throughout the disease transmission. In addition to that, the lockdown has severely crippled the nation and hinders the planet (Ivanov, 2020a).

The network of supply chains and distribution links all sectors and barely any acts since the COVID-19 pandemic have been illustrated. Worldwide, companies were at their lowest point, and Global inflation and Asian economic problems were expected by the World Economic Forum, the World Bank and the International Monetary Fund. Significant impacts on the COVID-19 supply chain and the manufacturing systems, including estimates of the influence of the global distribution system in the second half of the plan. It sets out the necessity for a stable supply chain and to search at new solutions at the recovery of supply chains.

Feed and medical supplies for healthy food and safety supply chains are the main products during the pandemic. The new global supply chain's vulnerabilities were revealed in COVID-19 to the loss of sales, demand, and supply. It is a learning experience for sustainability and robustness to support a weakening market in the supply chain (Ivanov, 2020b). Therefore, it is essential to provide a thorough overview of the global situation and the steps available. Furthermore, by reviewing the current studies and analyses published by many respected institutions such as the WHO, the WEF, and the International Monetary Fund, we spoke about the influences of the COVID-19 pandemic and subsequent follow-up on the commercial lockout. A redesign of the truck-drone distribution device coupled with medication and other essential products for the high-rise buildings is also shown. Also, three separate situations under pandemic conditions are built to test the Public Delivery Networks Supply Chain Network (PDS). A staggering strategy to rebuild the supply chain and manufacturing operations related to various sectors would also be addressed in order to accommodate the rapid increase in demand for treatment services, health goods, and critical items.

II IMPACT OF COVID 19 ON VARIOUS SECTORS:

Manufacturing Sector

The breakout of COVID-19 was the scheduling of the most important holiday in China during the New Year, since all the factories in the world shuttered for the whole month to allow citizens to go back home and spend more time with their family. The number of visitors to China is projected to hit around 370 million during the New Year. Industries who trade with China are informed of the closure, and a significant amount of order processing is issued accordingly to ensure they have supplied during this time. Simultaneously, the decision to close the plant forced the government to order prolonged factory shutdowns to contain the spread of the virus better. The holiday usually ends on January 24 and is scheduled to commence and continue from February 2. Most factories were, however, told to stay closed until February 9 until next week. Mast plants will typically have been completely operational by mid-February, but development re-establishes at a more sluggish speed due to prolonged closures and

difficulties in bringing workers back to the plants because of safety quarantines and travel restrictions. Only 70 percent of major corporations in some provinces had begun activities and had far less than maximum efficiency, based on local government data by the end of February (Siche, 2020). At just 43 percent resuming activities, small and medium-sized businesses were struck especially hard. The revival of China's extremely productive supply chains would undoubtedly take time even as manufacturers rebuild. Many analysts agree that the medium to long-term economic implications for most sectors is minimal, and global demand rates stay mostly unchanged.

In the near run, though, that could affect the automotive sector, the one that also leads to economic development. Catering, distribution, and travel companies will both face significant cash-flow constraints in the first half of this year owing to reduced sales of foodservice goods and rising fixed costs, which do not account for the cyclical deficit during the outbreak. Over the last month, several largest luxury companies have seen profit estimates decline as a consequence of COVID-19, and market demand declined over China.

On the other side, there have been relatively few impacts on productivity to date. In the short term, its effect persists mainly in the obstructions of supply and development recovery due to delayed workers' return, loss of personal mobility, and constraints on traffic. With the time of healing, the severity of these conditions decreases. Moreover, if the dissemination of the virus affected other central manufacturing countries outside China, it will make much more important for the industry. The industrial sector will return to its course in the long run.

Fiscal and Social Sector

The pandemic is unprecedented destruction as the coronavirus exploded around the globe in the past five months with the loss of over 100 000 lives and millions of illness verified. We self-isolate ourselves worldwide and stay away from gatherings and activities in order to prevent contractedness or illness transmission. Therefore, an extensive program of social exclusion is enforced, and the bulk of the United States has closed down nonessential businesses such as hotels, gyms and stores, hospitals, parks, and other public locations.

The spread of COVID-19 strengthened our daily life and impacted the global economy considerably. In the US, the Moody analyzes reported a 29% decrease in average US economic production relative to the first week of March 1 before widespread closures. The outbreak is ravaging industries such as transport and hotels. More than 20 million People submitted unemployment applications between March 21 and April 11 over weeks, according to the Labor Department, with significant parts of the workers discharged or working fewer hours. Any companies are struggling to recruit jobs to satisfy rising competition at the other end of the continuum (Rizou et al., 2020). There are sadly reports of labor shortages and stresses on production chains exacerbated by pathogens and concerns linked to the virus. The jobs most impacted by the crisis at this stage are drivers of vehicles, foodstuff employees, food manufacturing workers, and the absence of individual workers over the next few weeks will contribute to shortages or failures in those items.

Local Business and Chain Stores

The extent to which so many businesses were closed entirely, others were developing is a surprising feature of the COVID-19 crisis. Indeed, particular aspects have also been influenced by identical goods in relevant sectors of the economy. In the manufacture and preparation of milk, the most lucid

explanation is. Statistics from the Department of Agriculture of the United States (United States) reveal that just over half (54%) of the USD1.7 billion in 2018 of food revenue are off country. Since the coronavirus, though, much of the country's one million cafes have shut down entirely or relocated into exclusive retail, and 95 % of Americans are in some sort of residency. In addition to stockpiling customers as they stay at home, substantially more in-home food has increased demand in retail outlets, particularly in foodstuffs and e-business. Sales of food services then plunged, and the move became a massive problem for the food supply chain.

None becomes more evident than with milk products as well as other fresh farm items when adapting to a different channel blend. In tandem with panic purchasing, producers are dumping their surplus stocks of milk and eggs in the market for items like meat, butter, and eggs (Petropoulos & Makridakis, 2020). According to distribution outlets, variations in quality and labeling specifications imply that manufacturers can not readily give for servicing customers.

For example, grocery stores typically sell cheese. For example, grocery stores typically sell cheese. In comparison, foodservice items are often delivered in bulk and are not offered in packages geared towards customers. Write a grilled cheese 10 g packet toward the shoppers who buy the 8 gm packages at home.

While producers may change output and procure the packaging for distribution on the food market, they still have no arrangement with shops to bargain for floorspace.

The rise in demand has caused several consumer products firms to rely more strongly on manufacturing critical stock-keeping units at the required rate. For example, Coca-Cola is experiencing growing competition for food and e-commerce when customers buy, and the company is trying to supply the best-selling drinks while smaller product repair units are still available.

Transportation

Even if producers can provide the essential commodity in the right packaging and safe shelf room, it is another essential task to transport products. Carriers are usually unable to satisfy the market increase arising from the recession, and, in many instances, supplies have declined due to different factors. First, there is a persistent shortfall of freight lorry operators for many years, as drivers' aging employees withdraw from the business without sufficiently new staff (Baker et al., 2020). When the coronavirus spreads, individual drivers will not function because of the illness. In the meantime, many are concerned that they are affected by a virus, and is particularly harmful to anyone over the age of 60, and prefer not to take the chance of participating in jobs where they communicate with a few people on their way. Logistical constraints prohibit the effective delivery of goods in order to satisfy the increasing demand, in contrast to the lack of operators. The over-loaded distribution plants and storage areas that have little room to cope with increased production could trigger delays and long delays in plants. A lack of cooled vehicles has also slowed down the supply of meats and crops.

Health & Safety Sectors

The healthcare sector is perhaps the most critical supply chain in the crisis. It offers sufficient quantities of medical instruments such as fans, sanitizers, and safety gear, such as helmets, gloves, and clothing.

Most countries have placed export restrictions, so policymakers are redirecting exports in the case of medical personal security devices. Officials have taken goods at the border to retain them in the region, often distributing personal protective equipment to hospitals rather than to the original purchaser.

The primary sector in which supply chains are strained is pharmaceutical manufacturing. Throughout China and India, which are dependent heavily on the United States to produce medicines, essential narcotics are rapidly throughout short supply, as the plants are mostly shut down, and supplying pharmaceutical products used in drug processing is prevented.

The primary problem was the loss in imports from China as the coronavirus first spread. Supply chains are now threatened everywhere, and competition is rising as unemployment increases, and spending costs decline. In comparison to the businesses that manufacture critical medical/personal supplies and defense-related goods, few significant producers will continue to function entirely. For certain instances, automotive makers and their dealers have abandoned factories. However, several businesses have developed and relocated to manufacture different items to satisfy the rising need for medicinal supplies (Bonaccorsi et al., 2020). In one scenario, an oil/gas device maker has expanded into the development of medical visors. Regional producers and 3D printers are also common by factories to have their manufactured goods in short supply. Local procurement helps suppliers, in terms of lower flights and overextended trucking firms, to escape growing production prices, production limits, and shipment times delays, among others, hurdles. 3D printing technologies have given businesses in recent years with benefits in order to gain greater industrial efficiency, such as in the manufacture of replacement parts, which enables enterprises to retain lower inventories. 3D printing is a powerful resource during the disease outbreak in support of production chains and in resolving drug deficiencies.

III CHALLENGES FOR SUPPLY CHAIN IN FUTURE

Following the ongoing recession, companies will benefit from the problems they have encountered and take action to improve their distribution network. To others, the crisis would serve as a "Wake-up call" for further planning, and the analysis of the supply chain network is fundamental among distribution chain management specialists. Not only will the specific vendors of a product, but their manufacturers and global presence be included in the method.

When purchasing and monitoring their vendors, most businesses also focus on personal connections and anecdotes. The lack of a structured selection ensures that the expertise of recruitment workers fails them, switches positions, or retires. The utility of a chart can be more expensive and time-consuming, whereas supply network analysis can be labor-intensive and challenging. Understanding manufacturers, equipment, components, and goods are affected during a disaster allows businesses to maintain minimal resources and capability on specific sites first. Firms will also seek innovative methods of utilizing their origins, some of them contradictory to traditional wisdom. Over recent years, for example, multinational corporations have globally centralized their output to save money⁶. Companies will check the potential benefits of this sort of consolidation as the additional expense of a massive running plant in various areas is mostly not higher than the costs of one big plant. Around any stage, businesses will reach full (or nearly complete) gradual performance changes. In other words, in terms of economies of scale, they can not sacrifice anything at half the rate. When running two factories, businesses sacrifice nothing in productivity but achieve immense versatility across a supply chain that can withstand future epidemics and other natural catastrophes better.

Specific emergent technology, including blockchain and driverless vehicles, will provide policymakers and businesses with ways to react to COVID-19. Blockchains help the reliability and anonymity of monitoring and immune identification systems in different ways by verifying the sources of PPE and other safety items. Blockchains endorse them in numerous ways. In Italy, digital blockchain has allowed contributions to the Red Cross and used it to validate news on an editorial forum to combat fake news.

In the meantime, automated vehicles will lead in addressing driver shortages and logistics challenges, like emerging contact criteria. The implementation of signs is picking up ahead of the pandemic. Yes, during the coronavirus lock-down, autonomous vehicles delivered food and medicine in China. Around the beginning of February, one company distributed products to staff using automated transport devices, each of which was able to carry hundreds of parcels to locations like hospitals. India's 'dependence on China and other countries has been subjected to shortages of researchers scientists who research on vaccines, vital drugs, and supplies since the crisis. The contribution to demands for the US to stop depending on the import of such vital products and to increase national capacity to develop drugs and medical supplies.

IV A VIEW OF THE POST-COVID WORLD

From an organizational point of view, digital change projects for businesses globally will be intensified by the present scenario, because they confront their shortcomings and weaknesses. Technological market models will evolve as vital and relevant, and as we re-imagine, tomorrow's global supply chains will play a crucial role in deciding the strategy.

Despite the latest global recession, there are many directions for businesses to develop stable supply chains in the post-covid environment based on principles that have been strengthened and tested. Secondly, reliance on manual labor by shipping, distribution, and warehousing must be needed urgently. Labor can be allowed via core new technologies for industries like Internet-of-things, cryptocurrency, control rooms, artificially intelligent-machine learning for prediction of demand, rules-based, autonomous robots like AGVs and drones, among others. This can be accomplished via core communications technology.

The new trend shall be factories capable of modularizing production lines and shifting / adapting lines as a consequence of market shifts. We will be assisted by networks that could intelligently interact with each other and maximize their productivity and agility. Businesses should rely on rendering essential services on the web accessible to staff while operating from their residences. Most of the web migrants can also be seen making the big turn to the other hand — before eventually heading through the web for business continuity. Health must also be a vital part of all development activities, and company risk control should be vital. Some of the few negatives to the COVID-19 scenario introduces us to remote working possibilities through markets, sectors, and businesses, and this phenomenon would put a renewed emphasis on environmentally sustainable operational practices if it is maintained in the post-COVID setting.

Nevertheless, the most critical feature of the human being is when we turn into the post-COVID universe during the COVID-19 era. According to the estimation of the number of individuals sick/injured, only the main programs would affect cascadingly. The crisis in Italy, Spain, the US, and

China has been further compounded by the significant suppliers of facilities, including health care practitioners, emergency care staff, and groups hit by the epidemic. That is also evident in some of the more recently impacted countries, such as India.

HCL Software has taken advantage of emerging technology to promote and develop global robust distribution chains through our supply chain work. We continue to concentrate on integrating core technology and services and helping organizations across our experience as they rebound and utilize their experiences from the ongoing recession to grow faster, more competitive, and better willing to solve challenges.

V SOME OF THE ESSENTIAL THINGS OF TOMORROW'S SUPPLY CHAINS WOULD BE:

- To support companies, with the application of sophisticated machine learning techniques, to consider where and when to start from previous procurements, inventory prices, agricultural and manufacturing patterns.
- A common source of reality for major trading partners to see and respond to evolving demand and supply conditions around the globe from source to distribution.
- End-to - end knowledge control, taking the shape of a sort data cell to monitor strong accuracy and low redundancy supply chain transactions reliably. It would enable businesses across the supply chain to gain data into the efficiency of manufacturers, supply chain analysis, customer awareness, and risk control.
- A risk management allows companies model cost systems, pattern output details, and insight into the growth of the distribution chain to ensure a healthy and stable capability around supply fluctuations. It will allow companies to prevent unexpected supply chain delays and handle the knowledge shortages that other big multinational corporations, like Sony, already face.
- Analysis of potential supply chain approaches focused on modifying the market paradigm, existing and projected supply/demand / logistical constraints. Contributes to validating and evaluating the best cost-effective system to reach the required value chain quality of operation.

Also, our desire to benefit from our collective observations is one thing that humans would do more than any other form of thinking. From a strictly commercial point of view, COVID-19 poses a range of severe and often unparalleled problems for industry-wide companies, including potential liquidity collapsing, failures in the global supply chain, growing trade barriers, or transforming customer attitude. However, post-COVID technologies should play a pivotal role in boosting the entire spectrum of businesses, including more robust production chains, better customer interfaces, and intelligent automated systems to achieve market outcomes. Innovative and enterprise process improvement is now the moment to stay ahead of discussion for Supply Chain Management application vendors. Consumer organizations continue to analyze whether the approaches to supply chain management are best tailored to fluctuating competition, macroeconomic uncertainty, and demanding circumstances. Supply Chain Management may support strategic strategy and operations beyond the supply chain, building a robust yet flexible development process that is capable of addressing current and potential challenges.

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THE SPREAD OF COVID-19 AND THE EFFECT OF LOCKDOWNS ON THE INDIAN ENVIRONMENT

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ABSTRACT

The novel coronavirus diseases (COVID-19) of Wuhan, China has spread quickly across the nations. The virus has infected people of all ages with underlying medical issues like cardiovascular disease, diabetes, chronic respiratory disease, and smell loss etc. The origin of person-to person transmission forced people for social distancing. Therefore, to halt the spread of COVID-19, India has announced various lockdowns against this virus. As per number of cases, India reached at the second position and a large number of Covid-19 cases are being observed. However, the mortality rate is lowest among all other countries over the world. A positive impact of nationwide lockdowns has been observed in improving the environmental conditions i.e. Ozone, PM_{2.5}, NO₂ and CO. The observed value of aerosol optical depth was much lower in comparison to previous years.

Keywords: COVID-19, India, Lockdown, Pollution, Environment, Aerosol optical depth.

I. INTRODUCTION

The American physicist first identified the concept of paradigm shift and philosopher Thomas Kuhn as the fundamental change in the basic concepts and experimental practices of a scientific discipline and the paradigm shifts arises when current operational science is incompatible with new phenomena and

facilitates the adoption of a new theory or paradigm [1]. The paradigm shift is a theory or a concept about how something should be done, made, or thought. The paradigm shift happens when the traditional way of thought process about doing something is replaced by a new and different way. Due to COVID-19, now these days the term paradigm shift is very common not only in science, but in all the sectors i.e. business, sports, transport, education, social movements etc. This pandemic of 21st century is compelling us to redefine the value of governance system, human opinion system, medical and science and human relationships. Before COVID-19, the society was focused on the status, power, wealth and celebrity. After COVID-19, most of the 21st century tools and technologies became practically defence less to face the COVID-19 and the people are left with only the primitive weapons like cloth masks, chemical sanitisers and keeping the distance. The high transmissibility of the COVID-19 is the reason for the worldwide spread and the international travel and tourism could be a reason for its worldwide spread. The other reasons include the various religious, socio-cultural, scientific, sport, and political mass gathering festivals across the world. These types of mass gatherings are likely to exaggerate many of the risk factors of COVID -19, and have historically been associated with outbreaks of disease both in local and international levels. In the present paper, the effect of lockdown on the Covid cases and environment has presented. It has observed that there is a significant improvement in environmental conditions.

II. ORIGIN AND SPREAD OF COVID 19

Coronavirus disease (COVID-19) caused by SARS-COV2 and has presented itself as the potentially fatal disease of great global public health concern (Rothan and Byrareddy, 2020). In December 2019, a cluster of patients with preliminary symptoms of pneumonia were admitted to the hospitals and epidemiologically these patients were related to the wet animal wholesale market of Wuhan, Hubei Province, China (Bogoch et al., 2020). Therefore, it's suggested that the COVID-19 has been originated in a zoonotic way. The origin of person-to-person transmission of COVID-19 has forced to isolate infected people in the hospitals. The early reports provided the outbreak of Coronavirus and estimated the reproduction number for the 2019 Novel Coronavirus and was found to be significantly larger than 1 (ranges from 2.24 to 3.58) and named COVID-19, by WHO on Feb 11, 2020 (Zhao et al, 2020).

Up to January 22, 2020, only 571 cases of COVID-19 reported in the 25 provinces of China (Ren et al, 2020). As of January 22, 2020, the National Health Commission of China reported only 17 deaths and on dated January 25, 2020, the cases raised to 1975 with 56 deaths with confirmed infection of COVID-19 (Wang et al, 2020). Thereafter, as of January 30, 2020, 7734 cases of COVID-19 were confirmed in China and the other countries reported around 90 cases from that include Thailand, Vietnam, Taiwan, Malaysia, Nepal, Sri Lanka, Japan, Singapore, United Arab Emirates, The Philippines, Australia, Canada, United States, France and India (Nishiura et al, 2020).

As far as the number of COVID-19 patients are concerned, according to the CDC 24/7 (Centers for Disease Control and Prevention works 24/7) as of June 11, 2020, in United States more than 2 million cases have been confirmed with 113,914 deaths of people (CDC Daily Reports, 2020). USA is at top of the list with 27% of total number cases in the world having 27% of total number deaths. However, now the graph has started to show the decremented phase.

As of June 12, 2020, according to the report WHO, the current outbreak has infected more than 7 million people of the world. The very first case of COVID-19 outbreak in India reported on January 30 , 2020 in Kerala through a student who returned from Wuhan University of China to his home (India Today, 2020). According to the report of WHO, the number of cases in India are increasing at fast rate and as of October 02, 2020 India has acquired the second position. The data of total number COVID-19 cases has from WHO (<https://covid19.who.int/>). As of October 03, 2020, the highest number of cases of 1, 68, 66,312 have observed in the Americas region and then followed by around 72, 51,081 cases of

South-East Asia and 60, 16,094 of Europe. In other three regions, the cases are less in comparison to Americas, South-East Asia and Europe. Eastern Mediterranean has 24, 48,756 cases, Africa has 11, 91,323 cases, and Western Pacific has 61, 21, 915 cases.

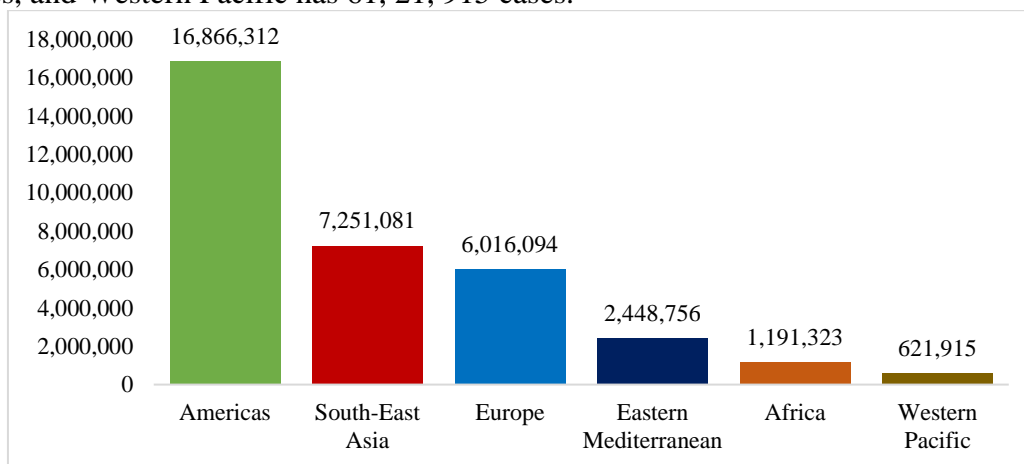


Figure 1. Number confirmed COVID-19 cases as on October 03, 2020

III. MEDICAL ISSUES

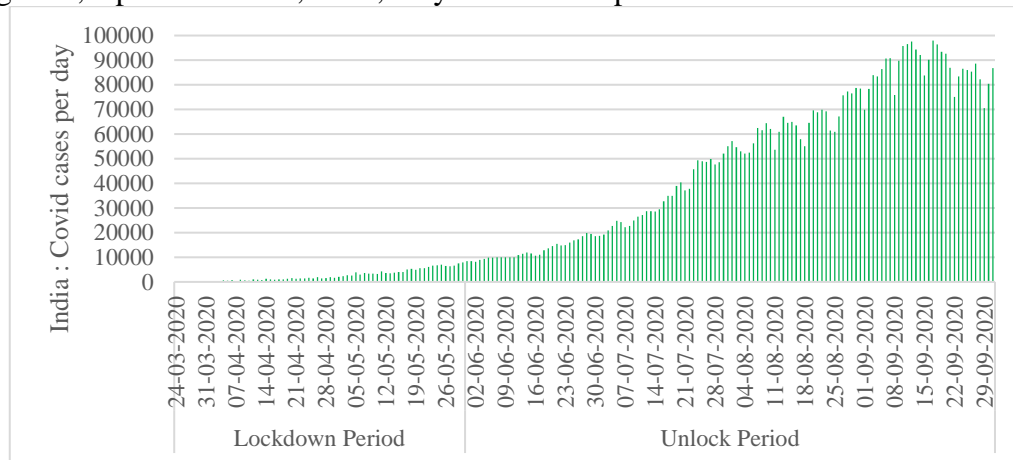
Before, SARS-CoV-2, six types of human CoVs were recognized: HCoV-NL63 and HCoV-229E are Alphacoronaviruses and HCoV-OC43, HCoVHKU1, SARS-CoV, and Middle East respiratory syndrome coronavirus (MERS-CoV) are Betacoronaviruses (Al-Tawfiq, J.A., et al.: Tang, Q., et al., 2015, Wu, A., et al., 2020; Song, Z., et al., 2019, Ge, X.Y., et al., 2013). The seventh member is the SARS-CoV-2 of the RNA-containing enveloped CoV family. CoVs use cell surface receptors to enter host cells of the human body (Jayawardena, N., et al., 2019).

The patients of COVID-19 are associated with a wide range of symptoms but most commonly, 87.9% had fever and 67.7% had cough, 3.7% had diarrhea and 5% had vomiting (Ge, X.Y., et al., 2013). Similarities of severe acute respiratory syndrome and Middle East respiratory syndrome has been observed in the patients of COVID-19 from the genetic and clinical evidences. Most commonly, the hematological changes like lymphopenia and thrombocytopenia found in COVID-19 patients. In addition, some of them had had leukopenia (Wu, A., et al., 2020). Most commonly, 79.1% patients had pneumonia with the 3.37% of acute respiratory distress syndrome (Guan, W.J., 2020). Until, the treatment for COVID-19 patients includes only providing oxygen, mechanical ventilation, intravenous antibiotics, and antiviral drugs [Guan, W.J., 2020; Huang, C., et al., 2020; Wang, D., et al., 2020). In Brazil, 88.8% of patients have witnessed total or partial sudden loss of the sense of smell called anosmia (Joffily et al., 2020). Among European COVID-19 patients, around half of patients were affected with anosmia. 98% of patients had recovered within 28 days and the mean duration of anosmia was 8.9 days (Klopfenstein et al., 2020).

According to Yiqiong Ma, majority of the HD Patients with COVID-19 showed mild clinical symptoms and more attention should be persuaded to prevent cardiovascular events, which may significantly affect the COVID-19 patients (Ma et al., 2020). In Italy, during the COVID period, elders people remained exposed to shoulder and elbow trauma and the subsequent hospitalization of these patients and made difficult to the management of the hospitals wards, partly occupied with COVID-19 patients (Gumina et al., 2020). In 36.6% of COVID-19 patients, the acute kidney injury has observed. Risk factors for acute kidney injury includes the factors like older age, diabetes mellitus, cardiovascular disease, hypertension and need for ventilation and vasopressor medication (Hirsch et al., 2020).

IV. LOCKDOWNS IN INDIA

The data for the number of cases regarding COVID-19 for India has taken from WHO. India observed there very first case on Jan 30, 2020 and as of March 2, 2020 there were only 3 cases reported. As shown in Figure 2, Up to March 23, 2020, only 439 cases reported in India before lockdown.

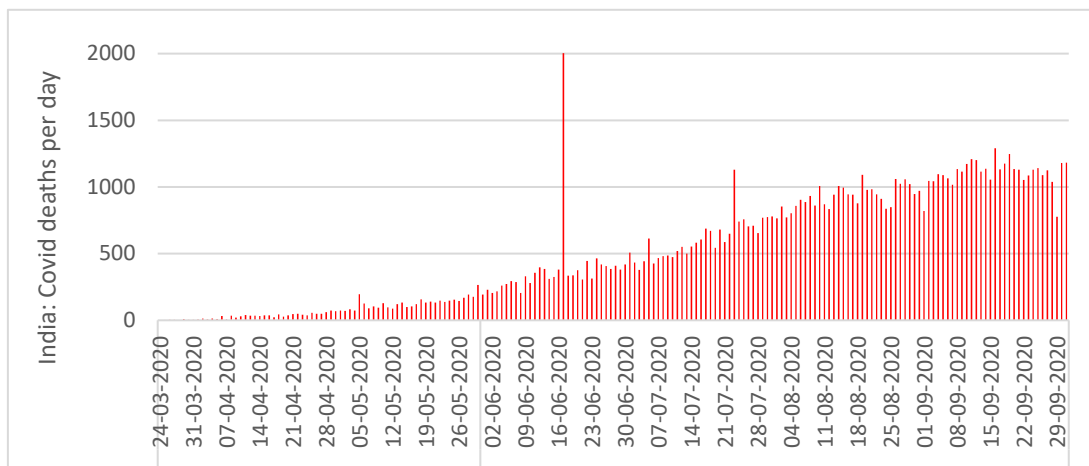


Lockdown 1 (March 24, 2020 to April 14, 2020): The Government of India ordered a nationwide lockdown for 21 days to terminate the movement of the 1.3 billion population of India as a preventive measure against the COVID-19 (Gettleman et al, 2020). The lockdown announced after a 14-hour of voluntary public curfew on March, 22, 2020 with implementation of a series of regulations (UN News, 2020). At the time of lockdown, the number of confirmed positive COVID-19 cases in India was approximately 500 (Gettleman et al, 2020). It was observed that the lockdown had slowed the growth rate of the COVID-19. As the rate of doubling decreased during the lockdown (CNN News, 2020). In this lockdown, nearly all the services of transport was suspended and factories were closed. In this lockdown period, as shown in Figure 3, India started with 492 cases and at the end of the lockdown, the number of cases were 10363. Therefore, at the end of lockdown the number cases increased around 21 times before lockdown

Lockdown 2 (April 15, 2020 to May 3, 2020): At the end of the lockdown 1, the state government of India and other advisory committees recommended to extend the lockdown. On April 14, 2020, the nationwide lockdown extended, with some relaxations after 20 April for the regions having minimal spread of COVID-19 (Livemint, 2020). The government of India allowed agricultural businesses, including dairy, aquaculture and plantations, farm shops to open. The public work programmes allowed to reopen and the cargo transportation including trucks, trains and planes started. In addition, the Banks and government offices allowed to open (BBC News, 2020). As shown in Figure 3, the lockdown period was started with 10363 cases and in this period, 37336 cases were reported. In this period, the percentage increment in the number cases was very less in comparison to previous lockdown. Here only around 3 times cases were increased.

Lockdown 3 (May 4, 2020 to May 17, 2020): On May, 1, 2020, the Government of India further extended the lockdown period for two weeks, with some relaxations (The Economic Times, 2020) by splitting the nation according number and density of COVID-19 cases, into 3 zones: red zones, orange zones and green zones. Red zones includes high coronavirus cases, orange zones includes comparatively fewer cases, and green zones were the zones without any cases in the past 21 days. Normal movement permitted in green zones. Orange zones allowed only private and hired vehicles with no public transportation. The red zones remained under lockdown (India Today, 2020). As illustrated in Figure 3, before this lockdown period, 37336 cases reported and at the end of this lockdown, the number of cases increased to 90927. So the multiply factor was reduced to two times and was less in comparison to previous lockdown.

Lockdown 4 (May 18, 2020 to May 31, 2020): On May 17, 2020, the Ministry of Home Affairs (MHA) of India extended the lockdown for a period of two weeks, with more additional relaxations. Red zones further divided into the containment and buffer zones. The local bodies given the authority to demarcate the containment and buffer zones (Livemint, 2020). As shown in Figure 3, the lockdown started with 90927 cases and ended with 18143 cases.



Unlock period: After lockdown 4, from June 1, 2020 the government of India started to focus on the economic situation and announced Unlock 1.0 and given the authority to states to act according to the situation. They issued the guidelines that lockdown restrictions are imposed in containment zones, while activities would be permitted in other zones. The phase permitted the shopping malls, religious places, hotels and restaurants to reopen from 8 June with night curfews from 9 p.m. to 5 a.m. (India Express, 2020). As provided in Figure 3, before opening the lockdown, the number of cases have increased to 3, 20,922 from 1,82,143. As several lockdowns were implemented in India from March 2020 to June 2020, starting from around 500 hundred cases, India has reached to 3, 20,922 cases and acquired the fourth position according to number of cases.

After the first unlock, the government of India announced three unlocks in each month and have lifted the various restrictions. In Unlock 2.0 (July 1,2020 to July 31, 2020) only the night curfews were in effect from 10 p.m. to 5 a.m. in all areas and the state borders remained open to all. Inter- and intrastate travel was permitted. In Unlock 3.0 (August 1,2020 to August 31, 2020), India removed the night curfews and permitted gymnasiums and yoga centres to reopen from 5 August and educational institutions remained closed till 31 August. In Unlock-4.0 (September 1, 2020 to September 30, 2020). Metro Rail was allowed to be reopened in graded manner from 7 September and Marriage functions and funereal/last rites ceremonies with limited gatherings were permitted. Religious, entertainment, political, sports, academic functions and gatherings of up to 100 people were allowed. In Unlock 5.0 (October 1, 2020 to October 31, 2020), the preference to online learning was given and swimming pools for training of sports person allowed to open. The lockdown in the Containment Zones was continued till 31st October, 2020 (Wikipedia). Through all the strategical implementations of various lockdowns and unlocks the number cases and number of deaths were increasing continuously upto the end September 2020. In the terms of number of cases, after USA, India has reached to the second rank and is very close to the USA. However, the number of deaths are still half in comparison to USA. India’s recovery rate stands at 84 percent and is highest in the world, with more than 5.5 million people recovered from coronavirus (<https://www.aljazeera.com/news/2020/10/5/india-at-100000-deaths-what-experts-say>) . As per the proposed model of Saswat Singh, the actual data is very close to the predicted value and the analysis showed that the increase in number of cases per day that shoot up after lockdown was a normal

trend (Saswat Singh). Initially, the implementation of various lockdowns have certainly controlled the spread of COVID-19. However, afterwards I the various unlocks, the number of cases per day increased much abruptly. At present on October 3, 2020, slight decrement in the both of the graphs has observed as shown in Figures. Till date, it will be too early to expect and say about the future impact on Covid- 19 on the people of India.

V. EFFECT ON ENVIRONMENTAL CONDITIONS

As the COVID-19 has took a hold on the whole world. With the country after country went into lockdown, the positive impacts on the air pollution have been noticed. Human's health is dependent on the environmental air quality, the upper level of air quality is essential for people's good health. However, according to the 2016 report, around 91% of the world population is living in the places of poor air quality that has exceeded the acceptable limits (WHO, 2016). In addition, the air pollution contributes around 8% of total deaths in the world and the most affected countries include Africa, Asia and some part of Europe (WHO, 2016). Throughout the world, quality of air is being monitored in every country. The term PM_{2.5} provides evidence of the air quality in the region of observation. The high values of PM_{2.5} may affect the human health. High levels of NO₂ is very harmful to vegetation, it can decrease the growth and crop yields. Also, NO₂ (Nitrogen oxide) can reduce visibility and may react with surfaces. The high emission of CO (carbon monoxide) may have effect on the greenhouse gases, which are further linked to climate change and the global warming. Also the land and sea temperature can increase. The increment in ozone can lead to many health issues including chest pain, coughing, throat irritation etc. and the ground-level ozone can reduce lung function and may inflame the linings of the lungs.

The drop in PM_{2.5} has been observed by the Copernicus Atmosphere Monitoring Service (CAMS) of the European Union in the February, 2020 in comparison to previous three years. According to CAMS, in large parts of the china around 20-30% of drop in PM_{2.5} has been observed by comparing with the average for the month of February of 2017, 2018, and 2019. During the month of March in USA, the partial lockdown resulted in linear declination of PM_{2.5} in New York and Los Angeles (Chauhan and Singh, 2020). Afterwards, during the month of April due to extreme changes in the human behaviour, the COVID-19 has greatly enhanced the air quality. 25.5% of NO₂ has been significantly decline during the current COVID-19 period in comparison to the historical data with decrement of 4.8 ppb. Also, the PM_{2.5} has been decreased more significantly in the urban counties and counties that closed non-essential business (Berman and Ebisu, 2020). In Spain, average concentration of PM_{2.5}, around 58% of decrement in PM_{2.5} was observed during March 2020 compared to February 2020 (WHO, 2016). Also, the average PM_{2.5} in Rome in the month of March 2020 was 24% lower as compared with February and 159% compared to the month of January 2020 (Chauhan and Singh, 2020). In India, to control the severe situation of the air pollution, in 2019, a 5 year plan was launched by the National Clean Air Programme (NCAP) to reduce the PM by 30% nationwide (MoEFC, 2019).

Here, we have analysed the data for Ozone, NO₂, PM_{2.5} and CO in the two most COVID-19 effected regions of India. The data for these pollutants has been taken from Central Control Room for Air Quality Management-All India (<https://app.cpcbcr.com/ccr/#/caaqm-dashboard-all/caaqm-landing/data>) from March, 4, 2020 to June, 12, 2020. The Period before lockdown and the lockdown period has been covered. The value ozone level in Mumbai was very high before the lockdowns. As shown in the Figure 5, after the announcement of Lockdown, From March 24, 2020, the value of ozone has been significantly decreased. Before the announcement of Lockdown its average value was 22.37 ug/m³. In lockdown 1, the average value suddenly reduced to 7.18 ug/m³ by 68%. Further, with Lockdown 2, 3 and 4, the ozone values have been decreased to 6.87 ug/m³, 6.6 ug/m³ and 6.39 ug/m³ respectively.

However in Unlock 1, when many restrictions were lifted the value has been increased to 6.68 ug/m³ by 4.5% only.

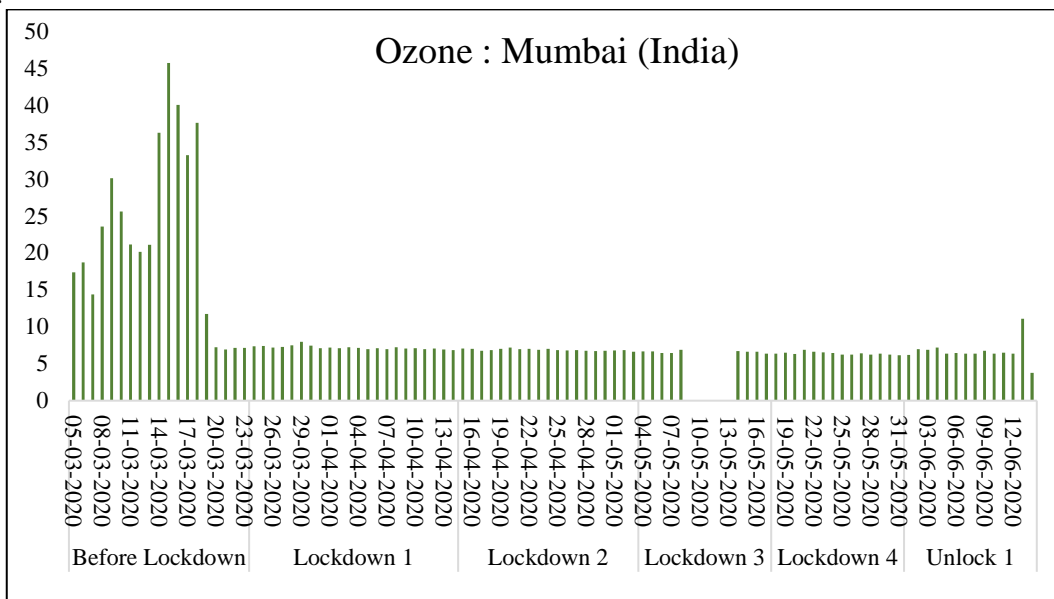


Figure 5. Ozone emission of Mumbai (India) before and after Lockdowns.

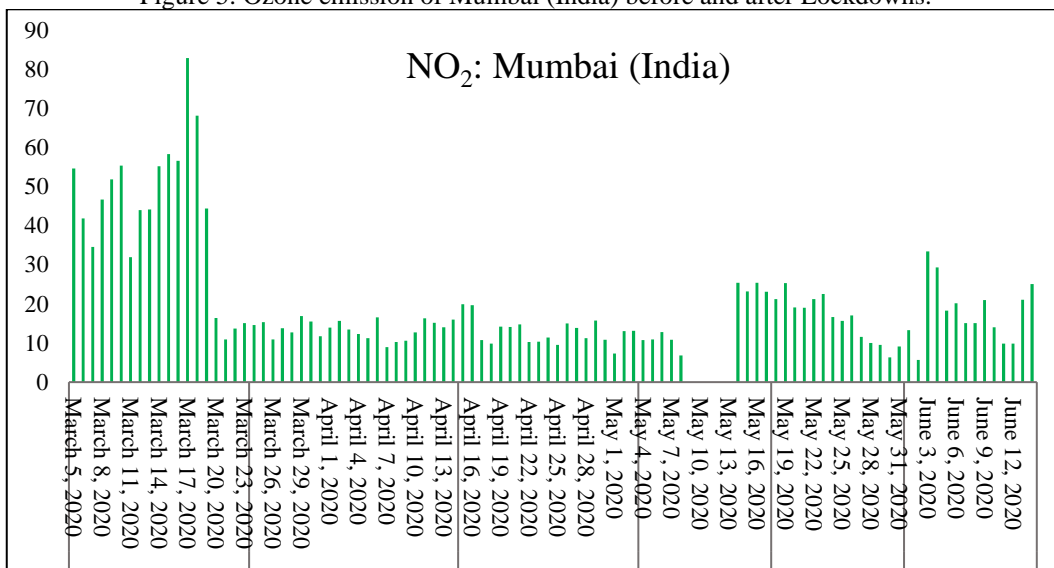


Figure 6. NO₂ emission of Mumbai (India) before and after Lockdowns.

The change in NO₂ emission for Mumbai (India) has been illustrated before and after Lockdowns in Figure 6. The average value of NO₂ before lockdown was 43.5 ug/m³ and it was very certainly high. It suddenly decreased to 13.58 ug/m³ in Lockdown 1. Further, value recorded in Lockdown 2 was 12.9 ug/m³. In Lockdown 3, after removal of certain restrictions the value increased to 16.24 ug/m³ and in Unlock 1, it further increased 17.09 ug/m³. The PM_{2.5} values for Delhi (India) are shown in Figure 7. Before the implementation of lockdown, the average value of PM_{2.5} was 73.99 ug/m³. After lockdown it certainly decreased to 52.68. Further, the average value of PM_{2.5} in lockdown 3 and 4 was 51.12 ug/m³ and 68.82 ug/m³. In unlock period the average value is 53.29 ug/m³. It has been noticed that there was lot of variation in the value throughout the lockdown periods. In lockdown 1 initially the value was low, then it increased at the end. In lockdown 4 after lifting the restrictions, the value was high at the initial period and afterwards, it was decreased.

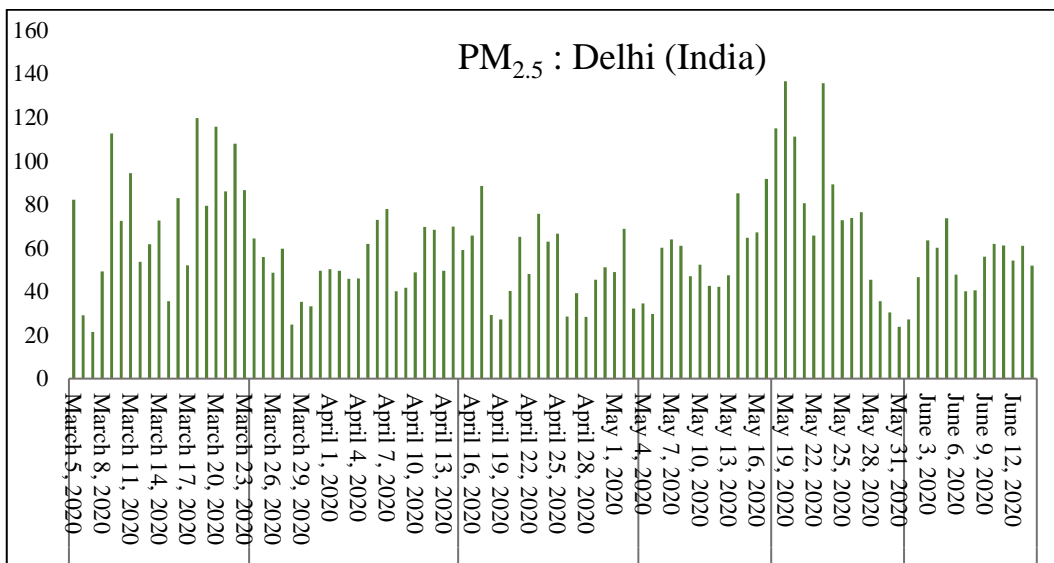


Figure 7. PM_{2.5} emission of Delhi (India) before and after Lockdowns.

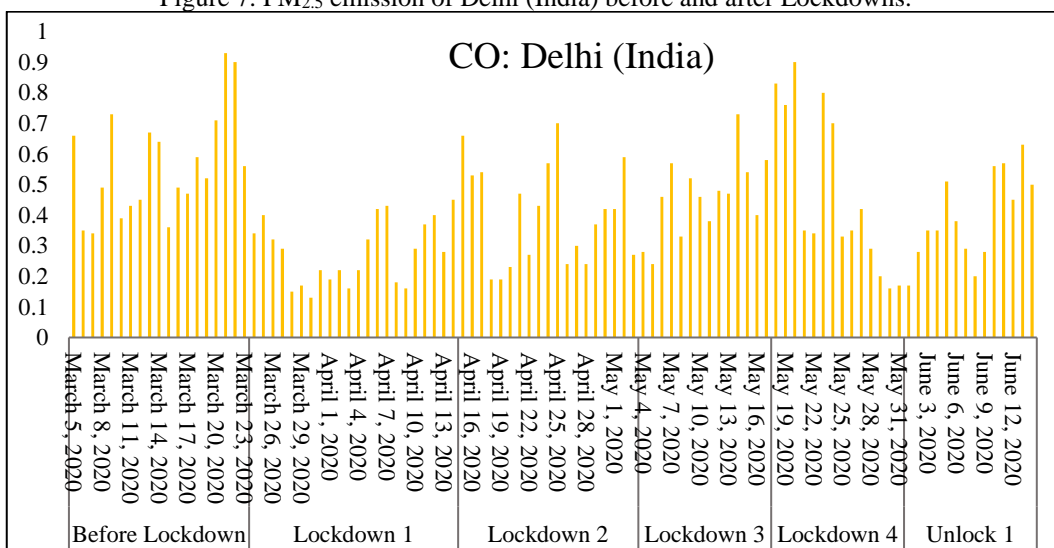


Figure 8. CO emission of Delhi (India) before and after Lockdowns.

Same trend has been seen in case of CO emission as shown in Figure 8 for Delhi. The average value was 0.56 before lockdown, then it decreased to 0.27 in lockdown 1, and average value in Lockdown 1, 2 and 3 was 0.4, 0.46 and 0.47 respectively and lot of variations can be seen which are due to several time to time different relaxations announced by the government.

AEROSOL OPTICAL DEPTH

The National Aeronautics and Space Administration (NASA) satellite imagery of Aerosol optical depth (AOD) levels over Indian regions were collected from NASA official website (www.nasa.gov) and represented in Figure. The data sets from 31st March to 5th April was made for each year from 2016 to 2020 by NASA satellite imagery. In India, the countrywide mandatory lockdown decreased the activities at factories and severely reduced the traffic and human activities throughout the country. NASA satellite sensors observed the aerosol levels at a 20-year low for this time of year in northern India. Aerosols are the tiny solid and liquid particles suspended in the air that causes to reduce the visibility and can damage the human lungs and heart. These aerosols contributes to unhealthy levels of air pollution across Indian cities. These aerosols includes dust storms, volcanic eruptions, and forest fires and includes human

activities, such as the burning of fossil fuels etc. The aerosols generated from humans contributes most of the smaller particles and are very harmful for human’s health.

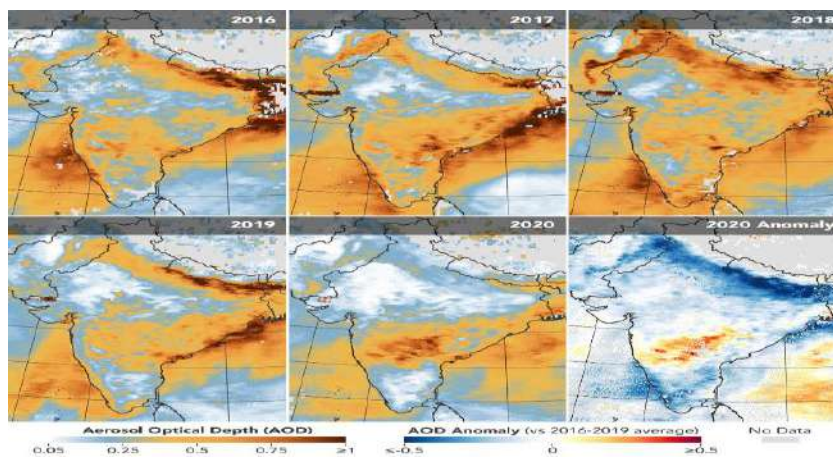


Fig. Satellite Imagery released by NASA showing AOD from 2016 to 2020 (NASA 2020).

The first five maps from 2016 through 2020 shows aerosol optical depth (AOD) measurements over India and the sixth map (anomaly) shows that how AOD in 2020 is compared to the average for 2016-2019. The calculation of aerosol optical depth is based on the concept that how light is absorbed or reflected by airborne particles when it travels through the atmosphere. The concentration of aerosols near the surface is considered as “very hazy” if the optical depth is 1 or more and an optical depth, or thickness, of less than 0.1 is taken as “clean.” The data has been retrieved by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA’s Terra satellite. The first 4 maps from 2016 to 2019 shows high value of AOD. However, the map of 2020 shows low value of AOD due to lockdown and reduced human emission sources. The Figure also shows that how the value of AOD reduced abruptly.



During the first few days of the lockdown, the change in the pollution signature was difficult to measure. However, decrement in aerosol observed in the first week of the shutdown due to combined effect of rain and the lockdown. Further, AOD decreased gradually in the lockdown period. However, in south part of India, as per the satellite data the aerosol levels not decreased to the same extent. The level was slightly higher than in the past four years. That may be due to change in weather patterns, agricultural fires, or other factors (Gupta).

VI CONCLUSIONS

- The origin of person-to-person transmission of COVID-19 has forced to isolate infected people in the hospitals and further lead to social distance.

- There is more health risk to the COVID-19 patients having older age, diabetes mellitus, cardiovascular disease, hypertension and need for ventilation and vasopressor medication.
- Although the lockdowns were called in India, but India reached to 2nd position. Initially, the implementation of various lockdowns have certainly controlled the spread of COVID-19. Afterwards the number of cases per day increased much abruptly. But, positive aspect is that India has achieved the highest recovery rate among all the countries across the World.
- The environmental conditions have been improved during the lockdowns. Although, the values of Ozone, No₂, P.M_{2.5} and CO are dependent on the regional conditions but the values were greatly affected by the various implementations imposed by the government of India during lockdowns.
- The Aerosol optical depth has been decreased to great extent and the environment was too clean in the month of March and April in comparison to previous years.

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ROLE OF TECHNOLOGY IN BUSINESS DURING LOCKDOWN: AN EMPIRICAL STUDY

Tripti Tiwari, Mohit Tiwari

ABSTRACT

In uncertain and challenging times, one fact that has been understood by businesses all over the world is that technology will play a hugely significant role in helping businesses deal with the impacts of the pandemic and give them tools and systems to recover, sustain, and maximise operations. This paper will

look at the impact and role of technology in business during Covid times. The purpose of the study is to know the role of technology advancements in business during lockdown period. A sample of 233 respondents was surveyed with the help of standard questionnaire, mean and multiple regression was applied to get the appropriate result. It is found that technology has played a great role in the business in minimizing the effect of COVID and lockdown situation by enabling the business sector to stay connected with their clients and investors to retain their business.

Keywords—Covid, Technology, Business during Covid, Multiple Regression

I INTRODUCTION

Several countries have declared lockdowns in their countries for the first time in history, enforced border controls, and grounded transport networks (Barry and Jordans, 2020). There has also been complete suspension of flights, both domestically and globally, and unprecedented use of security forces to enforce such measures in various countries. Economies across the globe have been stopped, with just a few businesses, and those that offer critical services have been allowed to do more. The initiatives were also accused of upsetting the supply chain (Shwartz, 2020), causing large-scale shortages of essential items like medical supplies that were in high demand in various parts of the globe.

Simply put, global business is characterized as corporate or economic activity that takes place across different countries, and digital transformation involves incorporating digital technology into all business areas, fundamentally changing how you / we operate and delivering value to customers; also creating a change in culture that requires organizations to continually question the status quo (Kumar 2020).

COVID-19 is much more than just a public health crisis. Its economic fallout is tremendous and still unknown. During and post-COVID, businesses will face a radically different environment. It is in times like these that recovery management literature provides for methods of navigating through workings of a crisis including recovery and preparedness.

Most businesses have been forced to slash or close down operations and growing numbers of people are projected to lose their jobs. Industries in the service sector have been among the hardest hit in the coronavirus pandemic lockdown, a significant area of growth for future economies. Manufactures were also affected, and the volume of world trade could drop again this year.

The eruption of Covid-19 has drastically altered all global business trends, forecasting, and estimation. According to experts, we are on the brink of economic recession. Crashing & collapsing of global business trends /activities arising out from this recent lockdown could be summarized as below: -

(a) Rise in unemployment (%):

1. China -5.9%,
2. Australia-5.2%, Germany5.0%,
3. US-4.4 %,
4. South Korea -3.8%

(b) Service activity in major economies:

1. US-39.8%
2. Euro Zone-26.4%,
3. China-43%,
4. Japan -33.8%

(c) Slump in major manufacturing economies:

1. China 50.1%, US-49.2%,
2. Japan-44.8%,
3. Euro Zone 44.5%

(d) Expected decline in global merchandise trade from 0% to -40%

(e) Expected economic forecasts downgraded for 2020: -1 to -5% in major developed and powerful countries.

These incidents have intensified economic pressure on families, pushing them to pursue family relief and other forms of social support to see them through the aforementioned restriction period. With labour market changes, data mining has been used to show that the calculation on topics such as global poverty will tip up, while this year (2020) the global poverty rate, in the absence of the coronavirus, would have followed the expected historical pattern that showed it could fall (Mahler et. al., 2020).

Yet now, with the available data on those locked down from over 166 countries, those losing their jobs and the impact on other economic fields, it reveals that the pandemic will drive poverty by about 0.5 percent higher than the 2019 average, and 0.8 percent higher than previously expected. During this time, data mining was also used to forecast that the current health crisis could lead to a recession, where some analysts claim that the recession in the United States has already begun (Stewart, 2020).

In this period of lockdown, which has stopped business activity, made global business trends fall and has led to the eruption of a financial crisis, the “Digital Transformation” can be a boon by acting as a revolutionary-cum-panacea tool to get rid of this crisis and leverage sustainability. Simply put, "Digital Transformation" is an incorporation of emerging technologies into all business fields, radically changing how we function and deliver value to customers, and also a cultural transition that challenges people to innovate and be comfortable with failure, and eventually thrive, improve and sustain business stability.

Platforms of digital technology, digital tools etc. like retooling & project changeover, e-learning, UPI, e-commerce, e-trading, Aarogyasetu, Zoom, Meet-up, Hangout, Facebook, WhatsApp, Paytm, Google pay, e-cash, e-investment, manufacturing execution system, exploring window 10 migrations, upgrading platform system, remote working and cloud-based tools help & support in remote development, engineering, asset utilization and analysis and dashboarding, e-office, e-Kisan, ISP, mobile apps, e-education, e-tutor, e- agriculture, e-mail, e-post, e-governance, e-business, e-transportation (Ola, Uber), e-medical, big basket, e-purchase, e-medical, telemedicine, e-medicine, e-consult, PPP, e-service book, Swayam portal (MOOCS) are playing a pivotal role in sustaining human lives and business too.

II LITERATURE REVIEW

How Businesses are using technology

Small and Medium Business enterprises are using emerging technologies to deal with the effects of unforeseen disasters like COVID-19. These include, for example, mobile and distributed technologies with telecommunication networks of the next generation (e.g., 5 G), big-data analytics, deep-learning artificial intelligence (AI), and block chain technology. Digital innovations digitalize the process of generating value and cross-link it. The literature provides evidence that the effective strategic implementation of Digital technologies will contribute to improved profitability, efficiency, and performance (Bruque and Moyano, 2007).

Technology determines the operating environment in which countries will adapt to the crisis that this lockdown is causing. While it may not have been necessary before, it can be seen that the pandemic has brought about socio-economic changes that would accelerate the development of and role of technology in business (Wuest et. Al., 2020).

Private & public sectors workers and officers operate with email correspondence from home. Virtual technologies like Tensorflow, chatbots, Node, Hootsuite, Stripe, Trello, Slack, Xero, SAP have gained immense popularity and are commonly used in small and medium-sized businesses, including cloud computing, automation, analytics and the Internet of Things (IoT) when it comes to IT expenses.

In the manufacturing sector-digital, manufacturing includes the use of digitized computer technology in industrial design, electronic software, cloud-based design, 3D modelling, simulation, measurement and tooling processes, online manufacturing platforms. The Industrial Digital Instrument Revolution Symbol i.e. Amazon Business a B2B e-commerce site, advanced and automated manufacturing robotics technology, reduced 3-D printing cost technology, online store etc. allowed the business to attract large-scale consumers.

Digital transformation, in the face of tremendous social change, makes a significant difference in major fields associated with employment and skills; building a computer age workforce could generate up to 6 million jobs worldwide between 2016 and 2025 in the logistics and electricity industries, moving to an environmentally friendly term – the industry's digital strategy could produce an estimated 26 billion tons of net CO2 emissions avoided between 2016 and 2025.

It is extremely important than as a part of a sustainable digital transformation, it will be imperative to develop new standards of ethical conduct for digital technology and to achieve higher levels of consumer confidence. As such, India's strength in information technology has brought in right balance for the industry to move towards technology, as the world races toward digitalisation. According to a recent report, the digital industry transformation will contribute \$154 billion to India's GDP by 2021 and will generate thousands of high-paid jobs, and possibly the most demanded skill jobs will be profiles like Computer scientist, AI engineer, cloud architect, software management and information security specialist and so on.

Companies, industry, start-ups, and entrepreneurship will have to play an integral role in building social sustainability after the advent of digitalisation. The policy of the government much also be public-centric policy and there should be a commitment to assist and encourage start-ups & entrepreneurs in order to generate more and more jobs in this competitive edge of technology. Digital transformation involves incorporating digital technologies into all business areas to radically change how businesses work and deliver value to consumers, and embracing technology and digitalisation will help them do that with a smart and highly flexible digital supply chain that predicts and responds to changes in the environment.

Yet transition is also about a systemic shift, involving a fundamental rethinking of individuals, structures, and technology. Becoming a digital organization involves providing not only new goods and services but also a strong central operating structure and technology-based processes, which can involve tectonic shifts in a company's activities and how employees communicate through the whole environment. A company cannot transform technologically until the cultural mindset of the people changes as well. Automation and digitalization will play a critical role in the creation of a sustainable alternative for the future (Nambisan, 2013).

Currently, any company focused on offering i exchange of products, ideas, goods, and services with minimal human contact should succeed. One such example is Cisco, which provides the physical networking infrastructure. Another thriving business is Zoom which provides video conferencing services. Digital retailers have also seen business thrive since lockdown was initiate. Since March 12,

Amazon has seen a 44 percent rise in stock price and is now hiring another 175,000 workers to work in its centers. While some may claim they are large and well-positioned firms, but even other major producers are struggling to survive.

At the other side, other small local businesses are flourishing; Some local restaurants, for example, have tried to reinvent themselves and are focusing on deliveries. Key elements of companies achieving success during these difficult times are the ability to adapt to the needs of new consumers and a willingness to adopt technology to enhance production and services.

Ways in which technology can help businesses during the pandemic

Companies need to be open and sensitive to this crisis. There are several innovations that can not only help them carry out their daily operations but can also boost business processes. Here we have only a few examples of how technology can enable companies to effectively move through this pandemic:

Going digital in the aftermath of the COVID-19 pandemic is no longer a pure indulgence; it is a critical requirement. The first step to digitalization is to have a company website where prospective customers can search your goods and services and order them. Then you can start search engines and social media sites to promote your company. Digital transformation, however, is not only about getting a digital presence; it is about incorporating digital technologies into all aspects of a market. Digital transformation entails all the shifts in the various facets of human society associated with the introduction of digital technology (Schwertner, 2017)

Lockdown conditions are very difficult for factories and companies and can result in severe losses to business. Factories that digitize through their supply chains are better equipped to cope with emergencies and unforeseen events. Automated guided vehicles and drones can help move products around a factory floor, with most people expected to remain indoors. Fitting sensors to monitor their entire supply chain will enable factories to set targets for production (Rapaccini et. Al., 2020). Certain technological advances such as Augmented Reality can help reduce the number of employees in a factory needed to keep the functions running smoothly.

Through reducing time-consuming jobs, automation will also help us increase efficiency. Data processing program reduces the record collection, storage, and manual file retrieval requirements. There are a variety of applications and infrastructure solutions out there to boost workflow. Such monitoring systems maintain sensitive knowledge in one location, which lets administrators, staff and clients remain secure, well aware and efficient (Melcher et. Al., 2020).

Because of the coronavirus epidemic businesses across the globe have switched to a work-from - home platform. As a result, employers need to find the best tools for tracking the success of their employees. Most of these resources were designed to provide managers with insights into manufacturing processes and activities they had completed. Nonetheless, to get optimum results, data should be open to administrators and workers alike. With the right infrastructure and applications in place, companies will optimize the capacity of their workers to operate remotely (Broadbent et. Al., 1999).

To boost the overall company efficiency, learning to streamline processes is important. Technology also provides automation applications that helps companies to restructure their routine paper-based ways of working, such as handling work orders, among others. Such techniques give one the power to conduct routine operations in less than usual circumstances and effectively keep on dealing with data backups and recovery mechanisms even though the worst occurs.

Hyper connectivity enables the availability of information on any platform, which can conveniently be exchanged by team members, collaborators, vendors, and consumers. Hyper connectivity makes companies become more flexible, because new staff members have direct access to the network without IT capabilities need (Fredette et. Al., 2020).

Artificial Intelligence in Business

Before COVID-19, instead of wanting a fully automatic interface, people said they would add a human dimension to their experiences. The human touch preference dampened the level of user interest in using AI, but COVID-19 could continue to shift customer attitudes, because human interaction has become a dangerous practice that may affect people's health. Self-service checkouts and contactless billing in shopping stores provide new ways to reduce physical contact. People can also view these technologies as helping to protect their health and improve their well-being (Naude, 2020).

When discussions surface on post lockout preparations, companies will need to make certain adjustments to their daily working. A post-lockdown society will need to be more vigilant, more sanitized, and keep a social gap even. AI will be an immense benefit to the situation (Vaio et. Al., 2020).

Dangers of using technology in Business

The consumer and data protection issue are of utmost concern for administrators in all sectors. Businesses will need to develop protocols for data processing, distribution, and review to address this problem. Where appropriate, the gathering of personal information should be prohibited; in this situation, with the permission of the subject, the absolute minimal of data should be obtained (Lee and Shin, 2018).

Adequate structures and support personnel should be in place to ensure digital connectivity is still available, ensuring that all business processes are run seamlessly (within the Business digital channels used). Post-COVID-19, small and medium-sized companies will need to revisit whether to revitalize their policies by integrating disaster situations and continuation measures for business when trying to raise revenue through alternative/additional sources of selling. Maintaining consumers is practically no simple task because delivering a substandard service would irreversibly damage companies (Mendling et. al., 2018).

III OBJECTIVE OF THE STUDY

1. To find the role of technology in business during lockdown period.
2. To find the impact of technology advancements in minimizing the effect of COVID during lockdown period.

RESEARCH METHODOLOGY

The present study is semi-experimental in nature in which descriptive design with hypothesis testing has been used. Survey method was used to conduct the present study in which a sample of 233 respondents was surveyed to know the impact of technology advancement during lockdown period. People on different designations in the business sector were surveyed with the help of standard questionnaire. The primary data was collected from the industry experts and business owners. Mean and multiple regression analysis is analyzing the data and determine the role of technology to minimize the Covid Impact.

IV FINDINGS OF THE STUDY

TABLE 1 DEMOGRAPHIC PROFILE OF THE RESPONDENTS

Variables	No. of respondents	%age
Gender		
Male	131	56.2 %
Female	102	43.8 %
Total	233	100%
Age groups		
30-40 years	55	23.6 %
41-50 years	63	27.0 %
51-60 years	59	25.3 %
Above 60 years	56	24.0 %
Total	233	100%
Designation		
CEO/MD/CMD	52	22.3 %
Manager / Sr. Manager	69	29.6 %
Business Owner	57	24.5 %
Key stakeholder in a Business (30% or more share)	55	23.6 %
Total	233	100%
Experience in Job or Business		
1-5 years	49	21.0 %
6-10 years	65	27.9 %
11-15 years	58	24.9 %
More than 15 years	61	26.2 %
Total	233	100%

Table 1 shows the demographic profile of the respondents. It is seen that in the total number of 233 respondents 56.2% are male and 43.8% are female in which 23.6% are from the age group of 30-40 years, 27.0% belongs to the age group 41-50 years, 25.3% of them are from age group 51-60 years and rest 24.0% of the respondents are above 60 years of age. 22.3% of them are on the post of CEO/MD/CMD in organization, 29.6% are managers/ Sr. managers, 24.5% are business owners and rest

23.6% are the Key stakeholder in a Business (30% or more share). 21.0% are in their respective field from 1-5 years, 27.9% are having the experience of 6-10 years, and 24.9% of them are working from 11-15 years and rest 26.2% are in their field from more 15 years.

Table 2 shows the role of technology in business during lockdown. It is seen that Technology became a link amid people and organizations to work and collaborate remotely with the mean value 3.91, it is also seen that Technology had worked as a leveller that has dissolved all the barriers between the sectors and the individuals with the mean score 3.89. Along with these it is observed that Business processes became faster and smoother due to technology during lockdown with the mean score 3.93 and OTT or “over-the-top” platforms had helped the entertainment sector to make their business even in the lockdown with the mean score 3.87.

TABLE 2 ROLE OF TECHNOLOGY IN BUSINESS DURING LOCKDOWN

Sl. No.	Role of technology in Business	Mean Value
1.	Technology became a link amid people and organizations to work and collaborate remotely	3.91
2.	Technology had worked as a leveller that has dissolved all the barriers between the sectors and the individuals.	3.89
3.	Business processes became faster and smoother due to technology during lockdown	3.93
4.	OTT or “over-the-top” platforms had helped the entertainment sector to make their business even in the lockdown.	3.87
5.	Online business of essential items worked well in the lockdown period only due to technology	3.82
6.	Technology became a bridge between the buyers, investors and the developers of the real estate business and helped them in retaining their business	3.65
7.	Technology has helped the Companies to stay connected with their clients and investors to retain their business	3.96
8.	Technology had enabled the Finance sector to function properly in the lockdown situation	3.84
9.	To some extent Healthcare sector is functioning well due to technology	3.70
10.	Technology is used by many business sectors to cope up with new demands of the market and the customer to support their company to keep going	3.69
D V	Technological Advancements have helped to minimize the COVID impact effectively	3.98

Online business of essential items worked well in the lockdown period only due to technology with the mean value 3.82 and Technology became a bridge between the buyers, investors and the developers of the real estate business and helped them in retaining their business with the mean value 3.65. It is also found that Technology has helped the Companies to stay connected with their clients and investors to retain their business with the mean value 3.96 and Technology had enabled the Finance sector to function properly in the lockdown situation with the mean value 3.84. Along with these it is also seen that to some extent Healthcare sector is functioning well due to technology with the mean value 3.70. Technology is used by many business sectors to cope up with new demands of the market and the customer to support their company to keep going with the mean value 3.69 and overall, it is observed that Technological Advancements have helped to minimize the COVID impact effectively with the mean value 3.98.

Analysis of Multiple Regression

Tables 3, 4 and 5 shows the relationship of the 10 independent variables and 1 dependent variable “*Technological Advancements have helped to minimize the COVID impact effectively*”

TABLE 3 MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.908	.825	.817	.36254

The Value of adjusted R square is 0.817, which means that the model explains around 82% of the variation. Table 2 shows the values of ANOVA, which is significant (sig. value below 0.05) which reflects the impact of independent variables are significant on dependent variable.

TABLE 4 ANOVA^A

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	137.250	10	13.725	104.421	.000 ^b
	Residual	29.179	222	.131		
	Total	166.429	232			

a. Dependent Variable: **Technological Advancements have helped to minimize the COVID impact effectively**

b. Predictors: (Constant), VAR00039, VAR00024, VAR00009, VAR00035, VAR00023, VAR00028, VAR00036, VAR00027, VAR00037, VAR00030

The impact of independent variables on dependent has been explained in the table 5.

TABLE 5 COEFFICIENTS^A

Model	Un standardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	-.033	.161		-.207	.836
	VAR00030	.381	.164	.341	2.321	.021
	VAR00035	.371	.170	.320	2.183	.030
	VAR00024	.086	.039	.092	2.178	.030
	VAR00036	.164	.052	.156	3.149	.002
	VAR00037	.573	.054	.559	10.676	.000
	VAR00027	.050	.050	.050	.995	.321
	VAR00039	.213	.047	.215	4.522	.000
	VAR00028	.551	.061	.560	11.238	.000
	VAR00009	.017	.032	.017	.516	.606
	VAR00023	.050	.038	.050	1.315	.190

a. Dependent Variable: **Technological Advancements have helped to minimize the COVID impact effectively**

Table 5 shows that out of 10 variables, 7 variables namely Technology became a link amid people and organizations to work and collaborate remotely, Technology had worked as a leveler that has dissolved all the barriers between the sectors and the individuals, Business processes became faster and smoother due to technology during lockdown, OTT or “over-the-top” platforms had helped the entertainment sector to make their business even in the lockdown, Online business of essential items worked well in the lockdown period only due to technology, Technology has helped the Companies to stay connected with their clients and investors to retain their business and Technology had enabled the Finance sector to function properly in the lockdown situation shows significant impact of dependent variable i.e. Technological Advancements have helped to minimize the COVID impact effectively and on the other hand 3 variables namely Technology became a bridge between the buyers, investors and the developers of the real estate business and helped them in retaining their business, To some extent Healthcare sector

is functioning well due to technology and Technology is used by many business sectors to cope up with new demands of the market and the customer to support their company to keep going shows no significant impact of technology on business during lockdown period.

V CONCLUSION

History suggests that pandemics can catalyze major changes, fundamentally changing the way people make sense of the environment. Technologies may also be transformational catalysts. Although emerging technologies play a crucial role in combating the covid-19 pandemic, the pandemic still poses a major new technology challenge. Several researchers believe that the pandemic will effectively normalize the full use of emerging technology in society and in business.

The study concludes that there are so many different roles that are played by the technology that had really minimized the effect of COVID and lockdown situation. It is also found that there is a significant effect of Technological Advancements that had helped to minimize the COVID impact in effective manner as technology is the only sources with the business sector by which they are able to stay connected with their investors, clients and the customers and retain their business.

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EDUCATION IN THE PANDEMIC SITUATION – ROLE AND LIMITATION OF TECHNOLOGY AND THE ROAD AHEAD

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ABSTRACT

The impact of COVID-19, on the socio-political, industrial, economic, and healthcare sectors have been immense. The pandemic has radically disrupted the daily lives of every individual, from toddlers to senior citizens, and the world is struggling to cope and adapt to these alien circumstances and situations. One sector that has had to entirely reinvent their methods of delivering services, is the educational sector. With in-person learning becoming obsolete in the current circumstances, educational institutions have had to adapt and resort to other methods of distance learning within a short span of time and completely move away from the traditional system of education. This paper explores the impact of COVID-19 on the education sector, and the role of technology in handling the situations created by this pandemic. It explores strengths of digitalization of learning, the possible methods of delivery of learning online, and the negative impacts of shifting learning to online platforms. The present study is descriptive and the results are based on empirical evidence collected with the help of primary survey. A sample size of 279 educators has been taken across schools and universities who have an experience of teaching online during this pandemic. The study finds that all the important variables of online teaching and learning may be covered under the major factors namely - Benefits of Live Online Learning, Storage and Passive Learning, Necessity of Time, Restrictions in learning through online platforms. These all variables have been found contributing significantly role of online learning in teaching (first three factors) and dissatisfaction (fourth factor) regarding the online learning.

Keywords—Covid, Technology, Teaching, Education, Learning

I. INTRODUCTION

The impact in terms of delivering education to students without compromising on the quality and learning methods has led to a sudden and drastic increase in the importance of technology, which has suddenly emerged as the primary, and only, alternative to making sure the educational requirements of students are fulfilled. This has led to multiple potential roadblocks and issues in terms of providing sufficient technological access to students from different and less privileged. It also helps by adjusting the cost of educational services and more importantly, teachers and students adjust to the technicalities involved in accessing and delivering education through digital platforms, and delivering education for courses/modules that necessarily require laboratory/in-person/directly vocational methodologies, for example, medicine. According to Raja and Nagasubramani, (2018) it is an important ingredient of curriculum, it establishes a system of delivery by assisting the traditional instructional system and lastly it improves the overall learning process.

Technology has a positive impact on learning and education but simultaneously, poses some challenges. Both mentors and students should take advantage of the positives that it has to offer and eliminate the drawbacks. It is necessary for nations to adapt and embrace a more technologically equipped education sector, in order to not only tackle this pandemic, but also be equipped for disasters and unforeseen circumstances in the future.

This pandemic also introduces a good opportunity to actively work towards the digitalization of the

education sector and move towards a more integrated and flexible pattern of learning to cater to the students who may not be in the same location. The pandemic has forced institutions to adopt the new technology to conduct online classes and making online learning possible.

It is also important to note that these issues are just the tip of the iceberg; while the daily logistical issues that currently plague the educational sector are still being handled, broader systematic discrepancies in the educational system have emerged, on a global scale. The impact of the virus in the near future has prompted many high-school graduating students to defer their university education by a year, which has resulted in a significant slump for the educational industry. A major part of the economy in developed nations, and which has, in turn, accounted for a lack of sufficient funding for current learning systems for students who are already enrolled. It has also presented a set of challenges for educational institutions, who have had to remodel their admission and recruitment procedures in light of this global pandemic.

While the issues are many, it also presents an opportunity for the educational sector to reinvent and reorganize itself and undeniably, the key to achieving that is through utilizing and adapting to technology.

II. LITERATURE REVIEW

According to Dhawan (2020), online education will act like a “panacea” for the challenges posed by the pandemic and is the only through which effective and quality education can be delivered. Her SWOC analysis (Strength, Weakness, Opportunities, Challenges) illustrates the different facets of using technology in the education sector, the potential challenges we can face, and also sheds a light on the opportunity for the Ed Tech sector to capitalize on this pandemic.

In order to focus on providing quality and accessible online education, one can learn from the strategic framework given by Huang et. al. (2020) and which elucidates and learns from the experience of the Chinese, who were the first to face the brunt of the inconvenience faced by the pandemic such as infrastructure, learning tools, learning resources, methods and coordination among all stakeholders of teaching and learning process.

STRENGTHS

A host of online resources are available for a positive and workable learning environment. Teaching staff can use a combination of audio, videos, and text to talk to students in this time of crisis to maintain a human touch to their lectures. It will help to create a holistic learning atmosphere in which students can provide their immediate input, ask questions, receive answers to their queries. For situations like natural disasters, or pandemics such as Covid-19, the flexibility of e-learning is a boon, as it helps in prevention of learning being disrupted, and it will help in preventing the deprivation of opportunities of studying at home or at work.

Technology offers creative and flexible solutions to counter instability in times of crisis, and lets people connect and even work remotely without face-to - face contact. This consequents to structural changes in organisations as they implement modern communication and functioning technologies, as determined Mark &Semaan, (2008).

According to a study conducted by Agarwal and Kaushik (2020) on Indian students using the online training platform Zoom, it was found that the students’ satisfaction level at the time being was almost initially comparable to the level of satisfaction during normal face-to-face interaction. It gave them a chance to be distracted from the pandemic; however, it is important to keep up that student-centred approach and ensure that the quality of learning does not decrease, and is paramount.

Crawford et. al. (2020) recorded the responses by 20 countries to the challenges faced by COVID, and their observations yielded similar results.

The pandemic had quite an immense effect on the higher education sector globally. Initial responses in

countries affected by the 180 million Chinese students (primary, secondary and tertiary) focused on delivering online training to students who were unable to leave China and the economic impact of this international cohort on universities that relied on income. Faculties hurried to turn education into an online environment, keeping in mind the technologies and websites that China could access. The spread to South Korea, then Iran and Italy culminated in the higher education sector shifting to concentrate on their own businesses in affected countries. Presently, with entire world reeling under the impact of the virus and more than 1.8 billion students impacted in more than 180 countries, nations have been forced to shift to methods of online teaching and learning, and have heralded an age of digitalization, and has created a sudden focus on quality of IT infrastructure and familiarisation of the faculty with digital teaching technologies.

Online training can be carried out by lectures in real time, or lecturers can share videos or use PowerPoint on learning platforms. It is meant to cater for students with different learning style preferences, and most notably, foreign students who may be in different time zone and are unable to attend those lectures. Over the time, continuous input from staff and students has driven quality ratings at the university and tracking online learning and teaching. Actions are needed by workers as part of the quality control process, in response to the feedback.

With email, videoconferencing, high-speed Internet access, online legal libraries and the like, education is quickly evolving into a new medium. But offering successful online classes requires more than just taking the material from the traditional course and uploading it to a website based on the internet. The course needs to encourage positive student participation and be digitally interactive if it is to be successful.

The universities provide face-to-face training workshops or guide to equipping lecturers with various online teaching modes. Examples of online teaching further show lecturers how to conduct online lectures, including voice-over PowerPoint teaching, uploading to YouTube videos, real-time lectures using WebEx, Zoom, or streaming to YouTube. Often, teachers are able to use a mixed mode with multiple learning modes to deliver lectures online. While the use of technology in teaching has been adopted for some time now in many western countries, only online education is new to lecturers and students. The universities usually find the online teaching approach a temporary solution and plan to resume face to face teaching after the crisis.

WEAKNESSES

However, it is also pertinent to note that online learning carries with it its own set of troubles and problems.

E-learning has some potential drawbacks in the way it can create issues in the relationship between the student and the mentor, i.e. direct interaction, and the lack of human interaction. The people using it might face several difficulties (Favale et. al., 2020). Flexibility in time and place is one of the salient features of online education, however, it is important to note that these elements are nevertheless unstable and cause problems. These problems and concerns that come with digital technology vary from downloading errors, installation concerns, authentication errors, audio, and video issues, and so forth. Often online teaching is considered by students to be dull and unengaging. There is so much time and versatility in online learning that students do not find enough seriousness/conviction to sincerely engaging in learning activities. Health treatment is also an immense concern affecting online learning. Students also want bidirectional interaction that often is difficult to enforce. Once the students practice what they read, the learning process cannot achieve its full potential.

Technological innovations require teachers to understand how to employ these technologies as part of their teaching methods. Thus, these latest developments raise the training needs of the teachers. The attitudes of teachers towards computers are a crucial factor in the effective implementation of the

education technology. Teachers must be able to prepare all the instructional elements as the key components of the introduction of online learning. These include instructional processes, learning media, the use of applied time-related instructional time, psychological and social factors that create a quality learning environment for students in a situation where physically being at the same location is impossible, and the teaching and learning mechanisms must be recreated on a digital platform (Aliyyah et al., 2020).

Gressard and Loyd (1985) found out that teachers do not always have positive attitudes about technology and their negative experiences can contribute to computer-based projects struggling these are lack of time, access, resources, expertise and support.

Another barrier given by Butler and Sellbom (2002) is reliability. Reliability includes hardware malfunction, incompatible software. Either this may be at the student's home or the teacher's, poor or slow internet connectivity and out of date software.

In a study conducted by Hanson et al. (2020) on the impact that COVID has had on learning for students in Ghana, it was revealed that due to the pandemic, students have faced several difficulties due to the closing down of schools. Students are thus unable to easily research from home, rendering the online learning program very ineffective. Also, parents are unable to assist their wards in accessing online learning sites, nor can they fully supervise their children's learning at home. The pandemic has also had a negative influence on their learning because they are not able to study effectively and without distractions in an environment that did not resemble the university and encouraged an atmosphere of learning.

The e-learning platforms rolled out are also challenging for most students due to the restricted internet connectivity and limited expertise of knowledge of these technological tools in Ghana. Therefore, the study suggests that students be exposed to creative and offline e-learning tools to supplement teaching and teach in the classroom, and support students who may not have access to internet connectivity. While the study focused on students in Ghana, the challenges faced are similar for most students in a variety of countries.

The study revealed that a high number of households in a lot of countries do not have internet access which had led to online learning platforms being reserved for access by students from more wealthy/privileged backgrounds who have the financial and logistical capability to afford and operate digital learning systems. because majority of the students do not have access to internet. Those who do have access to the internet also complain of high cost of data bundles to fully access this service and enhance their learning while at home. While learning methods may be very effective but accessibility has been an issue as well; technological devices such as the smart phones or the computer and the internet are needed to be able to access it. This has made learning in the house during this pandemic very challenging for students. It is also said that learning is effectively achieved when the right instructional materials are used for the right purpose during the process. This has made learning of some concepts especially those perceived to be abstract very difficult for the students in this period of lockdown and school closure.

Students also faced numerous problems related to depression anxiety, weak access to the internet and an unfavourable home study environment. Students from remote areas and disadvantaged communities face additional studying difficulties (Kapasias et al., 2020).

OPPORTUNITIES

There will always be adjoining opportunities too. This crisis can be the catalysts to a new online education process, which will force people, recognize the positive side of technology. A great deal of vision is required to carry out exciting new inventions and digitalisation. EdTech companies are also helping us fight the pandemic and by trying to make sure learning are as less disrupted as possible. Teachers should use technology and develop various versatile systems for a deeper understanding of the

students. Using online learning will test the instructor and the learners alike. It will develop problem-solving skills, critical thinking abilities and student versatility.

Online resources can be used by people of all ages to utilise the benefits of time and place versatility during learning. Teachers are able to develop novel pedagogical approaches to information delivery. EdTech start-ups can bring about revolutionary changes in almost every field of education, from teaching, learning, training, training, performance, qualification, and so on. Increasing global appetite for e learning also provides EdTech start-ups an exciting opportunity to bring technological innovation.

POTENTIAL SOLUTIONS

It is evident that technology poses a plethora of advantages and disadvantages. Some most pertinent issues that need to be taken care of include enabling equal and convenient access to online learning platforms, technologies, and ensuring that the flow of education delivery is not disrupted.

The next steps include making sure that online platforms are streamlined, and the quality of education be maintained. There can be measures, which can be taken to enhance the quality of and help students get the level of education that is needed. The students should be given personal attention so that they can respond easily to this learning environment. Communicating with students may be using social media and different community platforms. Teachers should set time limits and reminders to make the students alert and vigilant.

The quality of the courses should be improved, and programs should be designed in such a way that they are creative, interactive, and student-centred (Partlow & Gibbs, 2003).

Effective online directions encourage student input, make students ask questions and extend their scope for the content of the course (Keeton, 2004). Institutions will concentrate on pedagogical problems and use online guides to promote learning. (Kim and Bonk, 2006).

III OBJECTIVES OF THE STUDY

1. To find the role and limitations of technology in the education sector during the pandemic situation
2. To find the benefits and negative effects of online learning
3. To find the impact of online learning determinants on overall satisfaction of online learning

RESEARCH METHODOLOGY

The present study was conducted with the help of survey method in which a sample of 279 respondents were surveyed through a standard questionnaire. Teachers, students, and people from the management department of education sector were considered to know about the role, limitations, benefits, and negative effects of technology while online learning. The study is exploratory in nature and sampling method was random. Factor analysis and regression are applied to get appropriate results.

IV FINDINGS OF THE STUDY

Table 1 shows the demographic background of the respondents. It is seen that 58.4% are male and 41.6% are female. Among them 19.0% belongs to the age group of 20-30 years, 31.9% are of 31-40years of age, 27.6% are from the age group of 41-50 years and the rest 21.5% are above 51 years of age. 25.4% of the total number of respondents is students, 39.1% are teachers, and rest 35.5% are from the managements departments. 39.1% belongs to the rural areas and rest 60.9% comes from the urban areas.

TABLE 6 DEMOGRAPHIC BACKGROUND OF THE RESPONDENTS

Variables	No. of respondents	%age
Gender		
Male	163	58.4%

Female	116	41.6%
Total	279	100%
Age groups		
20-30 years	53	19.0%
31- 40 years	89	31.9%
41-50 years	77	27.6%
Above 50 years	60	21.5%
Total	279	100%
Occupation		
School Teachers	120	43%
University/College Teachers	159	57%
Total	279	100%
Area		
Urban areas except Metro	109	39.1%
Metro cities	170	60.9%
Total	279	100%

Extracting and grouping variables into Factors

Exploratory Factor analysis

It may be observed from the table 2 that the value of KMO is 0.875 which is more than the 0.6 hence it confirms the validity of the factor analysis. The value under significance column is .000 which shows that null hypothesis shall be rejected viz. Sample is not adequate and alternate hypothesis will be accepted viz. Sample is adequate (Hair and Black, 1995).

TABLE 7 “KMO AND BARTLETT’S TEST OF SPHERICITY” AND “MEASURE OF SAMPLING ADEQUACY”

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.875
Bartlett's Test of Sphericity	Approx. Chi-Square	3099.205
	df	120
	Sig.	.000

The factor analysis has been applied with certain default settings and criteria. The factors have been grouped on the basis of the Eigen values. The minimum Eigen values should be at least 1. Table 3 shows that the total number of variables or statements is 16; hence 16 factors can be produced from factor analysis. However, with the help of Eigen values (more than 1), it is found from the table only 4 factors have been produced. These 4 factors explain around 74% of the variance which is more than the minimum criteria of variance explained i.e. 66% (Williams et al., 2012).

TABLE 8 VARIANCE EXTRACTED “EXPLORATORY FACTOR ANALYSIS” (EFA)

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.271	39.195	39.195	6.271	39.195	39.195	3.472	21.699	21.699
2	2.249	14.055	53.249	2.249	14.055	53.249	3.286	20.534	42.234
3	2.093	13.084	66.334	2.093	13.084	66.334	2.924	18.275	60.509
4	1.345	8.409	74.742	1.345	8.409	74.742	2.277	14.234	74.742
5	.820	5.123	79.865						
6	.602	3.765	83.630						
7	.492	3.074	86.704						
8	.415	2.593	89.297						
9	.357	2.230	91.527						

10	.266	1.664	93.191						
11	.253	1.581	94.772						
12	.218	1.363	96.135						
13	.185	1.154	97.289						
14	.176	1.101	98.390						
15	.143	.892	99.282						
16	.115	.718	100.000						

It is found from the table 3 that the 4 factors or factors explain 74% of the variance. The 1st Factor explains 21.699% of the variance followed by the 2nd Factor that explains 20.534% of variance, the 3rd Factor explains 18.275% of the total variance, and the last 4th Factor explains 14.234% of variance. Figure 1 presents the plot based on the Eigen Values derived from the main table ‘Total Variance Explained’. Figure 1 show that there is a steep fall in the line till 4th factors till the Eigen value of 1. Later the fall of line is very less and later the gap between the ‘factor number’ axis and line reduces which shows that later factors are less important because the Eigen values of those factors are below 1.

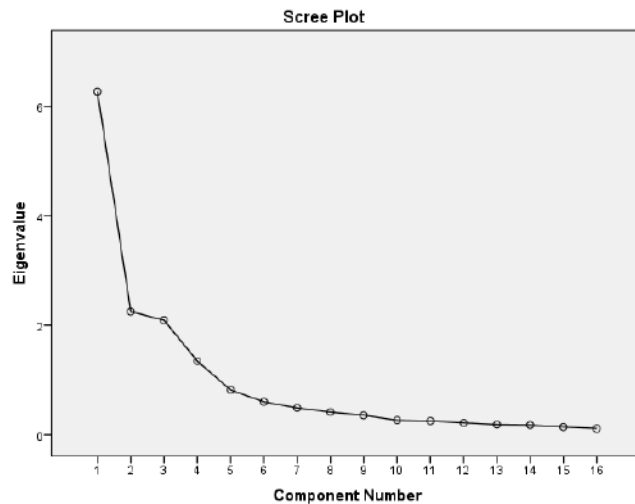


Fig 1 Scree Plot

Constructs or Factors

TABLE 9 ROTATED COMPONENT MATRIX^A

	Components			
	1	2	3	4
VAR00031	.905			
VAR00034	.890			
VAR00030	.886			
VAR00032	.880			
VAR00037		.878		
VAR00036		.860		
VAR00035		.798		
VAR00038		.797		
VAR00024			.861	
VAR00026			.846	
VAR00023			.799	
VAR00027			.731	
VAR00002				.772

VAR00003				.735
VAR00005				.729
VAR00006				.711

Development of the Factors/ Factors

There are 4 factors out of 16 variables/statements. These factors represent the different variables that are highly correlated with each other. The 1st factor is constituted by 4 variables namely as Online Learning gives good classroom experience, Mobile learning provides utmost flexibility and convenience, Virtual learning is simple and hassle free and Online learning provides good teaching-students interaction. The factor has been named as **‘Benefits of Live Online Learning’**. The variance explained by this factor is 21.699%. 2nd Factor is constituted by 4 variables namely Recorded lectures are available, one can be a part of connected community while online learning, Information storage is much easier and better in online learning and Written language skills are improving during digital learning. The factor has been named as **‘Storage and Passive Learning’**.

The variance explained by this factor is 20.534%. 3rd Factor is constituted by 4 variables namely Institutions must develop electronic portfolios, Online learning is the future for institutions and students, Institution needs Digital asset management and E resources are must for institutions to survive and grow. The factor has been named as ‘Necessity of Time’. The variance explained by this factor is 18.275%. 4th Factor is constituted by 4 variables namely as There is a lack of accessibility of online devices, Limited computer Literacy is still prevalent in India, Limited knowledge of Technology is a big hurdle in online learning and Online learning is not as effective as face to face teaching and learning. The factor has been named as ‘Restricts in learning through online platforms’. The variance explained by this factor is 14.234%.

Construct wise Reliability

The reliability statistics “Cronbach”s alpha” was applied which portrays the reliability of all constructs that measures the “Role and limitation of Technology in Education Sector in Pandemic situation.” The values of reliability for 4 constructs were found 0.942, 0.933, 0.861, and 0.741 from construct 1 to 4 respectively. The minimum value of reliability of a construct should be 0.7, hence the reliability of all the constructs is above the critical value, and hence the constructs formed are robust.

TABLE 10 FACTORS, FACTOR LOADING, AND RELIABILITY

SL. No.	Factor Names	Factor Loadings	Factor Reliability
1.	Benefits of Live Online Learning		
1.	Online Learning gives good classroom experience		.942
2.	Mobile learning provides utmost flexibility and convenience		
3.	Virtual learning is simple and hassle free		
4.	Online learning provides good teaching-students interaction		
2.	Storage and Passive Learning		.933
1.	Recorded lectures are available		
2.	One can be a part of connected community while online learning		
3.	Information storage is much easier and better in online learning		
4.	Written language skills are improving during digital learning		
3.	Necessity of Time		.861
1.	Institutions must develop electronic portfolios		
2.	Online learning is the future for institutions and students		
3.	Institution needs Digital asset management		
4.	E resources are must for institutions to survive and grow		
4.	Restricts in learning through online platforms		.741
1.	There is a lack of accessibility of online devices		
2.	Limited computer Literacy is still prevalent in India		
3.	Limited knowledge of Technology is a big hurdle in online learning		
4	Online learning is not as effective as face to face teaching and learning		

Analysis of Regression

Tables below i.e. 6, 7, 8 shows the relationship of the 4 independent variables and dependent variable “**Role of technology in online learning**”

TABLE 11 MODEL SUMMARY

Model	R	RSQ	Adjusted RSQ	SE
1	.724 ^a	.525	.518	.55683
a. IDVs - Benefits of Live Online Learning, Storage and Passive Learning, Necessity of Time and Restricts in learning through online platforms)				

The value of adjusted R square is 0.518, which means that the model explains around 52% of the variation. Table 3 shows the values of ANOVA, which is significant (sig. value below 0.05) which reflects the impact of independent variables are significant on dependent variable.

TABLE 12 ANOVA^A

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	93.752	4	23.438	75.592	.000 ^b
	Residual	84.957	274	.310		
	Total	178.710	278			
a. Dependent Variable: Role of technology in online learning						
b. Predictors: (Constant) and independent variables (Benefits of Live Online Learning, Storage and Passive Learning, Necessity of Time and Restricts in learning through online platforms)						

TABLE 13 COEFFICIENTS^A

Model		Un standardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.968	.033		119.020	.000
	Benefits of Live Online Learning	.529	.033	.660	15.834	.000
	Storage and Passive Learning	.186	.033	.232	5.579	.000
	Necessity of Time	.070	.033	.087	2.087	.038
	Restricts in learning through online platforms	-.134	.033	-.167	-4.020	.000
a. Dependent Variable: Role of technology in online learning						

Table 3 shows that all the 4 variables namely Benefits of Live Online Learning, Storage and Passive Learning, Necessity of Time and Restricts in learning through online platforms shows significant role of Technology in online learning during pandemic situation. However, the role of fourth factor is negative, hence restriction in learning through online platforms negative contributes to the teaching and learning process.

V CONCLUSION

It is evident that whether or not online education is preferred by universities, teachers, and students, it is here to stay for the time being. It is a challenge to get used to it, but it might usher in an era of aggressive digitalization for the education sector and make it the new normal. While it offers flexibility, convenience, is cost effective, and most importantly, safer, it also raises problems of accessibility and potentially increasing the divide between the privileged students and the ones who do not have the resources to access the learning systems on offer. It also raises logistical issues for teachers and students who are not used to technological devices and systems and shifting to online modes of learning also requires optimising teaching methods and making sure the quality of education is not compromised. The study concludes that there are Benefits of Live Online Learning and it is helpful in Storage and Passive Learning and in this pandemic situation the online learning is the Necessity of Time but at the same time there are some Restrictions in learning through online platforms. It is also revealed that there is a significant role of technology in online learning during pandemic situation. Nevertheless, it is abundantly clear that technology has an integral role to play in the future of education.

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STUDY ON VARIOUS SOURCES OF FINANCE AVAILABLE TO ENTREPRENEURS IN INDIA

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ABSTRACT-This paper presents the types of sources required for new businesses in India. The normal logical commitment bolsters the characterizing phases of advancement for new businesses, just as their financing sources at each stage. The objective of the exploration was to examine whether India has made a move from conventional to more current strategies for financing. Logical and look into commitments of the paper are reflected in the way that there is a moderately modest number of papers, particularly in the residential writing, that address these issues. Consequently, this research can conclude to a superior comprehension of the

financing system of enterprising endeavours. The paper will also discuss the amount of government expenditure through different policies and schemes for new blooming businesses in order to develop the economy and to boost the other potential entrepreneurs who are facing the issues in financing.

Keywords: *Economy, Entrepreneurs, Expenditure, Finance, Schemes*

I INTRODUCTION

Economy in which energizes pioneering business direction and animate the improvement of ventures is pioneering economy. Current economies are progressively changed into business enterprise in light of the fact that the way of business enterprise acknowledged creation development, benefits and business. A general public that encourages the advancement condition for undertakings is innovative society.

Enterprise as a crucial section of improvement and progress of any current district makes employments and main impetus of the economy, business enterprise and the advancement of a solid supporting social improvement. For fruitful business visionaries is critical to understanding the authoritative guidelines and managerial prerequisites, a wide scope of business disciplines and the appropriation of viable innovative experience. Business enterprise is a procedure wherein nothing is building something.

Business enterprise speaks to the eagerness of individual or numerous accomplices that, with certain capital speculation and guaranteeing vulnerability because of fractional beginnings a business adventure with the target of making a benefit. This is the way the business activity where a business person chooses what, how and for whom something is made (item, administration) all through innovative endeavor, at their own cost and with a specific measure of hazard, with the point of winning benefit.

The pith of business enterprise is in real life, the consistent quest for new thoughts, and creative mind in finding new business openings, a solid evaluation of the instinct and expertise and assurance. Business enterprise is a perspective isn't just firmly identified with the activity. Pioneering believing is significant - is connected to imagination, precise way to deal with the issue. "Business enterprise is the attitude and procedure to make and create financial movement by joining danger, imagination and/or development with sound the board, inside another or existing association".

Business process changes through history just as the perspective, human comprehension of what the term business person and enterprise truly implies and what we should mean by these terms. The two theoreticians and professionals of old style financial matters like Richard Cantillon and Adam Smith's thought of the business person attached to the ideas examiner and trend-setter, facilitator of business exercises, the organizer of business sectors for products, administrations and capital. Scholars and professionals of neoclassical financial aspects like Marshall and Schumpeter term business person attached to ideas facilitator, trend-setter, dealer, mindful leader under vulnerability, while the cutting edge economy places accentuation on the way that an individual is viewed as a business person until the discoveries, make also, misuse open doors for prosperity its advancement and the earth where it is found. This essentially implies the terms head and supervisor doesn't allude solely to entrepreneurs or administrative capacities, yet additionally to all representatives in their working environment with their exercises assume the attributes of the pioneer and/or administrator.

II OBJECTIVES OF THE STUDY

1. To find the different types of sources of finance available to entrepreneurs in India
2. To find the amount of government expenditure through different policies and schemes for entrepreneurs

Research Methodology:

The research paper is a review paper and the data collected for research is from secondary data collected from different research paper already published.

Types of Business Finance

1. **Long Term Funds:**Funds that are required to be invested in the business for a long period (say more than five years) are known as long term finance. It is also known as long term capital or fixed capital. This type of finance is used for acquiring fixed assets, such as land, building, plant and machinery, etc. The amount of long term funds required naturally depends on the type of business and the investment required for fixed assets. For example, the manufacture of steel, cement, chemicals, etc. involves heavy expenses to be incurred on buildings, machinery and equipment.
2. **Medium term Finance:** Business firms often need funds for a period exceeding one year and not more than five years for particular purposes. This is referred to as medium term finance or medium term capital. They may include expenses on modernisation of plant and machinery, or introduction of a new product, adoption of new methods of production or distribution, or an advertisement campaign. The necessity of this type of finance generally, arises on account of changes in technology or increasing competition. Manufacturing industries are more often in need of such finance. The amount required depends on the nature or purpose. The expenditure incurred is regarded as an investment because higher returns are expected out of it.
3. **Long-Term Finance:**This type of finance is required for a short period upto one year. It refers to funds needed to meet day-to-day requirements and for holding stocks of raw materials, spare parts, etc. to be used for current operations. Short term finance is often called working capital or short term capital, or circulating capital. As soon as goods are sold and funds are recovered the amount is again used for current operations. Generally speaking, production processes are completed within a year and goods are ready for sale. Hence, short term funds can be used over and over again from year to year.

III SOURCES OF FINANCE

1. **Venture capital:**The first thing to keep in mind is that venture capital is not necessarily for all entrepreneurs. Right from the start, you should be aware that venture capitalists are looking for technology-driven businesses and companies with high-growth potential in sectors such as information technology, communications and biotechnology. Venture capitalists take an equity position in the company to help it carry out a promising but higher risk project. This involves giving up some ownership or equity in your business to an external party. Venture capitalists also expect a healthy return on their investment, often generated when the business starts selling shares to the public. Be sure to look for investors who bring relevant experience and knowledge to your business.
2. **Business incubators:** They generally focus on the high-tech sector by providing support for new businesses in various stages of development. However, there are also local economic development incubators, which are focused on areas such as job creation, revitalization and hosting and sharing services. Commonly, incubators will invite future businesses and other fledgling companies to share their premises, as well as their

administrative, logistical and technical resources. For example, an incubator might share the use of its laboratories so that a new business can develop and test its products more cheaply before beginning production.

3. **Angel funding:** are generally wealthy individuals or retired company executives who invest directly in small firms owned by others. They are often leaders in their own field who not only contribute their experience and network of contacts but also their technical and/or management knowledge. Angels tend to finance the early stages of the business with investments in the order of \$25,000 to \$100,000. Institutional venture capitalists prefer larger investments, in the order of \$1,000,000. In exchange for risking their money, they reserve the right to supervise the company's management practices. In concrete terms, this often involves a seat on the board of directors and an assurance of transparency. Angels tend to keep a low profile. To meet them, you have to contact specialized associations or search websites on angels. The National Angel Capital Organization (NACO) is an umbrella organization that helps build capacity for Canadian angel investors. You can check out their member's directory for ideas about who to contact in your region.

4. **Bank loans:** Bank loans are the most commonly used source of funding for small and medium-sized businesses. Consider the fact that all banks offer different advantages, whether it's personalized service or customized repayment. It's a good idea to shop around and find the bank that meets your specific needs.

5. **Crowdfunding:** Crowdfunding is essentially financing of agrocultural producers and others across the agrobusiness chain by collecting financial resources from large number of people. The concept of "crowdfunding" is related to the one of "crowdsourcing", which refers to the outsourcing to the "crowd" of specific tasks, such as the development, evaluation or sale of a product, by way of an open call over the internet (Howe, 2008). Crowdfunding provides cheaper and faster financing as entrepreneurs can go directly to investors, suppliers and customers for money at much lower interest rates than those of banks. Crowdsources may in fact have intrinsic motivations, such as the pleasure of undertaking the task or participating to a community, as well as extrinsic motivations, related to monetary rewards, career benefits, learning or dissatisfaction with the current products (Kleeman et al. 2008)

IV INVESTMENT BY GOVERNMENT IN INDIA

In recognition of the contribution and the vast potential of the SSI sector as well as its inherent infirmities, provision of adequate credit to this sector has continued to be an important element of banking policy, even though economic and financial policies themselves have undergone significant transformation, particularly after the initiation of structural reforms in 1991. Bank credit to the SSI sector increased from Rs.168 billion in March 1991 to Rs.530 billion in March 2003.

In the policy context, there has been a paradigm shift. The Indian industry remained within a inward oriented policy framework up to the 1990s. With globalisation, liberalization, financial and real sector reforms, the country adopted an outward looking approach. At present, both the industrial sector in general and SSI sector in particular are exposed to international competitive environment. However, the most significant aspect is that India has evolved a sound institutional set up for financing of the SSI sector. A separate industrial policy was announced as part of the structural reforms in 1991 which not only eliminated various controls on the industrial sector, provided a greater role for the private sector and encouraged inflow of foreign investment and technology, but also contained specific

initiatives for the development of the SSI sector. The introduced a comprehensive policy package which includes fiscal, credit, infrastructural and technological. Now the emphasis is on quality improvement, marketing and streamlining regulations.

The Government of India had propelled numerous Schemes for mechanical up gradation and modernisation, security of labourers influenced by innovative up gradation and modernisation, framework improvement, business advancement, just as increment in as far as possible (to Rs.50 million) for SSI units delivering certain things. The Government of India set up another Ministry in October 1999 to give increasingly focussed consideration regarding the advancement of the SSI division. A few master councils had likewise been set up over the 1990s to survey the issues of the SSI division. A large portion of the proposals of these Committees identifying with improvement of advance application structures, propelling of another Credit Guarantee Scheme, raising of composite advances, and so forth have been acknowledged what's more, actualized.

The SSI sector has so far been resilient to the impact of the policy changes - increasing domestic and foreign competition following the de-reservation and import liberalisation of items as well as the relatively high interest rates - and has withstood the general deceleration in the industrial sector during 1997-98 to 2002-03. It has been well recognised that the investment limit of Rs.10 million for the remaining SSI units leaves little scope for such producers to achieve economies of scale and scope and become competitive. Today, it is, in fact, incentive-compatible for SSI units to remain deliberately small - by fragmenting production - in order to avail of fiscal benefits and to stay outside the purview of labour laws. The pace of de-reservation of SSI items, therefore, needs to be accelerated so as to ensure that size does not remain a constraint to higher production, cost-efficiency and technological upgradation.

V CONCLUSION

As the proof shows, a few activities are being taken at the national and universal levels to encourage the advancement of SMEs and improve their entrance to fund. Despite these activities, obstacles to SME money stay, in various degrees, in both created and creating economies, which comprise the absolute most significant factor that could outline their development direction. Appropriately, the consideration of strategy creators may need to concentrate on the accompanying three expansive issues, viz., making a favourable business condition, improvement of groups, and upgrading acknowledge streams to SMEs as these are broadly bantered in the contemporary conversations.

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GOVERNMENT ASSISTANCE TO AGRICULTURE SECTOR- LOAN/DEBT WAIVER SCHEME

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ABSTRACT

Farmers in India take recourse to debt, both from formal and informal sources, not only to meet their investment needs but also to smoothen consumption in the face of adverse income shocks. At very high levels of debt, apart from the inability to repay it, the loss of creditworthiness no longer acts as a deterrent for non-repayment of loans, particularly those acquired through formal channels. Debt relief/waiver schemes are, therefore, used by governments as a quick means to extricate farmers from their indebtedness, helping to restore their capacity to invest and produce. *Many state governments have announced farm debt waiver schemes with varying features / coverage to provide relief to indebted farmers.* This study reviews the existing research and available data on the implications of loan waivers, especially for the flow of credit to farmers from banks.

Keywords: Assistance, Banks, Credit, Farmers, Government, Loan.

I INTRODUCTION

Debt plays an essential role in the lives of the rural households in developing countries in a number of ways. It is an important instrument for smoothing consumption, in a context where incomes typically experience large seasonal fluctuations. However, credit markets in developing nations especially in rural households do not behave completely like competitive markets. They are dual structured, where formal and informal financial systems operate side by side. Due to the lack of availability of a properly structured debt market in the rural areas of the country, majority of the households borrow from informal sources of finance which charge high interest rates and often lead to informal agents usurping the assets of the households. To provide easier access to credit we often find governments intervening in the workings of the credit market in multiple ways. India was also no different. Under the 1949 Banking Regulation Act, all banks required to obtain a banking licence from the Reserve Bank of India, which is the Indian Central Bank prior to opening of a new branch. In 1975, the Narsimham committee conceptualised the creation of Regional Rural Banks (RRB). According to the RRB act of 1976, their equity is partly held by the Central Bank, partly by the state bank and the remaining by the sponsoring bank. The main aim was to develop the rural economy by providing credit to small and marginal farmers, agricultural labourers, artisans and small entrepreneurs. In 1977, the government of India wanted to increase access of credit in the rural areas of the country. As a means of ensuring this, they mandated that a bank can obtain a license to open a branch in an already banked location only if it opened branches in four unbanked locations.

The Finance Minister, in his Budget Speech for 2008-2009, announced a Debt Waiver and Debt Relief Scheme for farmers. The Scheme will cover direct agricultural loans extended to 'marginal and small farmers' and 'other farmers' by Scheduled Commercial Banks, Regional Rural Banks, Cooperative Credit Institutions (including Urban Cooperative Banks) and Local Area Banks.

II LITERATURE REVIEW

Chakraborty and Gupta (2017) Farmers in India take recourse to debt, both from formal and informal sources, not only to meet their investment needs but also to smoothen consumption in the face of adverse income shocks. At very high levels of debt, apart from the inability to repay it, the loss of creditworthiness no longer acts as a deterrent for non-repayment of loans, particularly those acquired through formal channels.

Patel (2017) Debt relief/waiver schemes are, therefore, used by governments as a quick means to extricate farmers from their indebtedness, helping to restore their capacity to invest and produce. The costs and benefits of such debt relief schemes are, however, widely debated in the literature.

Burgess (2005) Rural lending rates were also kept much below the urban lending rates. Every branch was also required to maintain a credit-deposit ratio of 60 percent within its geographical area of operation.

De and Tantri (2016) Apart from adding to the financial stress of governments whose fiscal space may already be constrained, they may work against the borrowing farmers if lending institutions refrain from extending loans to defaulters by construing that they are likely to default again. Borrowers' expectation of repeated bailouts by the government may vitiate credit culture among farmers and may further constrict farm lending.

Mukherjee (2017) show that the debt waiver engenders costs when it is directed to non-distressed borrowers, but generates substantial benefits when it is directed to distressed borrowers. They find that the default rate of distressed (drought-related) waiver beneficiaries is lower by 16%-22% when compared to distressed non-beneficiaries. It can protect and smoothen consumption expenditure too.

Kanz (2016) in his primary household survey in Gujarat finds that debt relief does not increase investment. Beneficiary households of ADWDRS reduced their agricultural investment by from 14% to 24% relative to non-beneficiary households. He also finds that debt relief does not increase productivity. Households witnessed a decline of from 13% to 19% in revenue per acre relative to non-beneficiary households, indicating a loss of productivity.

Wenner (1995) Rural credit markets in under developed countries like India have primarily three ways of ensuring repayment of loans; screening, monitoring and enforcement. Formal and informal institutions differ in their screening, monitoring and enforcement capabilities. We explore how these characteristics shape re-payment patterns of borrowers. In particular, it explores the role played by strong and weak enforcement by a lending agency on the repayment patterns of borrowers. Formal institutions have always faced problems with rural credit. Due to asymmetric information problem formal lenders discriminate against small borrowers because of the high cost involved in acquiring information.

Stiglitz (1990) there are a number of studies which have looked at various mechanisms which could help solve the screening and monitoring problem for formal institutions.

Ghatak (2000) the problem of screening can be solved using joint liability as it induces endogenous peer selection in the formation of groups in a way that is beneficial for increasing repayment rates.

Wenner (1995) many formal institutions find forgiving or refinancing a debt easier than strictly enforcing the contract and foreclosing on a defaulting borrower.

Bakshi (2008) Informal moneylenders can rely on social ostracism, interlinked contracts and blatant coercion as effective methods of enforcement.

Najmi (2015) the sectoral priorities of lending keep changing over time and the geographical spread of credit requirements is varied. Bank's willingness towards priority sector lending increased over time and public sector banks are lending more than their private sector peers.

Vijayalakshmi (2014) Alternatives to loan waivers – such as interest-free loans, extending loan tenure, improving agri-infrastructure, compensating loss with crop insurance etc. should be encouraged.

Deepa & Edwin (2018) examined agriculture loan waiver scheme of 2016 by collecting field data from seven district of Tamil Nadu and found that the probability of getting credit is higher for non-beneficial farmers than for beneficial farmers in immediate post-waiver period.

Tanika & Aarti (2017) the difference comes down as credit supply normalizes. Government interventions by way of loan waivers leads to a moral hazard encouraging farmer households to borrow for consumption purpose (as against to income generation) and makes them less cautious because the punishment for such thing is low.

III OBJECTIVES OF THE STUDY

- To study the extent of agriculture loan waiver scheme in country.
- To study about the financial assistance given by the Government to farmers.

RESEARCH METHODOLOGY

Research Design

The research design is a series of advanced decisions when taken together comprise a master plan or model for the conduct of survey. It provides a framework of plan for study which guides the collection, measurement, analysis and interpretation of the data. The study considers secondary data which have been extracted from various official websites, journals, articles, books and newspapers etc.

FARMER'S ACCESS TO AGRICULTURAL CREDIT

Agriculture is a dominant sector of our economy and credit plays an important role in increasing agriculture production. Availability and access to adequate, timely and low cost credit from institutional sources is of great importance especially to small and marginal farmers. Along with other inputs, credit is essential for establishing sustainable and profitable farming systems. Most of the farmers are small producers engaged in agricultural activities in areas of widely varying potential. Experience has shown that easy access to financial services at affordable cost positively affects the productivity, asset formation, income and food security of the rural poor. The major concern of the Government is therefore, to bring all the farmer households within the banking fold and promote complete financial inclusion.

Loan waivers have emerged as the prominent policy choice for addressing the issue of agricultural distress. Over the last one year waivers of farm loans were announced by a number of state governments such as Uttar Pradesh, Maharashtra, Rajasthan, Punjab and Karnataka and the policy is under serious consideration by the state governments of Madhya Pradesh and perhaps even by the central government. This expansion of the loan waiver policy has prompted many studies and commentaries by scholars that have presented a variety of perspectives on the issue.

AGRICULTURAL CREDIT POLICY

The Government of India has initiated several policy measures to improve the accessibility of farmers to the institutional sources of credit. The emphasis of these policies has been on progressive institutionalization for providing timely and adequate credit support to all farmers with particular focus on small and marginal farmers and weaker sections of society to enable them to adopt modern technology and improved agricultural practices for increasing agricultural production and productivity. The Policy lays emphasis on augmenting credit flow at the ground level through credit planning, adoption of region-specific strategies and rationalization of lending Policies and Procedures. These policy measures have resulted in the increase in the share of institutional credit of the rural households.

IV INITIATIVES TAKEN BY THE GOVERNMENT FOR INCREASING FLOW OF CREDIT

(i) Farm credit package: Government of India in its Farm Credit Package announced in June 2004, advised banks to double credit to agriculture sector in three years, i.e., by 2006-07. In the subsequent annual budgets, Government of India announced targets for credit to agriculture to ensure adequate credit flow to the sector. The flow of agriculture credit since 2003-04 has consistently exceeded the target. Agriculture credit flow has increased from Rs.86981 crore in 2003-04 to Rs. 468291 crores in 2010-11. The target for the 2011-12 was fixed at Rs.475000 crore and achievement as on 31.03.2012 is Rs. 511029 crore (as per provisional figures given by NABARD) forming more than 107% of the target. The target of credit flow for the year 2012-13 has been fixed at Rs. 575000 crore and achievement as on October, 2012 is Rs. 308025 crores.

(ii) Interest subvention to farmers: Government of India announced an interest subvention scheme in 2006-07 to enable banks to provide short term credit to agriculture (crop loan) upto Rs.3 lakh at 7% interest to farmers. Further, to incentivise prompt repayment, in the Union Budget for 2009-10, Government of India announced an additional interest subvention of 1% to those farmers who repay their short-term crop loans promptly and on or before due date. This was subsequently raised to 2% in 2010-11 and 3% in 2011-12 and 2012-13 also. Thus, farmers, who promptly repay their crop loans, are now extended loans at an effective interest rate of 4% p.a. As proposed in the Union Budget 2013-14, Interest subvention scheme for short-term crop loans to be continued scheme extended for crop loans borrowed from private sector scheduled commercial banks

(iii) Extension of interest subvention scheme to post harvest loans:In order to discourage distress sale by farmers and to encourage them to store their produce in warehousing against warehouse receipts, the benefit of interest subvention scheme has been extended to small and marginal farmers having Kisan Credit Card for a further period of up to six month post harvest on the same rate as available to crop loan against negotiable warehouse receipt for keeping their produce in warehouses.

(iv) Collateral free loans: The limit of collateral free farm loan has been increased from Rs.50,000 to Rs.1,00,000.

(v) Guidelines for providing relief in event of occurrence of natural calamities: Reserve Bank has put in place a mechanism to address situations arising out of natural calamities. The banks have been issued necessary guidelines for undertaking necessary credit relief measures in event of occurrence of natural calamities. The guidelines, inter alia, contain directions to banks to ensure that the meetings of District Consultative Committees or State Level Bankers' Committees are convened at the earliest to evolve a co-ordinated action plan for implementation of the relief programme in collaboration with the State/ district authorities.

Banks have been advised to provide conversion/ reschedulement of loans and consider moratorium period of at least one year in all cases of restructuring. To enhance awareness, the banks are also required to give adequate publicity to their disaster management arrangements, including the helpline numbers. Further, the banks have been advised not to insist for additional collateral security for such restructured loans. Asset classification for restructured loans will remain the same as prevalent at the time of restructuring for a period of one year as per extant guidelines. The relief measures initiated and undertaken are required to be reviewed periodically in the weekly/fortnightly meetings of specially constituted Task Forces or sub Committees of the SLBC till such time as conditions are normalized.

(vi) Interest subvention for loan restructured in the drought affected states in 2012: The standing guidelines of Reserve Bank of India (RBI) provide for rescheduling of short term crop loans upon declaration of natural calamity including drought. Such rescheduling of crop loans converts them into term loans for which normal rate of interest are applicable. Due to deficient rainfall this year in some parts of the country, the matter of providing relief to the farmers of the drought affected areas has been under the consideration of the Government. In order to provide relief to drought affected farmers, it has been decided that in cases where such loan are restructured due to drought, the interest subvention of 2% which is already available for short term crop loans to Public Sector Banks, Cooperative Banks and Regional Rural Banks will continue to be available for the current financial year on the full restructured amount.

(vii).Kisan Credit Card Scheme : In order to ensure that all eligible farmers are provided with hassle free and timely credit for their agricultural operation, Kisan Credit Card Scheme for farmers was introduced in 1998-99 to enable the farmers to purchase agricultural inputs such as seeds, fertilisers, pesticides, etc. The Kisan Credit Card Scheme is in operation throughout the country and is implemented by Commercial Banks, Coop. Banks and RRBs. The scheme has facilitated in augmenting credit flow for agricultural activities. The scope of the KCC has been broad-based to include term credit and consumption needs. All farmers including Small farmers, Marginal farmers, Share croppers, oral lessee and tenant farmers are eligible to be covered under the Scheme. The card holders are covered under Personal Accident Insurance Scheme (PAIS) against accidental death/permanent disability. Further, GoI has recently accepted suggestions made by a Working Group (Bhasin Working Group) on Kisan Credit Card Scheme to convert it into a Smart Card cum Debit Card and revised guidelines have been issued by NABARD.

Agriculture Debt Waiver and Debt Relief Scheme, (ADWDRS) 2008:

To mitigate the distress of farming community in general and small and marginal farmers in particular and to declog the institutional credit channels and make farmers eligible for fresh credit, the Debt Waiver and Debt Relief Scheme, 2008 was announced in the Union Budget for 2008-09. The scheme covered direct agricultural loans disbursed (i) between 31 March 1997 and 31 March 2007 (ii) overdue as on 31 December 2007 and (iii) remaining unpaid until 29 February 2008. In the case of small and marginal farmers, short term production loans (subject to a ceiling in respect of plantation and horticulture) and installments of investment loans overdue were covered, while in the case of the other farmers, one time settlement was extended under which a rebate of 25% of the eligible amount was given on the condition that the farmer repays the balance 75% in three installments. The debt waiver exercise was completed by 30th June 2008, whereas the debt relief exercise was closed in June 2010 after granting a few extensions. The Government of India has so far sanctioned Rs.52, 516.86 crore in 5 installments as reimbursement to the banks under the scheme. Out of

this Rs.29,275.81 crore was passed on to NABARD for reimbursement to RRBs and Co-operative banks and an amount of Rs.23,159.76 crore has been reimbursed to scheduled commercial banks, Local Area banks and Urban Co-operative banks.

V SCOPE OF THE SCHEME

The Scheme will cover direct agricultural loans extended to ‘marginal and small farmers’ and ‘other farmers’ by Scheduled Commercial Banks, Regional Rural Banks, Cooperative Credit Institutions (including Urban Cooperative Banks) and Local Area Banks (hereinafter referred to compendiously as “lending institutions”) as indicated in the Guidelines.

‘Direct Agricultural Loans’ means Short Term Production Loans and Investment Loans provided directly to farmers for agricultural purposes. This would also include such loans provided directly to groups of individual farmers (for example Self Help Groups and Joint Liability Groups), provided banks maintain disaggregated data of the loan extended to each farmer belonging to that group.

‘Short Term Production Loan’ means a loan given in connection with the raising of crops which is to be repaid within 18 months. It will include working capital loan, not exceeding Rs. 1 lakh, for traditional and non-traditional plantations and horticulture.

‘Investment Loan’ means

(a) investment credit for direct agricultural activities extended for meeting outlays relating to the replacement and maintenance of wasting assets and for capital investment designed to increase the output from the land, e.g. deepening of wells, sinking of new wells, installation of pump sets, purchase of tractor / pair of bullocks, land development and term loan for traditional and non-traditional plantations and horticulture; and

(b) investment credit for allied activities extended for acquiring assets in respect of activities allied to agriculture e.g. dairy, poultry farming, goatery, sheep rearing, piggery, fisheries, bee-keeping, green houses and biogas

‘Cooperative Credit Institution’ means a cooperative society that

- i) provides short-term crop loans to farmers and is eligible for interest subvention from the Central Government; or
- ii) carries on banking activities regulated or supervised by RBI or NABARD; or
- iii) is part of the Short-Term Cooperative Credit Structure or Long-Term Cooperative Credit Structure in a State or Union Territory.

IV LOAN WAIVER SCHEME OF DIFFERENT STATES

Details of States/UTs which have announced Farm Loan Waivers in recent past:

SN	Name of State	Details
1.	Tamil Nadu	Government of Tamil Nadu had announced waiver of loans outstanding vide GO No.50 dated 23 May 2016. Outstanding Crop Loan, MT-Agri & LT (Farm Sector) loans issued to Small & Marginal Farmers by the Cooperative Banks as on 31 March 2016 were waived. Rs.5318.75 crore were waived in respect of 1202075 farmers.
2.	Maharashtra	The Maharashtra Government announced Debt waiver for farmers vide GR dated 28.06.2017 covering 31 lakh farmers with amount of debt waiver of Rs. 30,500 crore.

3.	Karnataka	Karnataka government vide Govt. order No CO313 CLS 2017 dated 23 June 2017 announced waiver of farm loans of up to ₹50,000 taken from State-run Cooperative Institutions covering 22 lakh farmers with amount of debt waiver of Rs. 8,165 crore.
4.	Uttar Pradesh	Government of Uttar Pradesh on April 4, 2017 announced a Rs. 30,729 crore scheme waiving crop loans up to Rs.1.00 lakh for Small and Marginal Farmers. In addition to this, Rs.5,630 crore was allocated for writing off bad loans of around seven lakh farmers, which had become NPAs for banks. This takes the total amount allocated for loan relief to Rs.36,359 crore. The Chief Secretary, Govt. of UP, vide DO letter dated 24 May 2017 had issued a letter to CMD/CEO of all Scheduled Commercial banks informing State Govt.'s decision to implement a scheme for redemption of crop loan debt of Small and marginal Farmers of the state.
5.	Jammu Kashmir	Jammu & Kashmir Government declared Debt Waiver scheme under KCC vide Govt order no. 16-F of 2017 dated 23-01-2017. KCC loans upto Rs. 1 lakh were given 50% waiver in a phased manner. Total amount waived was Rs.244 crore for 1.15 lakh farmers.
6.	Punjab	The Punjab Government announced Debt waiver for farmers vide Notification No. 8/259/17-Agri/2(10)/19235 dated 17.10.2017 covering 10 lakh farmers with amount of debt waiver to the tune of Rs.10,000 crore.
7.	Chhattisgarh	Chhattisgarh Govt. announced Debt relief/waiver vide its notification no. 2838/2015/02-15/30-15F dated 26 December, 2015. 25% of debt waiver was provided for, amounting to Rs. 129.76 crore for 189379 farmers.
8.	Union Territory of Puducherry	The Union Territory of Puducherry vide G.O. Ms.10/Coop. dated 12/01/2018 announced the agriculture loan waiver Scheme 2016-17 covering loans of all agricultural and allied activities availed through Cooperative structure as on 31.03.2016.
9.	Andhra Pradesh	Andhra Pradesh Government announced Waiver of Agriculture crop loan to farmers vide GO Ms.No.164 dated 02.08.2014
10.	Telangana	The Telangana Government announced Debt waiver for farmers vide GO RT No.69 dated 13.08.2014

VII CONCLUSION

The scheme was introduced with aimed to maintain the farmer in good position and also with intention to stop suicides due to poverty and indebtedness. But it is criticized by critics in many ways which are as follows:

- Its impact on productivity is limited as it focuses on debt waiver and debt relief, not on increase in crop productivity which will directly help the farmers in maintain good financial position.
- Only providing Credit for agriculture sector is not enough but also there is need to educate farmer about the other issues related with agriculture loan and crop production.
- Due to its credit facility scheme, it becomes a burden on banks as they are going continuously in more bad debt status which is not good for banks, not also for the development of economy.
- It addressed only formal sources of lending, not informal sources of lending which is also a reason of increase in number of farmer's suicide cases due to their hidden indebtedness. It includes those loans which are taken by the farmer from informal sources, not from banks and lending institutions.

- Due to this scheme, some farmers intentionally misclassify their credit needs which lead to increase in loan defaulters.
- There is insufficiency in its monitoring and evaluation process which is also not good for the better implementation of this scheme.
- Sometimes many errors are found in identification of eligible beneficiaries as some non eligible people take benefit on place of eligible or needy people.
- No extension is given to farmers for fresh credit and outcomes related to fresh loans are also not monitored. There is only a process of debt waiver and debt relief.

During study, it is found that the scheme has adversely affected the functioning of credit institutions, led to an increase in the loan over dues and also affects the customer's psychology towards repayment of loan borrowed by him. The paper suggested that there should be a ban for general loan waivers and necessary steps should be taken by the banks and govt. for recovery of loan from such borrowers. The scheme should be designed in a manner that can easily understand the needs of the agriculture sector, especially credit needs of the farmers related to weather patterns, region and their risk. A special budget should introduce by the government for agriculture, at least 10% allocation of the total budget. The scheme has not percolated down to the needy. The government should have transparency and clarity for its successful implementation as they should find the needy person, waive or relief only those loans which are of non will ful defaulters. There is need to make it economics based, not social or political base. From paper, it is clear that a debt waiver and debt relief scheme is not sufficient to solve all problems related with inequality, low rural incomes and economic distress but it has a potential to provide genuine relief to the farmers.

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A WIDEBAND MONOPOLE MICROSTRIP ANTENNA USING TWO CROSS-SHAPED RADIATOR

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ABSTRACT

This paper presents design of a planar cross monopole antenna with bandwidth improvement for WiMAX/ WLAN application. The antenna design consists of two compact cross rectangular microstrip radiator with slotted ground plane and a 50 Ω microstrip feed line. The cross-shaped patch contain of vertical and horizontal rectangular radiator. The ground slot with proper dimensions placed under the feed line for improved impedance matching and also achieving wide impedance bandwidth (IBW). Simulation results make obvious that this structure exhibits a broad impedance bandwidth (IBW) of 4.94 GHz (109%), determined by 10 -dB return loss ranging from 2.06 -7.0 GHz, having centre frequency at 4.53 GHz. This frequency band can be used for simultaneous operations over WLAN (2.4/5.2/5.8 GHz) and WiMAX (2.5/3.5/5.5 GHz) frequency bands applications. The antenna system demonstrates wide multi-operation band in addition to good radiation patterns and small volume. The dimension of the Antenna is 50×45×1.6 mm³. What are more in this design: good Omni-directional radiation patterns by means of considerable gain transversely the operating bands in addition is accomplished to transplant inside dissimilar portable devices aimed at WiMAX/WLAN applications, low profile, low cost and with an appropriate modest feeding structure.

Keywords-Cross Monopole, Impedance Bandwidth, Microstrip feed line, Return Loss.

I INTRODUCTION

One of the significant recompense of microstrip antenna (MSA) is its lightweight and cost-effectiveness [1]. But MSAs generally have comparatively narrow bandwidths, which is not sufficient to maintain modern digital wireless communication systems [2-4]. In order to enhance the bandwidth, using dissimilar methods, for example by means of antenna structures with multilayer [5] or parasitic elements [6-10], have been tried. Additionally, another strip rectangle [11-12] or slot rectangle [13] MSA have been used to improves the IBW.

Here in this paper, a compact cross monopole planar antenna is envisaged and planned for wireless communication systems which can sustain for WLAN/WiMAX application. The anticipated antenna consists of two rectangular patches of the different size to accomplish a wideband operation. The matching of the impedance in this device is obtained by utilizing a partial rectangular ground plane on the other side of dielectric substrate. The proposed antenna shows two resonances which are combined and give a wide band which is 10 -dB

return loss ranging from 2.06 -7.0 GHz, i.e. 109%. Paucity of antenna designs giving wide impedance bands, motivated us to focus our work on designing a compact antenna. Primary objective of this paper was to design a miniaturized, WLAN (2.4/5.2/5.8 GHz) and WiMAX (2.5/3.5/5.5 GHz) application microstrip antenna in lower frequency band. The proposed antenna is designed using theoretical lower resonating frequency 2 GHz so that it can cover WLAN (2.4/5.2/5.8 GHz) and WiMAX (2.5/3.5/5.5 GHz). Initially to get the resonance at lower resonating frequency 2 GHz, we have designed our antenna by taking the dimension $56 \times 56 \times 1.6 \text{ mm}^3$. But after the optimization our antenna size is reduced to $50 \times 45 \times 1.6 \text{ mm}^3$ keeping the same lower resonance frequency at 2 GHz. We know frequency is inversely proportional to antenna dimension. But keeping the same resonance frequency we could design our antenna with 17.27% size reduction compared to conventional design procedure. This is significantly good result satisfying the miniaturization criteria. Our proposed antenna gives wide band characteristics, in addition also give smaller structure. A cross-shaped patch, a partial ground plane create wide IBW ranging from 2.06 -7.0 GHz, (i.e. 109%) having centre frequency at 4.53 GHz. To our knowledge, this is one of the better results obtained in comparison to related designs. We have utilized FR4_epoxy substrate which introduces some additional complexity on the antenna design beyond microwave frequency band. Therefore, this puts a limitation on our proposed antenna that it cannot be used for applications beyond microwave frequency band. We hoped to designing, a wideband microstrip antenna with single-fed for WLAN (2.4/5.2/5.8 GHz) and WiMAX (2.5/3.5/5.5 GHz) applications. This would overcome the need of multiple antennas. For the proposed antenna, measured $\square 10$ -dB IBW ranges from 2.06 -7.0 GHz. Simulation was done using ANSYS HFSS. Their results were similar.

The paper is structured as: Section 2: Antenna Design Procedure; Section 3: Experimental Result and Discussion; Section 4: Parametric Studies and Section 5: Conclusion.

II ANTENNA DESIGN EXPLANATION

The anticipated printed monopole antenna effortlessly can be implanted on a dielectric substrate. The designed antenna consists of two cross shaped horizontal and vertical rectangular patches form monopole antenna radiator which is fed by a 50Ω microstrip line and a partial ground plane on the opposite side of the low cost FR4 substrate [2-4]. The sizes of vertical microstrip line and rectangular patch are $b \times d$ and $(2 \times a + b) \times c$ respectively. The width of the microstrip feed line W_f is recognized to achieve 50Ω impedance matching characteristics.

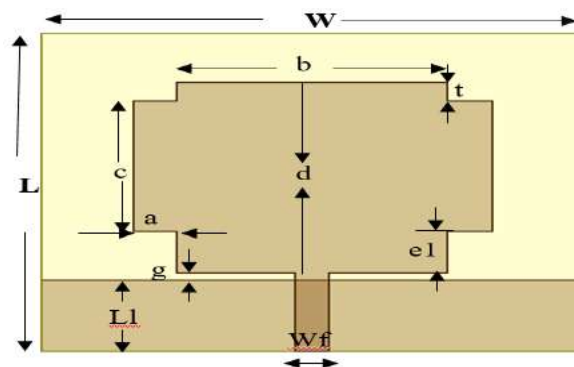


Fig.1: Dimensions of the planar cross monopole antenna

Besides, the anticipated antenna has a size of $W \times L$ with thickness of 1.6 mm. The dielectric substrate used is low cost FR4 with $\epsilon_r=4.4$ and loss tangent $\tan\delta =0.02$. The optimized dimension of ground plane for the proposed antenna is $W \times L1$. The feed gap height in between the ground plane and the feed point is used for wide impedance bandwidth. The optimized dimensions association of the earlier studied design and the anticipated antenna are shown in Table I.

Table 1					
Optimal dimension of the proposed antenna					
Parameter	Value (mm)	Parameter	Value (mm)	Parameter	Value (mm)
W	50	L	45	L1	10
a	4	b	25	c	18.5
d	27	e1	3	g	1
Wf	3	t	1.25	h	1.6

The antenna dimensions can be calculated using the following well known equations (i) – (viii).

A. Antenna Dimensions Calculation [2]:

(i)Width Calculation for MSA:-

The width of the radiating patch is

$$W = \frac{1}{2f_r \sqrt{\mu_0 \epsilon_0}} \sqrt{\frac{2}{\epsilon_{r+1}}} \dots \dots eq(i)$$

(ii) Effective Dielectric Constant Calculation (ϵ_{reff}) for MSA:-

$$\epsilon_{reff} = \frac{\epsilon_{r+1} + \epsilon_{r-1}}{2} \left[1 + 12 \frac{h}{w} \right]^{-1/2} \dots \dots eq(ii)$$

(iii)Effective Length Calculation (L_{eff})for MSA:-

$$L_{eff} = \frac{c}{2f_r \sqrt{\epsilon_{reff}}} \dots \dots eq(iii)$$

(iv)Length Extension Calculationfor MSA:-

$$\frac{\Delta L}{h} = 0.412 \frac{(\epsilon_{reff+0.3}) \left(\frac{w}{h} + 0.264 \right)}{(\epsilon_{reff} - 0.258) \left(\frac{w}{h} + 0.8 \right)} \dots \dots eq(iv)$$

(v) Actual Length Calculationfor MSA:-

$$L = L_{eff} - 2\Delta L \dots \dots eq(v)$$

(v) Bandwidth Calculationfor MSA:-

$$BW = f_H - f_L \dots \dots eq(vi)$$

(v)Resonance frequency Calculation for MSA:-

$$f_r = f_L + \frac{BW}{2} \dots \dots eq(vii)$$

The impedance bandwidth for a linearly polarized microstrip antenna is defined by equation (viii). Here Q is the quality factor of the antenna.

$$BW_{SWR}^{LP} = \frac{1}{\sqrt{2}Q} \quad (SWR < 2) \dots \dots \dots eq \text{ (viii)}$$

From eq (i) – eq (viii) it's apparent that if we tune one frequency region to another frequency region, antenna dimension will also be changed. If we move from lower frequency region to higher frequency region antenna dimension will be decreased or if we move from higher frequency region to lower frequency region antenna dimension will be increased, return loss will be changed correspondingly.

Using above equations we have designed our antenna at lower resonating frequency 2 GHz. So first we design our antenna by using the patch dimension $46 \times 46 \times 1.6 \text{ mm}^3$ ($0.5\lambda_g \times 0.5\lambda_g \times 0.017\lambda_g$ where λ_g is the guided wavelength at 2 GHz), whereas substrate dimension $56 \times 56 \times 1.6 \text{ mm}^3$ ($0.612\lambda_g \times 0.612\lambda_g \times 0.017\lambda_g$). But after optimization the patch dimension is $27 \times 29 \times 1.6 \text{ mm}^3$ ($0.295\lambda_g \times 0.317\lambda_g \times 0.017\lambda_g$) and substrate dimension $45 \times 50 \times 1.6 \text{ mm}^3$ ($0.492\lambda_g \times 0.547\lambda_g \times 0.017\lambda_g$). So now the area of the antenna is compact compare to earlier step as area of the antenna is reduced 28% now.

B. Operating Principle:

On the way to understand the working principle of the implemented antenna, three paradigms (Ant. 1 to Ant. 3) are illustrated in Fig. 2. The improvement of reflection coefficient (S11) of Antenna. 1–3 is depicted in Fig.3. At first in Step.1, Antenna.1 is designed to produce the fundamental lower resonance at 2 GHz that is well-ordered through the microstrip feed line and ground plane on the opposite side of the substrate [1]. As it comes in S and C- band WLAN/WiMAX application. But we get multi small impedance bands using Antenna.1. So in order to get the resonance at 2 GHz we go to Step.2 design Antenna.2. Here, first we have used partial ground plane on the opposite side of radiating patch then optimized the dimension of the antenna. At this juncture the gap (g) in between radiating patch and ground plane create a series capacitive effect. Total capacitive effect is increased which decrease quality factor that increase the bandwidth [14]. Now impedance bandwidth is increased but do not cover whole S and C bands. So in order to increase impedance bandwidth on upper frequency region we have to increase total current path length from the feed line towards the right side. So moved to Step.3 design Antenna.3. Here two cross patches are used, which satisfy our criteria as mentioned above. After optimization our impedance bandwidth increase much better than earlier design as shown in Fig.3 which also covers S- band and C- band WLAN/WiMAX bands. This is our final optimized design.

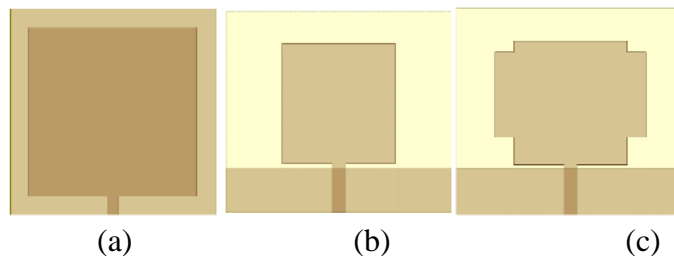


Fig.2 Three Improvement processes of Implemented Antenna (a) Antenna.1 (b) Antenna.2 and (c) Antenna.3.

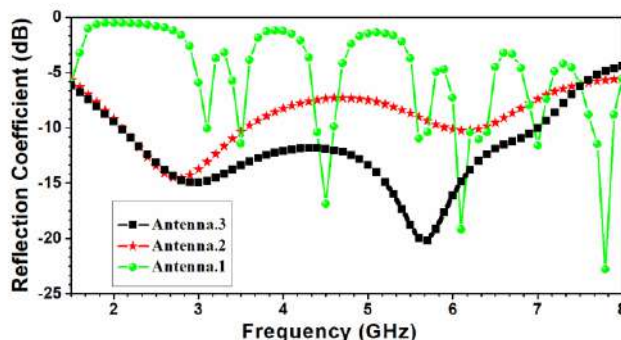


Fig.3 Simulated reflection coefficient for the implemented antenna improvement process.

III RESULT AND DISCUSSION

The simulation was completed with ANSYS HFSS. From Fig. 4 it's prominent that implemented antenna has the 10 -dB IBW of the simulated reflection coefficient spanning over the range from 2.06 -7.0 GHz, centre frequency 4.53 GHz, 109%. Fig.4 also shows the VSWR plot. Where the IBW is also same as VSWR<2 from 2.06 -7.0 GHz in this entire region.

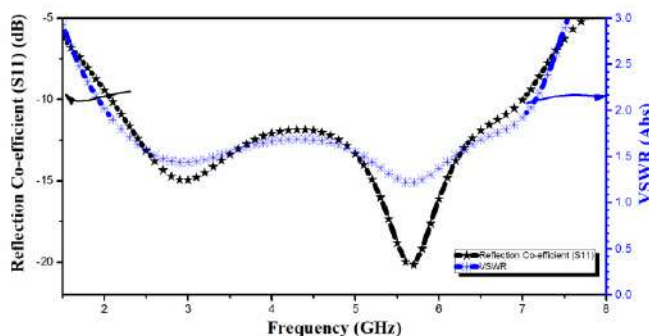


Fig.4 Simulated Reflection coefficient and VSWR Vs Frequency of proposed Antenna

Fig.5 depicts the simulated gain of our proposed antenna. The maximum gain of the antenna is 5.86 dBi at 6.9 GHz. Fig.5 also depicts the simulated efficiency of our proposed antenna. The radiation efficiency is more than 86% over the IBW region. The maximum radiation efficiency of the antenna is 97.21% at 2.1 GHz. As we go above higher frequency region antenna gain as well as efficiency decreases. In this design we have used FR4 substrate. The material FR4 exhibits loss at the upper end of the microwave frequency. It is well known that the dissipation factor ($\tan\delta$) inversely proportional to resonance frequency (f_r). If radiation and external losses are negligible, then total loss of the system under loaded condition becomes $\tan\delta = 1/Q_L$, where Q_L total or loaded quality factor. The loaded Q_L is obtained from the measured resonant frequency (f_r) and Δf , the half power (-3dB) bandwidth, leading to $Q_L = f_r/\Delta f$. As the frequency is increased, the permittivity of FR-4 varies and loss in the substrate increases.

Unfortunately, though low-cost, FR4 as the substrate beyond microwave frequency introduces some additional complexity on the antenna design. This is due to the inaccuracy of its relative permittivity and high loss tangent (around 0.02). Variations in the FR4 electrical permittivity can shift the operating frequency and the high loss tangent dramatically affects the antenna impedance bandwidth and gain, resulting in poor radiation efficiency.

Considering all the above loss conditions, we have designed the proposed antenna in the frequency range not beyond 8 GHz.

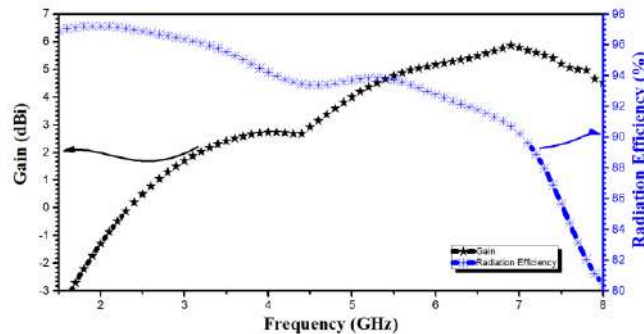


Fig.5 Simulated Gain and Radiation efficiency Vs Frequency of proposed Antenna

Fig.6 illustrates the input impedance (Z_{11}) curves Vs frequency. To investigate the resonance modes of proposed antenna, a plot of input impedance (Z_{11}) for the real (Z_{11} - Real) and imaginary (Z_{11} - IMG) parts are shown in below. It is reasonable that in the entire operating IBW, real part (resistance) approaches to 50- Ω while the imaginary part (reactance) approaches to 0- Ω for propose antenna which gives better impedance matching.

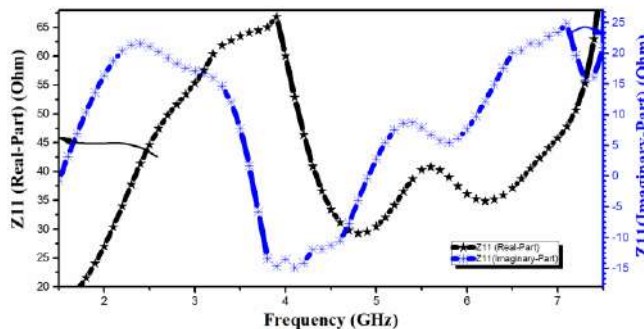


Fig.6 Simulated Z_{11} (Real and Imaginary) Vs Frequency of proposed Antenna

Fig.7 (a) and Fig.7 (b) shows simulated far field radiation pattern at the centre frequency 4.3 GHz for our proposed antenna. It is seen that radiation pattern is omni-directional for H-plane. It is noted that E-plane as expected is symmetrical with respect to theta equals to 0 degree since, the proper structure is symmetrical. Fig.7 (a) depicts that E-cross plane radiation pattern is lesser than E-co plane radiation pattern by 43.92 dB at 0 degree. Fig.7 (b) depicts that H-co plane radiation pattern is greater that H-cross plane radiation patter by 43.92 dB at 0 degree. This radiation also prove that MSA is a broadside radiator.

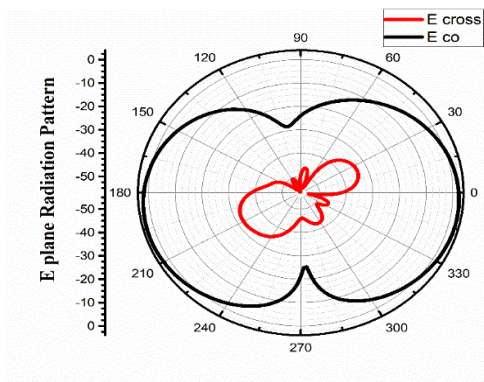


Fig.7 (a) E-plane radiation pattern.

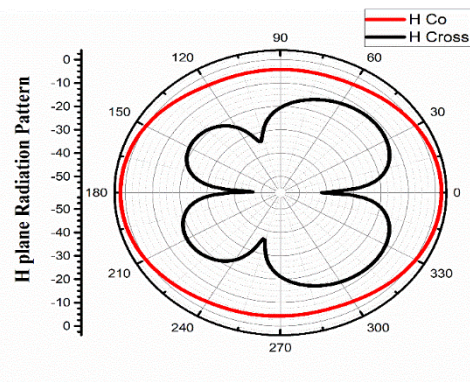


Fig.7 (b) H-plane radiation pattern.

IV PARAMETRIC STUDY:

In this segment the influences exerted by various geometrical parameters on the performance of reflection coefficient is discussed. An illustration with the dimensions of $e=2 \times e_1=6.0$ mm, $a = 4.0$ mm, $c=18.5$ mm, $b= 25.0$, $d= 27.0$, $g = 1.0$ mm, $W_f = 3.0$ mm, $L=45.0$ mm, and $W= 50.0$ mm are initially taken to exhibit impedance matching and wide impedance performance. To study the effect of varying above parameters on the antenna performance, parametric investigation is carried out. At a time, one parameter is examined whereas the dimensions of others are kept unchanged. Proposed antenna gives a wide impedance.

IV.1 Effect of e

Fig.8 illustrates the S_{11} curves by varying the vertical length “e” of the vertical patch (length after feed gap height g to horizontal patch). As anticipated, the S_{11} at higher band witnessed shifts towards the lower frequency region, but the length exerted almost no impact on impedance bandwidth in the lower region. Here as we increase vertical length effective current patch length is increased, which shift the higher frequency resonance towards lower frequency region. In conclusion, the value of e is optimized to be 6mm.

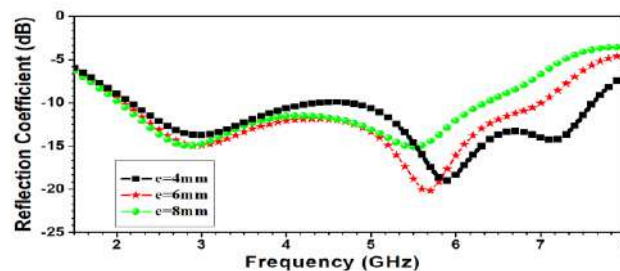


Fig. 8 Simulated S_{11} results with different value of e

IV.1 Effect of a

Fig.9 illustrates the S_{11} curves by varying the horizontal width “a” of the horizontal patch. As anticipated, the S_{11} at higher band witnessed some change, but the length exerted almost no impact on impedance bandwidth in the lower region. Here as we increase horizontal width bandwidth is increased, which change total IBW. In conclusion, the value of a is optimized to be 4mm.

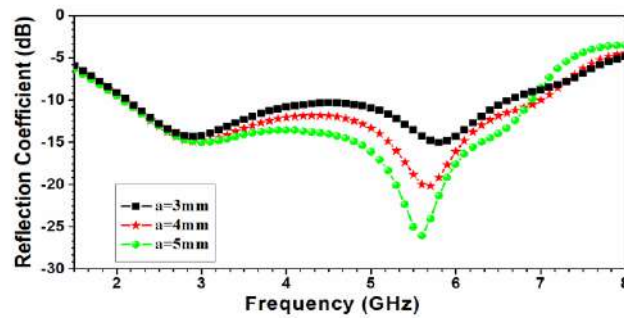


Fig. 9 Simulated S11 results with different value of a

IV.III Effect of c

Fig.10 illustrates the S_{11} curves by varying the vertical length “c” of the horizontal patch. As anticipated, the S_{11} at higher band witnessed shifts towards the higher frequency region, but the length exerted almost no impact on impedance bandwidth in the lower region. Here, as we increase vertical length effective current patch length is increased, which shift the higher frequency resonance towards higher frequency region. In conclusion, the value of c is optimized to be 18.5 mm.

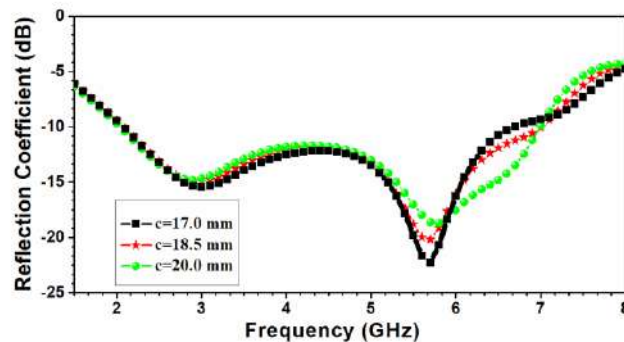


Fig. 10 Simulated S11 results with different value of c

IV.III Effect of b

Fig.11 illustrates the S_{11} curves by varying the horizontal length “b” of the vertical patch. As anticipated, the S_{11} at higher and lower band region has change significantly. Here as we increase horizontal total IBW is change. In conclusion, the value of b is optimized to be 25 mm.

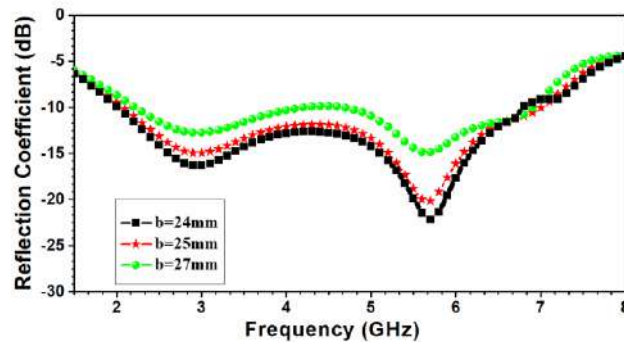


Fig. 11 Simulated S11 results with different value of b

IV.III Effect of d

Fig.12 illustrates the S_{11} curves by varying the total vertical length “d” of the vertical patch. As anticipated, the S_{11} at higher band witnessed some little shifts towards the higher frequency region, but the length exerted a great effect on impedance bandwidth in the lower region. Here as we increase vertical length effective current patch length is increased, which shift the lower frequency resonance towards lower frequency region. In conclusion, the value of d is optimized to be 27 mm.

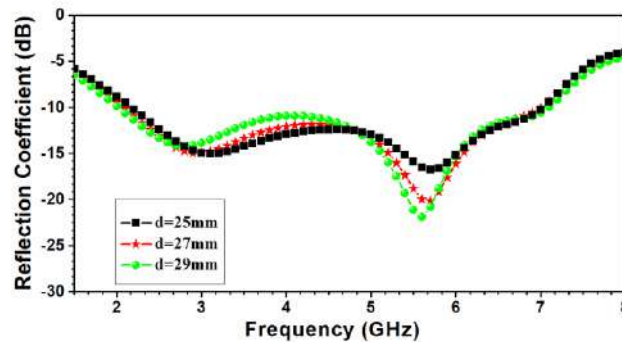


Fig. 12 Simulated S_{11} results with different value of d

IV.III Effect of g

Fig.13 illustrates the S_{11} curves by varying the total gap length “g” between the radiating patch and partial ground plane. As anticipated, the S_{11} at higher and lower band witnessed great effect on total IBW. At this juncture g create the coupling between the radiating patch and ground plane. Here as we increase the gap length the total coupling capacitor is increase, so total effective parallel path capacitive effect is increased, which decrease the total quality factor. As a result resonance frequency is increased which shift the higher frequency resonance towards the higher frequency region, consequently total IBW is increased. In conclusion, the value of g is optimized to be 1.0 mm.

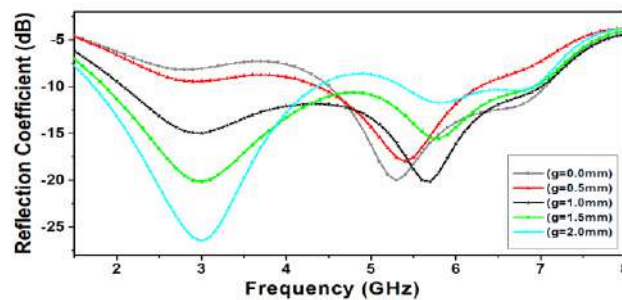


Fig. 13 Simulated S_{11} results with different value of g

IV.III Effect of W_f

Fig.14 illustrates the S_{11} curves by varying the feed width W_f of the radiating patch. As anticipated, the S_{11} at lower and higher band witnessed great effect due to change of W_f . Here feed width control the impedance of the antenna. In conclusion, the value of W_f is when optimized to 3mm give best matching which give wide IBW

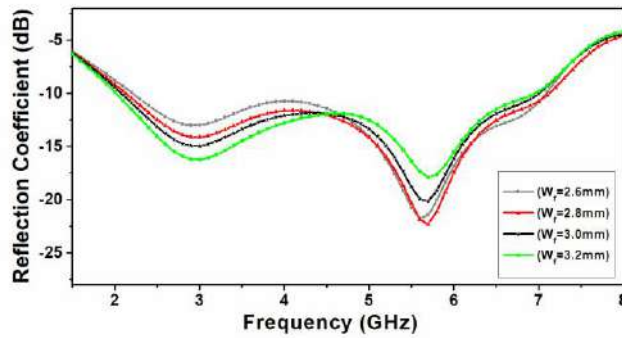


Fig. 14 Simulated S11 results with different value of W_f

IV.III Effect of L

Fig.15 illustrates the S_{11} curves by varying the total length of the antenna. As anticipated, the S_{11} on lower resonance, and higher resonance has shifted. It's well known that length can control the resonances of the impedance band which can also be seen from below graphs. In conclusion, the value of L is optimized to be 45 mm.

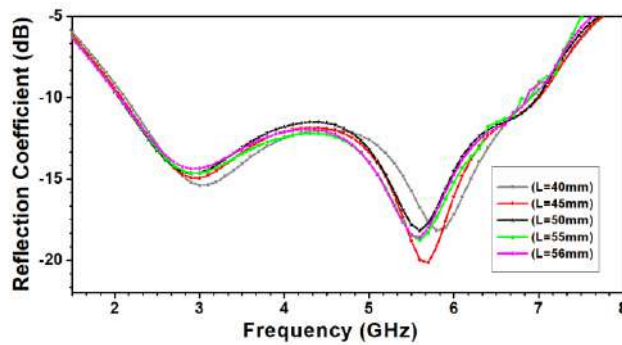


Fig. 15 Simulated S11 results with different value of L

IV.III Effect of W

Fig.16 illustrates the S_{11} curves by varying the total width of the antenna. As anticipated, the S_{11} on lower resonance, and higher resonance has shifted. It's well known that width can control the bandwidth of the antenna, which can also be seen from below graphs. In conclusion, the value of W is optimized to be 50 mm.

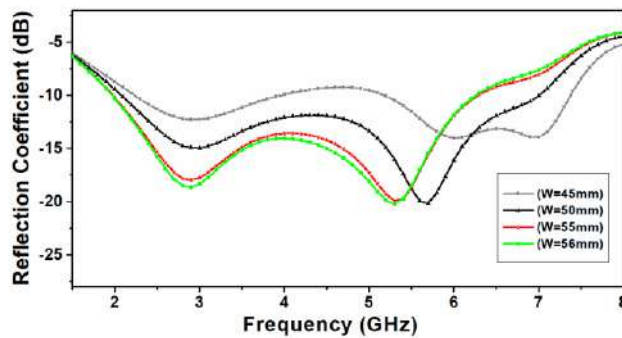


Fig. 16 Simulated S11 results with different value of W

V CONCLUSION

An optimized microstrip-fed monopole antenna with two cross-shaped radiators is effectively anticipated, simulated for WLAN/WiMAX, S and C band operation. Simulations are support to authenticate the design perception and process, presents excellent concurrence of results. The anticipated antenna characteristics compact size ($45 \times 50 \times 1.6 \text{ mm}^3$, i.e. $0.492\lambda_g \times 0.547\lambda_g \times 0.017\lambda_g$), wide band operating bandwidth (2.06 -7.0 GHz, i.e.109%) and stable radiation patterns representative that it might be good devices for WLAN/WiMAX applications.

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SOCIO-ECONOMIC AND HEALTH IMPLICATIONS DUE TO CURRENT COVID-19 PANDEMIC AND MITIGATION STRATEGIES

Ruby Bhullar Garcha, Dr. Anjana Bhatia

ABSTRACT

Coronavirus has become a global pandemic triggered by SARS-CoV-2, emerged from the Wuhan city of China at the end of 2019. It caused distressing public health and socio-

economic burden around the world. In the absence of a safe and effective vaccine or anti-viral in humans Governments and policymakers aimed at reducing community transmission by using non-pharmaceutical interventions like social-distancing, community lockdown, use of facemasks, isolation and contact tracing of confirmed cases, and quarantine of suspected ones. As the disease, spreads across the globe various mathematical models are used to explain and understand transmission dynamics – suspected, recovered, deceased patients, as well as how many have been tested and control of COVID-19. Though there are various models like SIR, SEIR, SEIRU, SIRD, SLIAR, ARIMA, SIDARTHE, and like but here we took the Θ -SEIHRD model based on the Be-CoDiS model initially used for the Ebola outbreak in 2014-2016 and has been used for the 2018-2020 Ebola outbreak in democratic republic of congo with very positive forecast. To simulate the pandemic dynamics using a society of agents that participate with people, businesses, and government a new SEIR agent-based model is sited with varied epidemiological and economic effects. It can act as a useful tool to assist politicians and health authorities to plan their action against the COVID-19 pandemic. In this paper, we present a review of the mathematical model for the outbreak of the COVID-19 with some basic concepts, notations, and foundation for epidemiological modeling considering epidemiological features like case fatality ratio, susceptibility, basic reproduction number, asymptomatic infections, and herd immunity. Positivity of the models with some graphs are presented in this paper showing human-to-human contact is the potential cause thus isolation can reduce the risk of spread of

Keywords: COVID-19, Social-distancing, Mathematical model, Epidemiological modeling, Mitigation strategies

I INTRODUCTION:

The World Health Organization (WHO) declared a public health emergency caused by an outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) on January 30, 2020, with the name of the Coronavirus disease 2019 (COVID-19) [1]. WHO reported the spread of COVID-19 cases across 235 countries, areas, or territories with 316,884 new cases, 32,429,965 confirmed cases including 985,823 deaths by 26 September 2020 [2]. Due to the high rate of infection spread and the extensive number of deaths many state and local governments started to apply strict preventive measures to mitigate the community spread by taking preventive measures like social distancing [2][3]. Researchers are working on many vaccines for use against the pandemic so the focus is on implementing non-pharmaceutical interventions (NPIs) like social-distancing, community lockdown, contact tracing, quarantine of suspected cases, isolation of confirmed cases, and use of face masks in public [2][4].

With no uniformity in the infection several mathematical, computational, clinical, and examinational studies are conducted to regulate the course of an epidemic using modeling for prediction, treatment, and control of the disease [2][5]. There are various mathematical models performed for COVID-19 to predict the magnitude and timing of the epidemic peak and final epidemic size based on modified susceptible-exposed-infectious-recovered (SEIR) the compartmental framework to investigate the development of COVID-19 [6]. They are like [6]:

Wu. et al. Introduced **Describe** **Forecasted based on reported data from December 31, 2019, to January 28, 2020**

SEIR model	Transmission dynamics	National and global spread of disease
Read et al. used an assumption of Poisson-distributed in their data fitting	Reported	Value of 3.1 for the basic reproductive number of the early outbreak
Tang et al. Incorporated into their model	Found intervention strategies followed by quarantine and isolation	
Clinical progression of the disease, Individual epidemiological status, and intervention measures	Reduce the control reproduction number and the transmission risk	
Imai et al. Conducted Computational modeling	Estimate The outbreak size in Wuhan, China	Results Control measures block well over 60% of transmission in the outbreak
Li et al. applied Meta-population SEIR model and Bayesian inference	To infer Critical epidemiological characteristics in China	Estimates 86% of all infections were undocumented before January 23, 2020
Leung et al. quantified Transmissibility and severity of COVID-19	Locations Outside Hubei province	Simulated Potential consequence and relaxing restrictions in anticipation of the second wave in China

All these assumptions enclosed a varied series of epidemiological features and have enhanced our understanding of the complex transmission mechanism of COVID-19 [6].

Here, we enlist numerous mathematical models used to estimate the spread, peak, and reduction of cases based on the basic Susceptible-Infectious-Recovered (SIR) model [7].

- Susceptible-exposed-infectious-recovered (SEIR) predictive model
- Auto-regressive Integrated Moving Average (ARIMA)
- Time-series model
- The multivariate linear regression model
- Grey forecasting model
- Backpropagation neural networks
- Simulation models
- Phenomenological models
- SIDARTHE model (latest)

All these models are used to solve situations in which lockdown measures be eased without endangering the probability of a second wave that may be or even more disturbing than the primary [4].

II. HUMAN TO HUMAN CONTACT AS A POTENTIAL CAUSE OF OUTBREAK:

The primary diffusion of the virus that causes COVID-19 is through droplets produced which are too heavy to hang in the air and quickly fall on the floor or surfaces when an infected person coughs, sneezes, or exhales [8]. It is typically transmitted through respiratory droplets that we may inhale from close contact with one another [8].

Wang J. in his recently published article focused on the basic SEIR framework that reveals direct human to the human transmission where both symptomatic and asymptomatic individuals are capable of infecting others [6]. Additionally, an epidemiological and

socioeconomic status may change the transmission rate and be impacted by outbreak control like many countries executed strong disease control measures together with large scale quarantine, intensive tracing of movement and contact, isolation of infected individuals, extended medical facilities, and social distancing which may reduce the transmission of the virus [6].

A. Understanding model parameters:

To gain a deeper understanding of epidemic pattern a modified SIR model is presented to project :

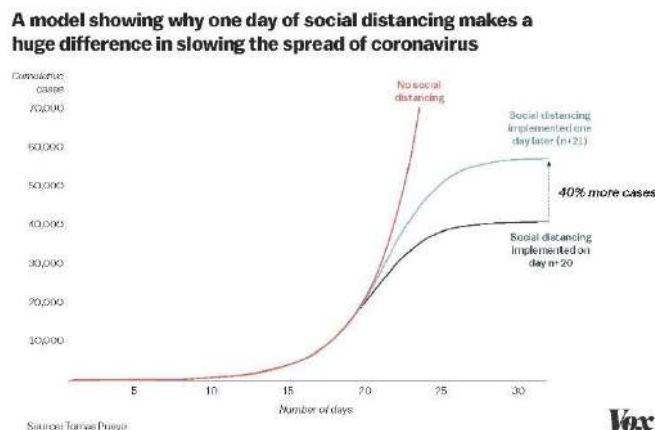
- The actual number of infected cases
- The specific burden on an isolation ward
- Intensive care units

Anwar Zeb *et al.* in his recently published article discussed the parameters used in the SIR model statistically and divided the total population into five compartments to control the infection [8]. The five compartments are [8]: susceptible; exposed; infected; isolated and recovered from the disease which will lead to the mathematical model formulation used to describe the human-to-human transmission [8]:

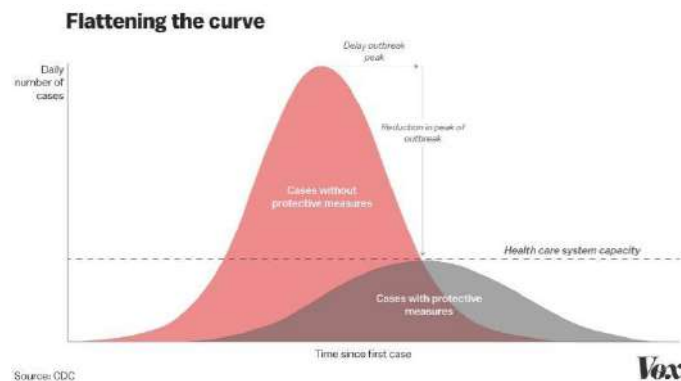
Parameters/Variables Describes

S	Susceptible population
E	Exposed population
I	Infected population
Q	Isolated population
R	Recovered population
B	The rate at which susceptible population moves to infect and exposed
Π	The rate at which the exposed population moves to infected
Υ	The rate at which exposed take onside as isolated
Θ	The rate at which infected were added to isolated
Θ	The rate at which isolated persons recovered
M	Natural death rate + Disease-related death rate

The rate of spread of infection is proportional to the number of infected people [9]. An epidemiological model visualized by the New York Times under different scenarios describes how **flattening the curve** over time is essential to save lives by taking drastic measures like closing schools, canceling public events, work from home will reduce social contact, and also isolate the infected from others [9].



Picture:1 [9]



Picture 2: [9]

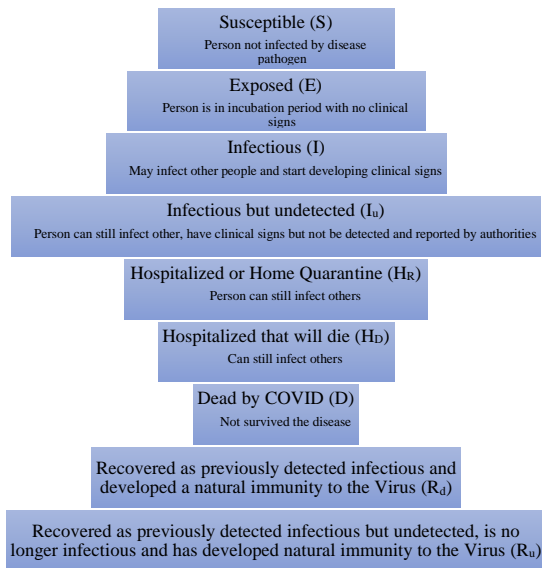
To assess the effect of various control strategies on the dynamics of the disease modeling and simulation act as vital decision tools [10][11]. Rossa, K. *et al.* published three dynamic phenomenological models as Generalized logistic growth model, Richards model, and sub-epidemic wave model to generate short term forecasts in real-time and were validated with an outbreak of diseases other than COVID-19 whereas Kucharski, A.J. *et al.* combined a stochastic transmission model with data to evaluate how transmission varied over time and proposed SEIR type model with variations [12][13]. As COVID-19 is a new disease so needs a model that is merged enough to grab central effects but also simple enough to let an affordable identification of its parameters with **specific characteristics** that incorporate [11]:

- Effect of undetected infected people on the percent of detected cases over the real total infected cases.
- Effect of diverse sanitary and infectiousness situations
- Assessment of the need for hospital beds which is one of the major problems for policymakers

B. Novel model Θ -SEIHRD:

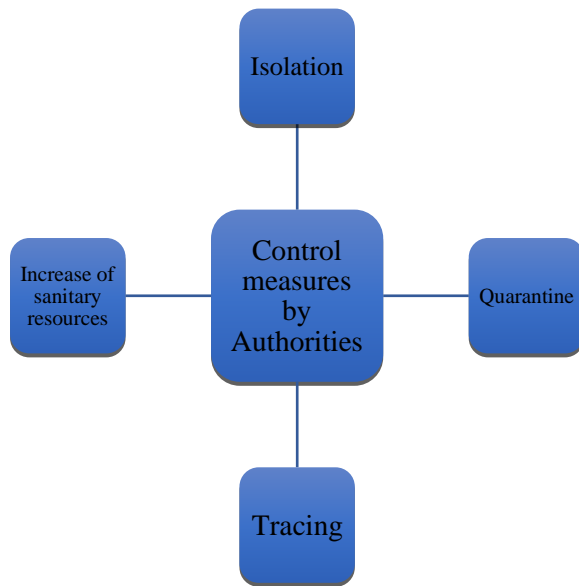
Ivora, B. *et al.* in a recently published paper addressed a new mathematical model Θ -SEIHRD model based on the Be-CoDiS model with a novel approach that imitates the fraction Θ of detected cases over the real total infected cases which permits reviewing the status of this ratio on the impact of COVID-19 [11]. Epidemiological characteristics of COVID-19 [11]:

Diagram 1:



Various control measures are taken by the authorities keeping in view the compartmental model as [11]:

Diagram 2:



- Isolation decreases Covid-19 fatality rate
- Quarantine: Restricted and controlled movement avoids the additional spread of disease
- Tracing: Recognize potential infectious contact and increase the number of tests to increase the percentage of detected infected people
- Increase of sanitary resources: Increase in the number of operational beds and sanitary personal to perceive and treat affected people creating a decrease in infectious period for the compartment I.

C.Simulation:

Simulation of model Θ -SEIHRD to evaluate the spread of disease during a fixed time-intervals within some territories for COVID-19 [11]:

At the beginning of the simulation, model parameters are set by the users [11].

Consider time $t=0$

The most probable date for the index case in China 1 December 2019 seven days before the date that features in literature as according to WHO first confirmed case was on 8 December 2019 [11].

Start the simulation at any initial time $t_0 \geq 0$ [11]

Consider, only susceptible people live in the territories that are free of disease whereas,

The number of people in compartments S, E, I, I_u , H_R , H_D , R_d , R_u , and D of the infected territories are set to their corresponding values [11].

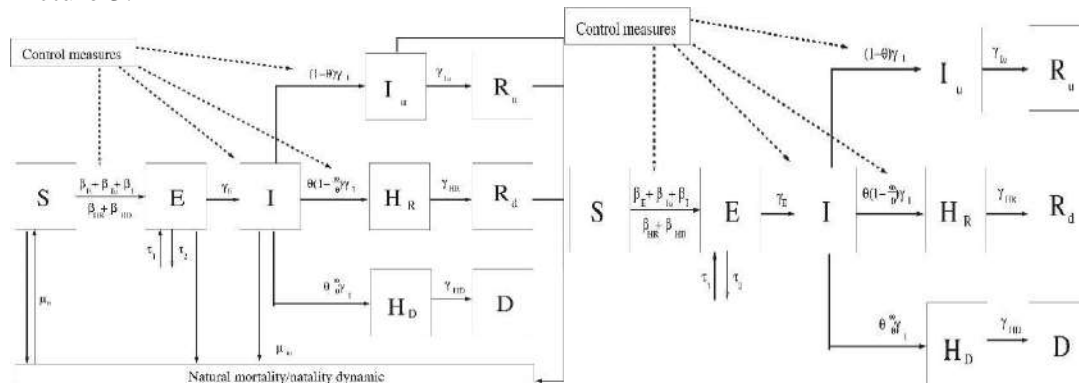
Within country daily spread procedures are applied, during the time interval $[t_0, t_0 + T_{\max}]$ with $T_{\max} \in \mathbb{N}$ being the maximum number of simulation days [11].

Simulation is stopped if at end of a simulation day t there is less than one person in each compartment E, I, I_u , H_R , and H_D or else it is stopped when $t = t_0 + T_{\max}$ [11]

While initializing the model control measures as well are implemented which can be stimulated or neutralized to the degree of their efficiency to decrease the magnitude and duration of a COVID-19 epidemic [11].

Ivora, B. *et al.* presented in their recently published paper the main structure of the full model and its simplified version used for simulation for within-country disease spread with suitable values of t_0 as:

Picture 3:



The main structure of the full model for COVID-19 b.

4. Simplified version (used for simulation) of the model for COVID-19 [11].

Ivora, B. *et al.* mentioned a deterministic SEIR model as the first approach to use over a stochastic model due to certain advantages like [11]:

- Low computational complexity
- Allow better calibration of the model parameters
- Use of ordinarily differential equations for suitably analyzing and interpreting the model
- For modeling a new problem with few data

As with the stochastic model, it is difficult to determine the distribution probability requires more data for calibration of the model [11].

Ivora, B. *et al.* introduced a model that not only considers the impact of the ratio from fraction Θ of detected cases over the real total infected cases of COVID-19 but also able to evaluate the need for beds in hospital [11].

Mathematical models act as essential tools to investigate the current situation with intervention strategies like pharmaceutical (antivirals and vaccine) and non-pharmaceutical (isolation, quarantine, restrictions on travel, closure of schools or workplace, shops), to evaluate the potential benefits and costs of different strategies used to reduce the spread of infection [14].

D. Understanding various epidemiological features:

Researchers around the globe have proposed various methods with parameters and variables on COVID-19 since its outbreak here we highlighted some as [14]:

Case fatality ratio (CFR):

Describe the severity of the transmittable disease. It estimates the proportion of death from the disease to the total number of cases diagnosed with the disease [14].

Susceptible-infected-removed method (SIR):

One of the fundamental epidemiological models that illustrate the dynamic of an infective epidemic. It divides a homogenous and isolated population into three categories of susceptible which are expected to get infected and infected tend to be removed (die/recover) [14]. It is well-thought-out the simplest prototype that contributes an extremely limited dynamics to capture the complexity of the outbreak by fixing certain parameters such as the contact rate and removal rate [14]. Wang, N. *et al.* in his recent publication showed an extended version of the SIR model by Chen *et al.* and Biswas *et al.* were [14]:

Chen *et al.* propose a time-dependent SIR model to estimate the number of confirmed cases by converting it to a discrete-time model using two-time series data i.e. transmission rate and the recovery rate at time t.

Biswas *et al.* combined the SIR model with the Euclidean network which can develop better reliability based on the data in China.

Basic reproduction number (R_0):

A crucial indicator in epidemiology to signify whether an infectious disease develops into an epidemic or not [14]. Mathematically, if R_0 is higher than one then the epidemic spread rapidly, and if less than one then it proliferates slowly and disappears before everyone gets infected [14].

$$R_0 = C * \beta * D \quad [15]$$

Where,

R_0 = Basic Reproductive number

C = Acquisition rate of new contacts

β = Probability of transmission during a single contact

D = Duration of contagiousness

Here, are some R_0 values for Disease outbreak [16]:

Disease outbreak	R_0
SARS	2-5
H1N1	1.4-1.6
Ebola	1.50-2.67
MERS-CoV	0.6-1.3
COVID-19	3.58

Asymptomatic transmission:

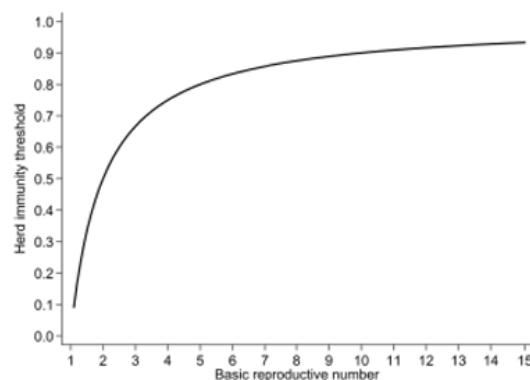
Asymptomatic cases are the inadequate capacity of testing and unawareness of infections where the massive number of people have no symptoms [14]. It is the most challenging part in monitoring the ongoing COVID-19 epidemic [14]. The basic SIR model is extended to the

SEIR model with a practical approach to model a disease in a substantial incubation period when the exposed person is not yet infectious [14].

Herd Immunity:

Is a fundamental concept in epidemic theory regarding the population-level effect of individual immunity to prevent transmission [14]. Herd immunity in a population is only considered if a sufficiently large proportion of the population possesses immunity against the virus so the chance of active contact between infected and susceptible is minimized [14]. The herd effect is achieved in an indirect effect of vaccination where not only non-immunized individuals are protected but also there is a decrease in the number of individuals who spread infection [15].

Relationship between R_0 and herd immunity [15]: Below figure shows higher the basic reproductive number higher is the threshold to reach herd immunity [15].



Wangping, J. *et al.* in his recent publication articulates that mathematical models play a key role in determining the type and intensity of disease intervention, prediction, and controlling the disease like COVID-19 [17].

III. MODELING THE ECONOMIC IMPACT:

Wuhan the epicenter of the outbreak in China which is a hub from car manufacturing plants (General Motors, Hyundai, Toyota) to multinational companies (Apple, Alphabet, Starbucks, McDonald's, and Proctor and Gamble) have closed production facilities, offices, travel restrictions (decline in air travel demand) for countries like Iran, Italy, South Korea, and Japan also by a government apart from China which exposed global economies to risk [16]. The decline in economic activity leads to [16]:

- Fall in share prices and commodity prices
- Stock markets around the world suffer
- Collective loss in one week from February 21, 2020, to 28,2020 of \$444 billion of the world's 500 richest people

A. Agent-Based Model (ABM)

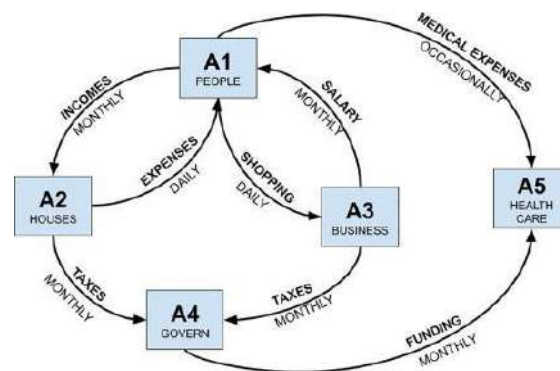
Silva, C.L.P. *et al.* in his recent publication developed an Agent-based Model (ABM) that aims to [18]:

- a) Simulate the dynamics of COVID-19 epidemics
- b) Epidemiological and economic effects of social distancing interventions
- c) Emulate a closed society living in a shared environment, consisting of agents (people, houses, business, government, and healthcare system) each with specific attributes and behavior.
- d) Model the economy which can help us estimate the economic impact under different types of interventions by changing the simulation environmental variables and measuring their effects.

- e) As a useful tool to assist politicians and health authorities in planning their action against the pandemic.

The main contributions and findings of the Agent-based Model highlighted by Silva, C.L.P., et al. are [18]:

- 1) Simulate using the society of agents
- 2) Assessing economic effects of seven different scenarios –
 - Do nothing
 - Lockdown
 - Conditional lockdown
 - Vertical isolation
 - Partial isolation
 - Use of facemasks
 - 50% adhesion to social isolation along with the use of facemasks
- 3) Simulation supports the lockdown and the conditional lockdown to achieve the primary goal in terms of controlling the number of infected and deaths. The lockdown period presents the worst economic loss to the industry with potential unemployment and recession.
- 4) Simulations present additional evidence the vertical-isolation does not work though it is the policy advocated by some governments like the Brazilian.
- 5) Combining the use of facemasks and partial isolation of the population could be good and more realistic for implementing in terms of social cooperation. This scenario flattens the infection curve and has a smoother effect on the economy than the lockdown scenario.
- 6) To simulate using SEIR agent-based model for the health and economic impact of COVID-19



Agent-based model

B. Seven scenarios using ABM:

Silva, C.L.P. et al. discussed different scenarios and how they impacted the economy using the Agent-Based Model [18].

Baseline scenario: It illustrates population A1 and government A4 are losing wealth and the businesses A3 are floating at the equilibrium point that is when income and expenses are equal. Initially, A3 is profiting but in the accounting day, profits are settled by the labor and tax expenses [18]. The baseline scenario is consistent with economic predictions [18].

Scenario 1: do nothing

If the government decides not to take any actions against the spread of COVID-19 so this decision only targets an economic point of view [18].

Scenario 2: Lockdown

As per WHO recommendations complete social isolation during a precise date range where all A1 agents (people) are kept in their houses with the main goal to save as many lives as possible by minimizing viral spread [18]. In healthcare terms, this scenario is highly conservative whereas worst for the industry as A1 agents cannot produce wealth but keep receiving their labor incomes [18]. As the entire population stays in lockdown for a predefined period A3 (business) does not have income but keeps paying taxes to A4 and labor expenses to A1 resulting in a loss of 20% of its GDP share after two months [18]. A4 can adopt economical countermeasures as tax exemptions and universal income to minimize wealth loss [18].

Scenario 3: Conditional Lockdown

The same restrictions of mobility but less conservative than scenario 2 and are imposed conditionally [18]. It depends on an effective healthcare system capable of carrying out necessary tests in A1 and granting reliability in I_t (% of infected agents in a population) [18].

Scenario 4: Vertical Isolation

A name was given to social intervention policy advocated by the Brazilian president where- [18]

- a) Known infected people and known risk groups (elderly and people with pre-existing disease)- are kept in isolation.
- b) Young people and adults are allowed to work regularly

People over 65, below 18 years of age and symptomatic irrespective of age stay at home. The assumption of this policy showed ineffectively and almost the same epidemiological and economical results of scenario 1 i.e. people outside the risk group would not develop a severe case of disease [18].

Scenario 5: Partial isolation

In scenario 2 and 3 mobility of all agents is restricted necessitating restrictive public policies enforced by the government which if not taken seriously by the entire population partial isolation levels are reached which means the percent of the population that is fulfilling the isolation while the remaining is not [18].

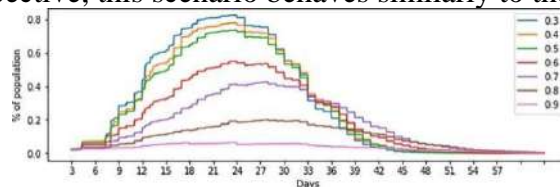
Partial isolation level $IL \in [0,1]$

Scenario 0 and 1 have $IL \leq 0.1$

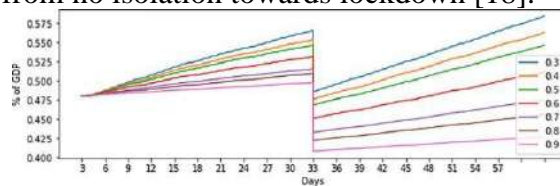
Scenario 4 have $IL \approx 0.2$ because of age distribution and the definition of risk groups [18].

Scenario 5 aims to assess the effect of intermediate IL s, and simulated by randomly choosing agents A1 with probability $IL \leftarrow 0.5$ which is not epidemiologically effective, and a level of isolation greater than $IL \leftarrow 0.5$ is recommended [18].

From an economic perspective, this scenario behaves similarly to the baseline [18].



In the above figure Infection curve, I_t (% of infected agents in population) flattens as the isolation level increases from no isolation towards lockdown [18].



As the value of Isolation Level (IL) increases wealth loss of agent A3 is higher which screen the position of agent mobility in the economy [18].

Scenario 6: Use of facemasks

Without imposing any mobility restrictions on agents this scenario represents the policy of mandatory use of face masks and physical distancing [18]. It was implemented [18]:

Reducing the contagion disease $\beta_1 = 0.5$

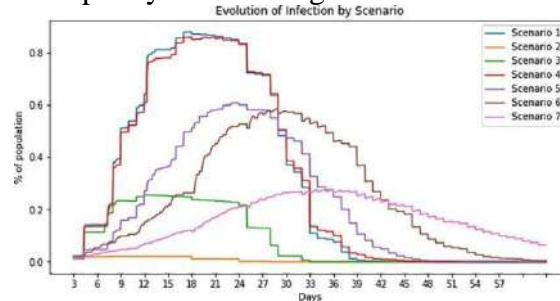
Contagion rate $\beta_2 = 0.3$ as the effect of using masks and physical distancing

Scenario 7: Use of face masks and 50% of isolation

It combines the policies used in scenario 5 and 6 implemented by using $\beta_1 = 0.5$, $\beta_2 = 0.3$, and $IL = 0.5$ (β_1 : Contagion distance, β_2 : Contagion probability)

Here, I_t is flattened and the economy despite the downturn suffers less than in the scenario with lockdown [18].

Comparing I_t (percentage of infected agents in population) value of all seven scenarios and the effect of each intervention policy in flattening the curve can be seen below [18]:



Scenario 2 and 3 have the best epidemiological values followed by scenario 7 [18].

From the citizen's point of view: Scenario 2 and 3 are not economically damaging whereas from a business perspective they are worst [18]. Expenses of government in the simulation are related to the cost of the healthcare system thus in scenarios with a high number of deaths like scenarios 1 and 4 costs of maintaining the healthcare system are increased which demands an increase of public expenses [18]. Below figure shows the economic result of each scenario by response variable [18]:

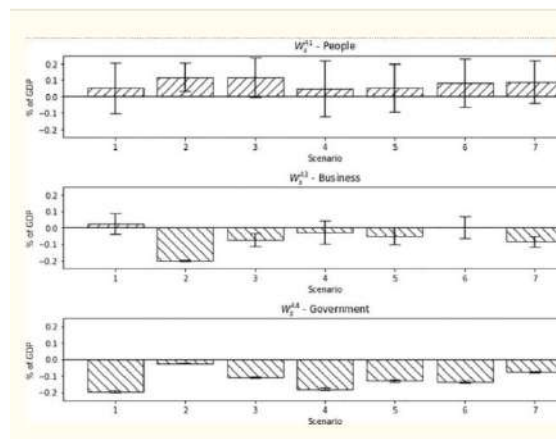
Economic variables [18]:

W_s^{A1} : Percentage of Gross Domestic Product owned by the people (A1 agents) at time t under scenario S

W_s^{A3} : Percentage of Gross Domestic Product owned by businesses (A3 agents) at time t under scenario S

W_s^{A4} : Percentage of Gross Domestic Product owned by the government (A4 agent) at time t under scenario S

Picture 5: shows the economic result of each scenario for A1, A3, and A4



Scenario 2 from a life preservation perspective is best but worst financially for business [18]. The best solution is presented in scenario 7 for both government and people with the lowest number of deaths and optimal solutions for business [18]. Appropriate pandemic-spread scenario simulations deliver administrative ethics for suppression and mitigation policy developments [19].

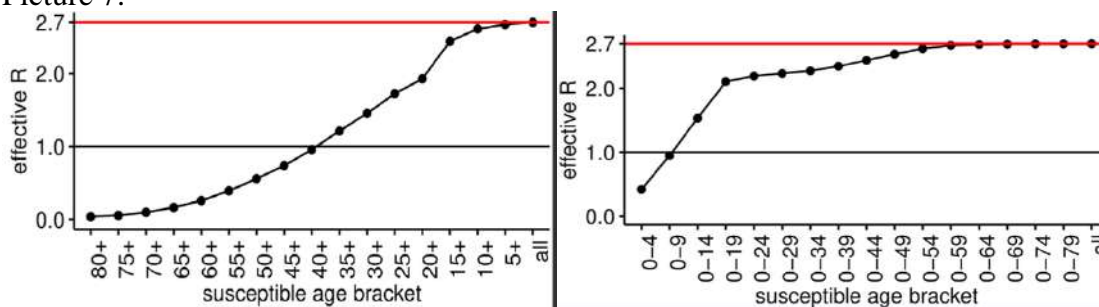
IV. AGE-TARGETED MITIGATION STRATEGIES:

Chikina, M., and Pegden, W. in their recent article modeled the effect of age-targeted heterogenous mitigation strategies which are likely to condense mortalities and ICU use for natural parameter selections [20]. They also highlighted that COVID-19 depends on the unplanned age-specific mortality rate that is very strongly anti-correlated with age-specific contact patterns during the period of normal social interaction [20].

The basic consequence of contact pattern is [20]:

Disease spread by contact whose pattern is captured by methods like POLYMOD study, Demographic Household Surveys (DHS) and with an effective moderate range of R_0 (2-3) where an older population cannot sustain a pandemic on its own but the younger population can withstand even in a hypothetical condition where an entire older population is immune.

Picture 7:



It shows effective $R_0=2.7$ people above a certain age are susceptible. Picture 8:

This shows people under a certain age are susceptible. Thus, a relatively small number of young individuals suffice to achieve a large R_0 while it takes a very large bracket of the older population to cross the epidemic threshold [20].

Another distinctive feature of COVID is the strong association of a high fatality rate with age [20].

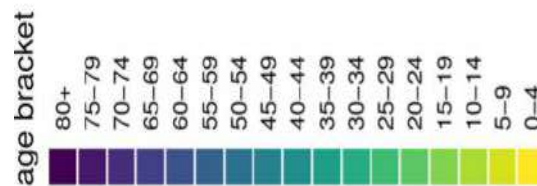
Age-group	Hospitalization rate	ICU rate for hospitalized cases	IFR
0 to 9	0.1%	5.0%	0.002%
10 to 19	0.3%	5.0%	0.006%
20 to 29	1.2%	5.0%	0.03%
30 to 39	3.2%	5.0%	0.08%
40 to 49	4.9%	6.3%	0.15%
50 to 59	10.2%	12.2%	0.60%
60 to 69	16.6%	27.4%	2.2%
70 to 79	24.3%	43.2%	5.1%
80+	27.3%	70.9%	9.3%

Picture 9: (IFR: Infection Fatality Rate)

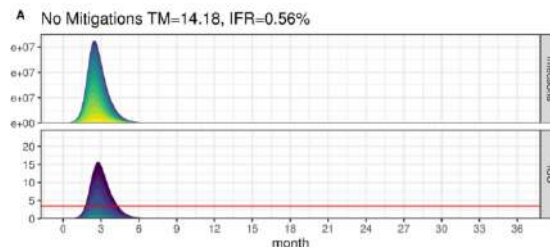
The infected/immune population to consist of younger individuals with a lower fatality rate means vaccines with high effectiveness only in younger individuals yet to be expected to have a large effect at the population level [20].

Chikina, M., and Pegden, W. articulates infection by age-distribution can be shifted by mitigation strategies which they showed by simulating in susceptible population size of roughly $3 \cdot 10^8$ an initial infection affecting 100,000 individuals by assuming normal transmission levels that are linearly continued between 9- and 15- month mark from the start of simulation [20].

Epidemic in the *absence* of mitigation strategies [20]: Picture 10:

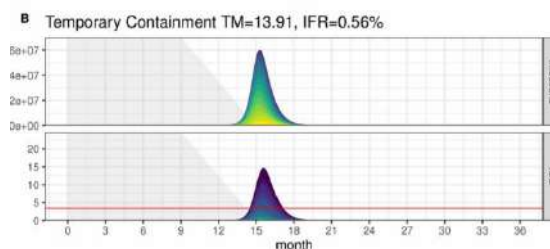


Picture 11:



Epidemic in the *presence* of mitigation strategies:

Picture 12: shows containment followed by a resumption in transmission level between 9 and 15 months



Each figure shows [20]:

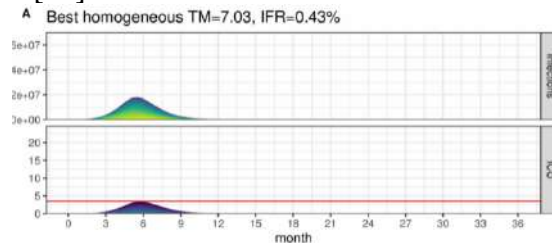
Size of the infected population and ICU utilization over time by age group.

TM: Total mortality

IFR: Infection fatality rate

Light grey shading is the reminder that the normal transmission rate linearly resumes between 9- and 15- month marks.

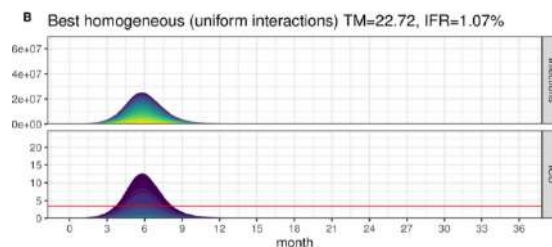
Subsequently, they showed the power of mitigation with natural relative contact patterns and without the contact matrix [20]:



Picture 13:

The above figure shows the outcome of optimal homogenous measures. Here, transmission reductions by 40% are equally applied to all age groups and then gradually resumed which minimizes deaths by nearly 50%.

Picture 14:



This figure shows the outcome of the same mitigations ignoring the role of natural contact patterns in the population. In this scenario, 2.5 times more mortality is seen as here probability of two people of different ages interacting is determined just by the relative sizes of the populations of the age groups [20]. ICU utilization is given away by a factor of 10,000/total population that is ICU utilization figure is ICU capacity per 10,000 people with the red line in the above figure shows a nominal capacity level of 3.47 beds per 10,000 people [20].

For each of the above scenarios, age-targeted mitigations can be seen from the potential to decrease IFR by shifting the age-distribution of the infected population [20].

A. Impact of Age-targeted mitigations:

Consider, relaxing mitigations on those under 40, 50, and 60 [20].

Targeted mitigations are based on the household level of risks considering only 2/3 of the younger population is subject to normal transmission levels [20].

Assuming, the relaxed population is the focus to normal transmission level, while transmission to, from, and within is dejected by 70% from normal levels.

Picture 15:

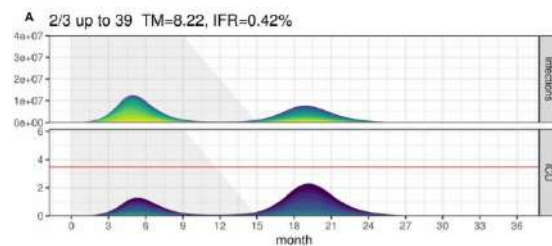


Fig. 1 shows 2/3 under 39 released at normal levels

Picture 16:



Fig.1(a) above shows all under 39 released at normal levels

Picture 17:

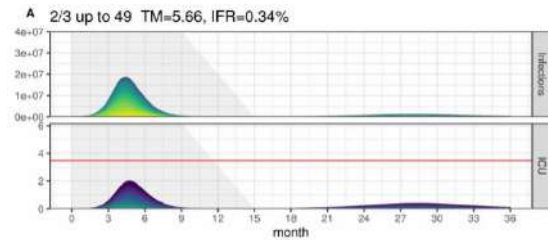


Fig.2 shows 2/3 under 49 released at normal levels

Picture 18:

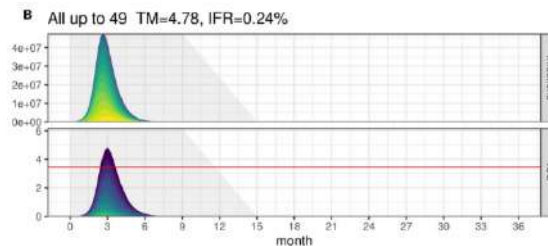


Fig.2 (a) above shows all under 49 released at a normal level

Picture 19:

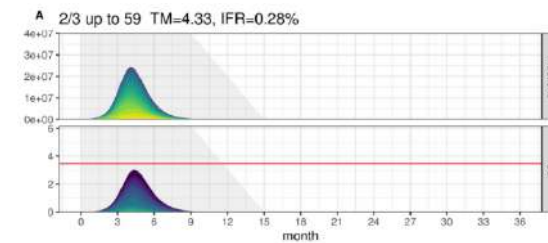


Fig.3 shows 2/3 under 59 released at normal levels

Picture 20:

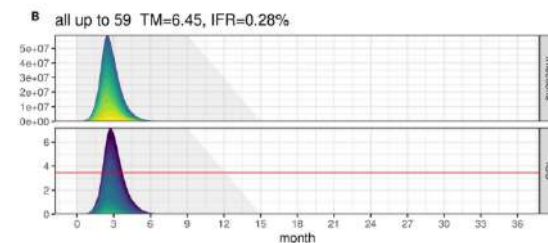


Fig.3 (a) above shows all under 59 released at normal levels

All Figures. 1, 1(a), 2, 2(a), 3, 3(a) conclude [20]:

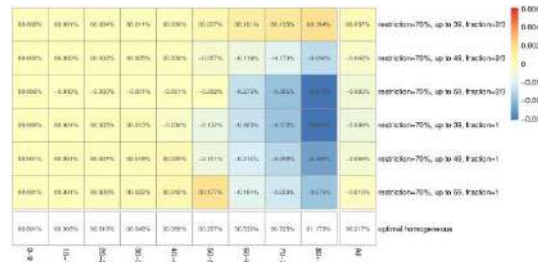
- Age-targeting is likely to reduce total mortality linked to optimum choices for homogenous measures.
- Best policies for age-targeting are subtle to the segment of the younger population which can be released.

Initially, if too few people are released a second wave arises when the transmission level proceeds to normal [20].

If too many people are released ICU utilization is high in first wave thus ideal choice for age cut off rest on the fraction of people, we suppose below the age cut off essentially be released [20].

Chikina, M., Pegden, W. modeled the impact of age-targeted restrictions reduce mortality among the older population with a very small impact on the younger population [20].

Picture 21:



<https://doi.org/10.1371/journal.pone.0236237.g007>

The above figure shows the Impact on mortalities by age group (in a group of 10 years) [20]. Age-targeted mitigations have a dramatic effect both on the mortality and ICU utilization through good strategies exist but as long strict or very strict mitigations on the restricted group are applied the precise choices which minimize ICU utilization and deaths are sensitive [20]. The qualitative finding of this model reveals a powerful effect on both mortality and ICU utilization even if the relative transmission rate among age groups finally normalize [20]. Chikina, M., Pegden, W. modeled two-stage strategies [20]:

- Responsiveness of initial relaxations to conditions on the ground
- Proceed thoughtfully and ideally on return to the normal

V. CONCLUSION

To study implications new model Θ -SEIHRD addressed by Ivora, B. *et al.*, with various simulations to evaluate the spread of disease are highlighted with an approach that considers the fraction of detected cases over the real total infected cases [11]. Then discussed what is R_0 as the characteristics of the epidemic are governed by the ratio of $R_0 = \beta/\alpha$ (transmission per recovery) where β is a constant capturing the frequency of transmission events and α is a constant capturing the frequency of recovery/removal events [20]. The epidemiological and economical effects of COVID-19 are simulated by the Agent-Based Model (ABM) where seven different scenarios were elaborated to reflect specific social intervention [18]. This paper focuses on the way to respond to COVID-19 by using containment measures to delay the epidemic until a vaccine is possible, yet it may involve risks and unknown like achieving immunity by infection to reach herd immunity though based on well-understood principles but cannot prevent all deaths, using other technologies or approaches like aggressive contact tracing, testing/quarantine on a massive scale which may allow us to suppress an epidemic indefinitely [20]. Here, we talked about compartmental models which are the simplest model like the SIR model that describes the progression of an epidemic through a system of differential equations operating on compartment in a population [20]. Age-targeted mitigation strategies have the potential to greatly reduce the mortality and ICU utilization for COVID-19 [20].

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IMPACT OF THE COVID-19: OUTBREAK ON DIGITAL PAYMENTS IN INDIA

Sonia Chawla and Shani Kumar

ABSTRACT

Due to societal distancing conventions and national lockdowns, the Covid-19 pandemic has contributed to an imminent increase in the use of new technology. All around the globe, individuals and organizations have had to transition to new ways of working and living. The continued use of mobile-based payment systems as a technique to sustain social distancing

must reign as the propagation of Covid-19 is anticipated to continue for a long time. A novel attempt was made to define the adoption and continuity of mobile-based payment to curb the spread of the Covid-19 outbreak as a preventive care conduct. This paper offers a critical analysis of the pandemic's catalog of negative and positive impacts and provides insights into how it can be useful. Shifting from physical banking transactions to mobile based transactions can be used as a method of social distancing that helps to prevent the spread of the Covid-19 virus on basis of previous literature review. Due to societal distancing conventions and national lockdowns, the Covid-19 pandemic has contributed to an imminent increase in the use of new technology. All around the globe, individuals and organizations have had to transition to new ways of working and living. Individuals and organizations should be ready to adopt potential outcomes of the new surge and the challenges of digital payments that occur.

Keywords– Digital payments, Covid-19, Mobile based payments,

I. INTRODUCTION

COVID-19's continued spread has been one of the major threats to the world economy and capital markets. India, like many countries around the world, is taking many steps to reduce the effects of the coronavirus epidemic, including a national lockdown; restricting the travel of the entire population; closing down public places and transport; and advising the public to remain indoors, retain social isolation, and function from home. The ensuing economic instability is immense, and the short-term drop in market investment, both big and small, is substantial (Sreelakshmi and Prathap, 2020). The financial future of the digital payments market is no different, with economic growth predicted to be seriously impacted, and it will follow a similar trend, at least in the short term. However, the resilience and creativity potential of the sector will play an invaluable role in restarting the economy under the new standard.

With the spread of the pandemic, lockdowns have been implemented in almost all regions, shutting down activities requiring human gathering and interaction, including colleges, schools, malls, temples, offices, airports, and railway stations (Rajkumar, 2020). The lockdown has resulted in most individuals from home turning to the internet and internet-based facilities to connect, connect, and proceed with their job duties. Compared to pre-lockdown stages, Internet providers have seen growth in use from 40 percent to 100 percent. Video conferencing systems such as Zoom have seen a 10-fold growth in use, and content management systems such as Akamai have seen a 30% growth in content utilization (Branscombe, 2020).

The COVID-19 pandemic's adverse impacts are trickling down to large sectors of the Indian economy, with engineering, aerospace, banking, aviation and hospitality bearing the brunt of the lockout. This, in effect, has influenced fast-growing digital payments that are closely related to the sectors listed above. Shut down stores, travel bans and decreased customer leisure spending (on eating out, movies, sports, and so on) have a more adverse effect on digital payments (Auer et al, 2020). The global digital payments market is expected to grow from \$3,885.6 billion in 2019 to about \$5,439.8 billion in 2020. People are using digital payment options to avoid contact and spread of infection through direct cash handling, and also to adhere to social distancing to curb the spread of Covid-19. Because of the closing of traditional market places and in order to prevent mass events, customers tend to buy vital goods online, which in turn raises demand for the digital payment market. At a CAGR of 20

percent by 2023, the industry is projected to stabilise and hit \$8,059.3 billion (Digital Payments Global Market Report 2020).

While the pandemic is now receding and stabilising in several countries at the end of May 2020, it is also on the rise in many others, with significant challenges. In most nations, analysts are mindful of the risk of re-emergence of the disease outbreak, and that lockdown norms should be cautiously and steadily eased with social isolation at the centre of the new standard.

The goal of this analysis is to explain the attention paid to digital payment mechanisms in science literature and to examine the effect of M- payment purchases on the battle against the pandemic of Covid19. The purpose of this analysis is to explain the attention given to digital payment systems in the science literature and to examine the effect of digital payment on the Covid19 pandemic war. We explore the effect of the Covid-19 pandemic on the use of digital payments in the next section, where we discuss some potential post-pandemic environment scenarios and research concerns. The next section summarizes the ramifications for science and practice, and we discuss our findings in the last section.

II Scenarios and research issues of the digital payment surge Review Stage

The pandemic phase in Covid-19 has been a global intrusion and its implications on which positive and negative conversions to be realised in India are addressed. Not all areas of the economy have been similarly impacted by this process. Therefore, many lockdown steps have been taken globally. Economic instability has become unavoidable in this phase and large or small companies have suffered a decline in operation. In the other hand, some problems have started to emerge in the financial market. The financial viewpoint of the digital payments market is no different in terms of projected economic growth worldwide. Cash transfers have lead to unparalleled public fears during the pandemic phase. Most importantly, there are major variations in these priorities across continents. A important research by (Zhang et al, 2020) has been published. They indicated that the Covid-19 pandemic resulted in the possibility of the global financial market growing.

The use of information technologies has strengthened and provided facilities in the digital payment system before and since the pandemic. Contactless payment ideas have arisen in recent years as an alternative to conventional currencies in digital convergence technologies; digital wallets and digital currencies. In order to send and accept money electronically, these digital platforms have made it easier for everyone to register to have a digital wallet or payment system. In this phase, both "money" and "virus" words have crossed the highest number of internet searches (Upadhyay, 2020).

Digital money

In the post-pandemic case, digital payments and digital currencies are expected to play a central role. Since digital payments are contact-less, policymakers will promote them and will therefore see a spike. The gig economics and work-from-home (WFH) conditions will also improve this. There are two distinct digital money-related phenomena that during the pandemic helped the war. Only, it was believed that banknotes and coins contained the virus and that 'dirty money' was preferred to digital payment (Gardner, 2020; Samantha, 2020). Online distribution providers have allowed clients to make payments via digital payment systems such as a credit / debit card or mobile payment, with government mandates in many parts of India (Bhandari, 2020).

India's digital payments market, which by fiscal year 2025 would have crossed Rs 6,464 trillion at a CAGR of 25 percent, is now expected to record a growth rate of 27 percent to

cross Rs 7,092 trillion in volumes in five years, powered largely by increased acceptance of mobile payments (Manikaran & Shrivastava 2020).

This is expected to lead to an expansion in the use of digital payments, leading to work on the diffusion of digital payment technologies. Second, there was a lack of jobs after the lockdown, and governments supplied assistance through payments platforms and automated payment forms. As seen in past crisis relief cases as well, these are a convenient form of fund transfer from donors to recipients (Pollach, Treiblmaier, & Floh, 2005).

Mobile Payments

Mobile payment is defined as any financial process that is made using a cell phone. Mobile payment offers users different advantages such as one-click payment option, no hassle carrying cash, fast monitoring of minor expenditures, 24/7 possibilities of payment anywhere, deals, discounts and cashback incentives and, most notably, safe. (Shah et al, 2016) observed that India's readiness to accept digital payments was primarily based on comfort followed by great prices, incentives and cash returns. They also noted that Indian customers have started using digital payments for offline point-of - sale; however, the habit of using currency, the sophistication of digital payment methods and the small scope were major hindrances to its expansion. With digital payment, which contributed 8% to the overall volume of global retail payment transactions in 2015, it is expected to rise to 24% by 2020. UPI has risen from 11.63 million in volume terms in July 2017 to 1,497.36 million in July 2020, as per data given by NPCI. The amount rose from Rs 3,411.35 crore to Rs 2,90,537.86 crore in the same period in terms of transaction volume. In addition, year-on-year growth has doubled from Rs 146,386.64 crore in July 2019 to Rs 2,90,537.86 crore in July 2020 in terms of transaction volume (Venugopal 2020).

The pandemic of Covid-19 began to influence global, environmental, social, psychological problems all over the world. New lifestyles and revolutionary innovations have arisen as a result of this effect on new behaviors. In this article, the position of digital payments, mobile wallets and mobile payments during this time has been highlighted. As is well established, the key goals of digital payment systems are: to ensure consistency in transactions of interbank money, to mitigate the cost of payment, to promote the handling of money and to provide the financial sector the ability to deliver new services (Pandey and Pal, 2020).

Increasing digitalization

If the use of video and audio conferencing technologies grows dramatically, to prepare for the boom, companies can scale up their technology infrastructure. This will lead to greater capacity growth purchases, network infrastructure, and applications that leverages cloud technology. With workers being acclimatised to the principle of work-from - home (WFH), meeting and transacting online, businesses will change as a rule rather than an exception to WFH. Many companies (Akala, 2020; Khetarpal, 2020), who have the digital infrastructure in place to manage the load and bandwidth required, are embracing this.

Internet access and digital divide

In the post-pandemic scenario, information technology, and especially the internet, will remain key, where creativity will drive the increase in usage. The management and governance of the internet itself would be a crucial feature of this boom. Since the internet is a global resource and its protocols and functionality cannot be managed by any government, its local access and availability remain an in-country concern. Few nations, for several reasons, have blocked access to the internet during the pandemic (Chhibber, 2020).

After the pandemic, oversight of the internet will become important as it will be a policy

instrument for policymakers. They will intercede on tracking, management of bandwidth, security, intermediary accountability, and e-commerce aspects. The pandemic has brought the world to a position where complete deprivation is faced by those not connected to the internet. With rigid social and physical measurements of distance in place, modern routines enable most programmes to access the internet. Those on the opposite side of the digital divide are also totally left out. There are several explanations for the gap: unaffordable access to computers, unaffordable access to the Internet, importance of content, access abilities or Internet shutdowns mandated by the government (Armbrecht, 2016; Scheerder, van Deursen, & van Dijk, 2017).

III Implications for research and practice

- Continuing drive for digital payments: There will be a continuing drive from states, regulators and banks alike to embrace digital payments. As digital means gain traction and recognition and change from a luxury to a need, there will be a noticeable shift away from currency.
- Consumer behaviour: People's urgent survival fear, be it diet and/or drugs, is counteracting long-standing digital purchase apprehensions that could have hindered greater acceptance so far. There will be a marked change in market conduct, with digital payments continuing by a huge number of first-time adopters long after the present crisis ends.
- Tackle fraud: fraud will escalate with growing digital purchases, with fraudsters exploiting the growth of internet activity to threaten naive customers.
- Merchants and. Both stakeholders in the environment will need to improve risk control, use business analytics software and improve real-time monitoring.
- Systems are in motion, while still providing programmes for consumer knowledge. Often, tokenized transfers will see an increase.
- In these days, digital payments, once a pleasure, have become a requirement. With most of the industries leading to digital payments still in a state of flux, the long-term effect of COVID-19 on digital payments is still too early to assess.

IV Conclusion

Both first-timers and new-to-internet customers have accepted digital payments owing to the shutdown. In addition, many e-commerce firms, merchants, utility providers, and utilities are embracing contactless transactions and internet transfers to mitigate the cash handling danger of disclosure. This is in line with what customers have been urged to do by institutions such as the Reserve Bank of India and the National Payments Company of India. In both urban India and rural Bharat, the pandemic may well be the landmark moment for online purchases, the tipping point where digital payments are not just a protection but also a way of life.

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REVIEW ON ENHANCEMENT OF EFFICIENCY AND EFFECTIVENESS OF MATERIAL IN POLYETHYLENE TEREPHTHALATE RECYCLING PROCESS

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ABSTRACT

Just as we know how pollution is increasing in today's time and how it has led to climate change and sometime a catastrophe that no one can predict, e.g., Australia devastating bushfire, floods, heat waves, etc. seeing all this situation, the whole world needs to bring advancement in the field of pollution control and waste management. Existing process of this field need to be optimize with the help of new idea and new technologies. As we can realize that plastic is a material that play a big role in making human life comfortable. The discovery of plastic and its growing technology can also be attributed to the industrial revolution, but one of the major disadvantages of plastic is that it takes about 1000 year to decompose. Therefore, in the field of waste management, plastic waste management has a unique importance and need also, so with regard to plastic recycling, it is divided in to 7 rank. Beverages bottles, mineral bottles, syrup bottles (medical field), etc. Made from polyethylene terephthalate plastic. As this material is most likely for recycling which comes in 1 rank and step of waste management such as collection and segregation are very easy so in comparison to other plastic products.so its recycling process needs to be stepped up so that not a single bottle goes into the landfill. This necessities optimization of its recycling process. Generally the bottle consist of three parts body, cap and neck ring. It can be made using polyethylene terephthalate, high density polyethylene and polypropylene material. So it is challenging area to separate these materials during its recycling process. Thus many methods are available for segregation of plastic flacks but flotation method is mostly use for PET bottles recycling process. This research work has mostly focused on the improvement of material efficiency in recycling process of PET bottles.

Key words: PET recycling, sink-float separation, wetting reagent, material efficiency.

I INTRODUCTION

Introduction to Recycling

Recycling is the process of converting waste materials into new materials and objects. The recyclability of a material depends on its ability to reacquire the properties it had in its virgin state. It is an alternative to "conventional" waste disposal that can save material and help lower greenhouse gas emissions. Recycling can prevent the waste of potentially useful materials and reduce the consumption of fresh raw materials, thereby reducing: energy usage, air pollution, and water pollution. Who invented recycling? Nobody knows who exactly the very person to recycle was. But while sources are too unreliable to confirm its practice during the Bronze Age (from 3000 to 1000 B.C.), historians are nonetheless certain that **the principle of recycling came hand-in-hand with the development of the first human craftsmen.** However, some archaeological research projects have proven that proto-waste from Ancient Greece — around 400 B.C. — contained fewer used tools or broken vases during times of recession. This would imply that materials were systematically reused, and melted down to make new pieces.



International Symbol of Recycling

Recycling is a key component of modern waste reduction and is the third component of the "Reduce, Reuse, and Recycle" waste hierarchy. Thus, recycling aims at environmental

sustainability by substituting raw material inputs into and redirecting waste outputs out of the economic system.

Introduction to Plastic Recycling

Plastic recycling is the process of recovering scrap or waste plastic and reprocessing the material into useful products. Since the majority of plastic is non-biodegradable, recycling is a part of global efforts to reduce plastic in the waste stream, especially the approximately 8 million metric tons of waste plastic that enters the Earth's ocean every year. One of the largest recycling efforts of the 20th century happened of course during wars when governments demanded of their people to donate their unused metals, tires and even nylon, but the notion of recycling plastic came only after the environmental revolutions of 1960s. During those years people really started noticing the impact of plastic waste on environment, and started laying groundwork for future recycling efforts. First plastic waste recycling mill in the world was created in Conshohocken, Pennsylvania in 1972, marking the beginning for all future recycling plants. As years went by, government programs and eco-friendly communities slowly started to educate regular people into habit of recycling and forcing manufacturers to start producing easier to recycle plastic. Their efforts came to life during 1980s and 1990s with the adoption of PETE and HDPE plastic, which were designed with recycling in mind. These recyclable plastic products were introduced by Plastic Bottle Institute of the Society of the Plastics Industry and clearly marked on their containers by logo of triangle made of arrows. The process of recycling plastic is not as simple as recycling paper, glass and metals, because the greater number of steps involved for extracting dyes, fillers and other additives that can be found in "virgin" plastic. First step in their recycling is sorting by the type of resin that is in their structure (seven basic types) and in some cases additionally sorted by color. After that, plastic is chopped into small pieces, cleaned to remove debris and small residue, melted down and compressed into pellets named nurdles. These small pellets are then transported to plastic processing plants where they are introduced into manufacturing process. Broadly, there are two major ways to recycle plastic:

- I. Mechanical recycling (chop and wash), where the plastic is washed, ground into powders and melted.
- II. Chemical recycling, where the plastic is broken down into basic components.

But here major drawback is, Because of the complicated recycling process and unwillingness of people to properly dispose of their unwanted plastic, recycling rates of plastic lag far behind of other items such as paper, glass and metal. In 2008 only 6.5% (2.2 million tons) of post-consumer plastic waste was recycled, 7.7% (2.6 million tons) was burned for energy and 85.5% (28.9 million tons) went to landfills.

Resin Identification Code

The International Resin Identification Coding System is a set of symbols appearing on plastic products that identify the plastic resin out of which the product is made. It was developed in 1988 by the Society of the Plastics Industry Association in the United States, but since 2008 it has been administered by ASTM International, an international standards organization. In its original form, the symbols used as part of the RIC consisted of arrows that cycle clockwise to form a triangle that encloses a number. The number broadly refers to the type of plastic used in the product, by chronological order of when that plastic became recyclable:

1. "1" signifies that the product is made out of polyethylene terephthalate (PET) (beverage bottles, cups, other packaging, etc.)
2. "2" signifies high-density polyethylene (HDPE) (bottles, cups, milk jugs, etc.)

3. "3" signifies polyvinyl chloride (PVC) (pipes, siding, flooring, etc.)
4. "4" signifies low-density polyethylene (LDPE) (plastic bags, six-pack rings, tubing, etc.)
5. "5" signifies polypropylene (PP) (auto parts, industrial fibres, food containers, etc.)
6. "6" signifies polystyrene (PS) (plastic utensils, Styrofoam, cafeteria trays, etc.)
7. "7" signifies other plastics, such as acrylic, nylon, polycarbonate and polylactic acid (PLA).

Introduction to PET Bottle

Nathaniel C. Wyeth is an American inventor and chemical engineer who was invented PET plastic bottle in 1973. PET, which stands for *polyethylene terephthalate*, is a form of polyester. It is extruded or molded into plastic bottles. Like glass, PET is hygienic, strong, and resistant to attack by micro-organisms, does not react with foods or beverages, and will not biologically degrade. Its safety for food and beverage use is recognized by health authorities around the world. But unlike glass, PET is extremely lightweight, simple to transport and won't break, which is why it's preferred for packaging many foods and beverages. That is why many soda and bottled water companies use PET bottles rather than glass bottles.



Resin Identification Code for Polyethylene Terephthalate Plastic

Here is a list of some companies that are major PET bottle producers

1. Coca-Cola
2. PepsiCo
3. Nestle
4. Danone
5. Arizona beverages, etc...

1.2 Statistic of Production and Recycling of PET Bottles

If we talk about today, a total of 583.3 billion PET bottles being produced per year, were in 2014 there was 475 billion and in 2016 there was 485 billion bottles produced.

Country	Recycling rate (%)
India	90
Japan	72
US	29
China	82
Germany	97
UK	57

And if we talk about PET bottles recycling rate globally, And total 52% PET bottles gets recycled in all over the world.

II PET BOTTLES RECYCLING PROCESS

PET bottles are made of 100% recyclable plastic resin. It is a form of polyester. It is a polymer, created by the combination of two monomers: modified ethylene glycol and purified terephthalic acid. Life Cycle Assessment of the PET bottles is divided into two part, which are following...

Outbound Logistics

The first step in PET recycling is the collection of bottles. Collection process vary for different country. As in developing country like India, large portion of collection is done via rag pickers while in developed country, collection of PET bottles is done by “curb-side” recycling where trucks come to pick up the blue recycle bin and via recycling centre drop-offs. For curb-side recycling, often referred to as “single stream” recycling, all types of recyclables are placed into a single bin and trucked to a materials recovery facility for sorting. Recyclable materials may include glass, aluminium cans, plastic bottles, and paper/cardboard. This mixed stream of recyclables are partially sorted manually and partially via recycling machinery such as a trommel, eddy current separator, and more. Once collected and sorted at the MRF, the plastic bottles are baled into large compacted bundles and sent to a PET bottle recycling plant either locally or abroad for processing into “hot-washed” PET flakes.

Inbound Logistics

In this section, we will focus on the process inside the recycling plant. When the plastic bottles arrive at a PET recycling plant, they are usually in large bales that have already been separated by colour. The goal of a PET bottle recycling plant is to recover these dirty plastic bottles, thoroughly shredding, separating and cleaning them so they can be reused. At the same time, various contaminants must also be separated such as the plastic labels wrapped around each bottle. To clean the PET bottles, a series of recycling machinery must be used. This series of machinery, either fully or partially automated, is often times referred to as a PET bottle recycling line. There are five phases that the bottles go through including sorting, shredding separating, washing, and drying. For a standard, fully automated PET washing line, the first piece of equipment is a “debaling machine” that takes large, compacted bales of PET bottles and breaks them loose so the bottles flow freely onto a belt conveyor which leads to a large trommel separation machine. The trommel, a large rotating tunnel with holes smaller than the standard PET bottle, is a robust piece of machinery for removing small contaminants from the material stream. As most plastic bottles come from MRFs, it is likely for the bales to contain various small contaminants such as broken glass, metals, rocks, paper/cardboard, etc. that are leftover from the sorting of “single stream recycling” materials. These small contaminants fall through the holes on the trommel while PET bottles move forward in a steady flow. An accurate way to removing contaminants from the material stream is via manual sorting. For instance, a 1 gallon milk bottle (these are made from HDPE) would have made it pass the trommel process, however, this is considered a contaminant since it’s not made of PET plastic. The material stream now enters long rows of belt conveyors where attendants standing on both sides of the conveyor pluck out contaminants manually before the bottles are cut down (shredding) into small pieces. A granulator is used to cut PET bottles into small pieces of plastic shred often referred to as “PET flakes” that are 6-12mm in size. As wet granulators are often used in this process where a stream of water is sprayed onto the bottles as it is being cut, a wet granulator acts as the first stage in the washing process. The PET flakes at this time still require a lot of work before it can be recycled into a new product. To continue the sorting process, the flakes are subjected to an air classifier where lighter materials are removed from heavier ones. This is accomplished by blowing the material

stream with a column of pressurized air. In PET recycling, the use of an air classifier effectively blows the plastic film labels away from the heavier PET plastic. Now that the bottle labels have been removed, it's time to remove other material of the bottle caps and neck ring which are made from PP/HDPE plastic (polypropylene and high density polyethylene). This is actually a process where the material stream is subjected to a large tank of water, in a recycling line, this tank is often called a float/sink separation tank. Sink float separation tank uses the density of water to accomplish separation. Water has the density of 1 g/cm³, any material that has a greater density will sink while material with lesser density will float. In the case of PET bottle recycling, when the stream of material enters the sink float separation tank filled with water, PET plastic will sink to the bottom while PP/HDPE plastic will float to the top. Specially designed rotating drums move the floating material (the contamination) forward into a storage silo for collection. Screw conveyors operate at the bottom of the separation tank collecting the PET flakes which moves forward onto the next piece of machinery. At this time, this relatively pure stream of PET flakes will enter its first, official washing machinery, the hot boiler/steamer washer which uses hot water with the addition of a caustic or similar solution to remove glues, grease, oils, and left over liquids/foods stuck to the bottles. As these contaminants are broken down in the hot washer, a secondary cold friction washer is used to further scrub the PET flakes. Via these two pieces of washing equipment, the PET flakes are now perfectly clean and is ready for drying.

To actually reuse the PET flakes, it must be dry since melting PET flakes with water inside will leave air bubbles in the final product which is not desirable. Hence, an elaborate drying system must be implemented to efficiently get rid of all the water. The first step is the use of a de-watering machine which uses centrifugal force to spin away a large portion of the water. Further drying is done by a dehydration process where thermal heaters are used to bake the PET flakes down to moisture levels below 1 percent.

At the end of a PET bottle recycling line are clean, contaminant-free PET flakes ready for use in the manufacturing of various recycled products.

III TYPES OF METHOD INCLUDED IN THE REVIEW

Combine Systeme with DDA or PVA Regent

The separation of polyethylene terephthalate (PET)–polyethylene (PE) and polyethylene terephthalate (PET)–polypropylene (PP) mixtures was studied in order to improve the grade of the raw input used in PET bottle recycling. First, PET bottles and their caps (made of PE or PP) were shredded and the floatability of each polymer was tested. Even with the addition of the wetting reagents dodecylamine acetate (DAA) or polyvinyl alcohol (PVA), the results did not suggest that the required 99.995% purity of PET plastic could not be achieved by floatation. Second, the mixtures were separated with a sink–float process using a drum separator. Finally, as the required purity of PET could not be obtained by either technique alone, a system utilising a combination of the two processes was developed.

Flotation with PVA Regent

Saitoh et al. (1976) reported flotation of mixed plastics utilizing selective wetting characteristics in order to change the surface of specific plastics from hydrophobic to hydrophilic. Using this technique, plastics were collected with recovery approx. 75% and purity approx. 81%. Also studied flotation of plastics. Employing polyvinyl alcohol (PVA) of relatively low degree of polymerization, he reported a successful separation of PP from PE.

PVC/ PP/ POM/ PPE Separation with Common Wetting Regent

Shibata et al. (2004) successfully separated four different types of plastics, namely polyvinyl chloride (PVC), polycarbonate (PC), polyacetal (POM) and polyphenylene (PPE), using common wetting reagents like sodium ligninsulfonate, tannic acid, Aerosol OT and saponin. At first, floatability of individual plastics was measured by means of column flotation in the presence of various depressants, and a three-step process was then developed. The first step of the process involved heavy media separation to obtain a float product of PPE having purity and recovery of 100%, respectively. Subsequently, the PVC concentrate of 95.7% purity was separated by flotation during the second step using sodium lignin sulfonate depressant. Finally, the float product with 87.6% POM and the sink product with 90.3% PC were obtained at the third step of the process by means of flotation in the presence of a saponin/Aerosol OT combination.

Dry-Physical conditioning process

Stuckrad et al. (1997) developed a new dry-physical conditioning process by plasma activation of the plastic surface as an alternative to chemical conditioning. It was reported that this new conditioning method allowed the same sorting quality, but its emission of pollution was much lower. Furthermore, the results showed that by only one step of flotation, the purity of collected products was higher than 95% and the recovery was between 80–90%. After reviewing the flotation of plastics and discussing the relation of floatability of PVC and PMMA (polymethyl methacrylate) mixture with surface chemical related and gravity factors.

Combination of froth flotation and gravity separation

Shen et al. (2001) suggested that plastic flotation is a combination of froth flotation and gravity separation. Accordingly, the idea of particle control was applied for separation of mixed plastics. The experimental results showed that PVC and PMMA products were selectively separated by flotation. The recovery, and the purity of each collected product was higher than 98% respectively. Subsequently, they investigated the floatability of seven other types of plastics (including PVC, PET, PS and ABS) in the presence of methylcellulose and separated them into various groups. Accordingly, the results of flotation of plastics within the same group were limited, due to their small differences in floatability, whereas flotation of plastics of different groups were achieved with recovery generally higher than 71% and purity higher than 77%.

Flotation with flame treatment

Pascoe et al. (1996) also developed a method for separation of PVC and PET using flame treatment and flotation. Flame treatment was used to modify the surface of plastics to allow water-based coatings to be applied. The effect of the treatment was therefore to produce hydrophilic species on the surface of the plastics. The flame treatment involved the use of an acceleration chute that delivers the flakes through the flame of an angled burner. Then, a combination of a two-stage flotation process, and flame treatment was tested for the separation of PET. In the first stage, the PET was floated away from the PVC utilizing differences in particle thickness and surface contamination. The float product was then subjected to flame treatment and hydrophobic recovery prior to the second stage of flotation. In this stage, the PVC was reported to the float product leaving a PET-rich sink fraction. Nevertheless, it was reported that the efficiency of the process needs to be improved before being of commercial interest. Italian researchers studied the wet density separation of different types of virgin plastics using a dynamic medium separation system. Plastic separation using this method required media with low density, say around 1000–1300 kg/m³. For this purpose the most utilized media were: water and water solutions of calcium chlorite,

sodium chlorite, calcium nitrate and ethyl alcohol. The process was tested on a PS/PP mixture using a two-stage Tri-Flo separator of 100 mm in diameter and water as medium. The results were satisfactory as the PP content in the float products was 89.9%. Moreover, the behavior of PVC and PET in a LARCODEMS dense medium separator has been investigated using calcium chloride solutions as the medium. It has been shown that particle thickness and surface conditioning can SEPARATING PLASTIC MATERIALS FOR RECYCLING 171 have a significant influence on plastic behavior within the separator. Thus, given the complexity of a mixture of shredded plastics in terms of size, shape and thickness, density separation using the LARCODEMS is likely to be only considered as a preconcentration step.

Three-Stage Sink–Float Method

Sangobtip Pongstabodee et al. (2008) the aim of their research was to separate the different plastics of a mixed post-consumer plastic waste by the combination of a three-stage sink–float method and selective flotation. By using the three-stage sink–float method, six mixed-plastic wastes, belonging to the 0.3–0.5 cm size class and including high density polyethylene (HDPE), polypropylene (PP), polyvinylchloride (PVC), polystyrene (PS), polyethylene terephthalate (PET) and acrylonitrile–butadiene–styrene copolymers (ABS) were separated into two groups, i.e., a low density plastic group (HDPE and PP) and a high density plastic group (PET, PVC, PS and ABS) by tap water. Plastic whose density is less than that of the medium solution floats to the surface, while the one whose density is greater than that of the medium solution sinks to the bottom. The experimental results elucidated that complete separation of HDPE from PP was achieved by the three-stage sink–float method with 50% v/v ethyl alcohol. To succeed in the separation of a PS/ABS mixture from a PET/PVC mixture by the three-stage sink–float method, a 30% w/v calcium chloride solution was employed. To further separate post-consumer PET/PVC and PS/ABS based on plastic type, selective flotation was carried out. In order to succeed in selective flotation separation, it is necessary to render hydrophilic the surface of one or more species while the others are kept in a hydrophobic state. In flotation studies, the effects of wetting agent, frother, pH of solution and electrolyte on separation were determined. The selective flotation results showed that when using 500 mg l^{-1} calcium lignosulfonate, 0.01 ppm MIBC, and 0.1 mg l^{-1} CaCl_2 at pH 11, PET could be separated from PVC. To separate ABS from PS, 200 mg l^{-1} calcium lignosulfonate and 0.1 mg l^{-1} CaCl_2 at pH 7 were used as a flotation solution. Wettability of plastic increases when adding CaCl_2 and corresponds to a decrease in its contact angles and to a reduction in the recovery of plastic in the floated product.

IV CONCLUSION

In the available literature, there have been studied several ways of separation of deferent type of plastics. However, vary few studies have been reported on polyethylene terephthalate and polypropylene/polyethylene plastics material separation process. It is further needed to investigate the optimum value of sink–float separation process variables. Very few studies reported in the literature those have been attempted by employing the experimental design methodology. Thus, it is observed that the well-established DOE methods must be investigated. The modelling & optimization of the various process outcomes in sink–float separation can be attempted by applying some suitable optimization method.

FUTURE ASPECT

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CHANGING DIMENSIONS OF MARKETING COMMUNICATION IN THE DIGITIZED ERA

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ABSTRACT

Although noticeable changes found in marketing communication due to internet emergence of up-to-date information technology, still the companies which are using traditional media for advertising & communication are lagging behind in front of those which are equipped with all modern media tools. Expansion of blogs, chat rooms etc being more interactive are widening the scope of communication especially the marketing and advertising communication thereby pointing out a clear cut transformation in business strategies also. Investing in advertising with the help of new media and online social networks has occupied a mandatory place in the distribution of communication budgets, and new media are an inevitable part of the media mix, both for small companies and for large multinational companies. This article discusses how traditional marketing communications are getting transform to reflect more versatile, resource intensive digital marketing communications that contribute to the effectiveness of their organisational efforts to generate consumer value.

Keywords: Communication strategies, internet social networks, new media

I INTRODUCTION

The development of Internet business rules are drastically changed in different segments either profitable, non-profit activities. Consumers are at that situation as they may force suppliers of services, products and the information first becomes "online" and back a couple of years also to become "mobile", as the Internet has also become mobile. Application of the Internet in marketing communication has been presented for the past fifteen years and a special branch of marketing has developed, so-called internet marketing, or online marketing, e-marketing or interactive marketing. Differences between terms online, online, e or interactive Marketing is too small to be able to talk about different concepts. The popularity of use the concept of interactive marketing had a crucial impact among various Authors & scientists that has been seen in many journals.

Interactive marketing is an integrated process of exchange with the help of which an organization understand consumer behavior, uses technology and others resources to create and manage values for consumers, created a cooperative relationship and turned out value for shareholders through brands / products / services, ideas and messages communicating and delivering them to real consumers through suitable channels at the right time [27].

A Special Challenge for Marketing Professionals in understanding interactive marketing is that there is actually no structured database knowledge that describes everything about this branch of marketing because it is parallel to the other side rules of interactive marketing which is changing fast with the continuous appearance of new ones technique and tactics needed quickly implement in a comprehensive management marketing.

If we go deeper inside the marketing through the concept of marketing mix, which is one of the most popular theoretical frameworks, we can say it is the internet which enabled the creation of completely new forms products, digital products, such as e-books or online editions of daily newspapers. It also influenced new strategies for creating prices where they can offer the same product or service to different consumers and can charge a different price; eg. Airline tickets whose Prices depend on flight capacity or capacity for a specific season when demand is higher or lower, and as these data are available to airlines in Real time and prices can be corrected in Real time according to changes in demand. Also, the Internet has become a new distribution channel, of course, is limited in the segment for the products in digital form and through which it is thus possible to distribute (e.g. software).

To complete all 4P marketing mixes we still lack a review of the promotion, and that the segment is in the focus of this paper .The theme of the paper is defined as marketing communication in digital world, not as internet marketing from the reason that this term, although it originally referred to primarily on advertising on the Internet, today nevertheless covers a much wider circle of marketing studies.

II INTEGRATED MARKETING COMMUNICATION -THE IMPACT OF DIGITALIZATION

Align promotional tools with each other within the available financial resources, or marketing budgets, in order to reach the maximum in realization of communication (eg increase brand awareness) and sales targets (e.g. realization of the annual sales plan) of some product / service, or brand, and optimum aligning of all the elements of the marketing mix among themselves, represents a continuous challenge for each brand manager. Success or failure of some promotional activities or campaigns depend on a series of predictable and unpredictable factors that are often very difficult or even impossible to control in a day moment. For example, sales promotion activity which initially has a good response from consumers can be

easily converted into a complete fiasco and cause negative publicity if it turns out to be is the promotional material that consumers got on a gift of bad quality and decaying after the first use. The failure in the above example would depend on the reliability of promotional material suppliers which cannot always be guaranteed. On the other side, well-chosen communication channel, combined with perfect timing and ideal message directed toward the target group along with low investment can bring unexpected and above-average results. To set up Communication Strategy Brand Managers are relying on the results of market research, experience from the past, study of competition and advice experts for different types of communication (PR specialists, marketing agencies or e.g. trade marketing managers). Informatization and digitization has affected almost every segments of creation, how marketing mixes, and so promotional mix, or setup Integrated Marketing Communications (IMK). The mixture is described in Table 1.

It brings the close relationship among people residing in different countries and launched a new medium of advertising & promotion which is quite unique that was not experienced before [29]. Digital revolution and especially rapid growth accepting the Internet in all aspects communication and information has a clear impact on creating a promotional mix and creation communication strategies.

Table 1: The impact of digitization on the promotional mix
The impact of digitization

IMK tools	The impact of digitization
Advertising	<ul style="list-style-type: none"> · Billboards with moving images, LED displays for outdoor advertising · Faster, better quality, better targeted and cheaper with digital TV and radio · Internet ads, banners, pop up, social networks, viral marketing
Promotion selling	<ul style="list-style-type: none"> · Creating a consumer database for more efficient planning of actions sales promotion code most interested consumers
Personal sale	<ul style="list-style-type: none"> · The possibility of online connectivity sales representatives and customers · The ability to present a website of the companies and product catalogs for help at a sales meeting
PR, events, sponsorships	<ul style="list-style-type: none"> · Faster and more effective news delivery and press releases via e-mail and other e-channels · Effect of information transfer from the mouth to mouth "virally"
Consumptive service	<ul style="list-style-type: none"> · Establishment of consumer services at web
Direct marketing	<ul style="list-style-type: none"> · Easier to identify targeted consumers through the creation of consumer bases data · Reducing processing costs on potential consumers who in Realities are not interested and will not Never become real consumers

Source: adjusted according to [13]

III SELECTION OF THE MEDIA OR NEW MEDIA

Part of the Implementation of an integrated marketing Communication is definitely a choice of communication channels through which the organization is in the role of communicators which communicate to the target audience, respectively consumers. In addition, the media that have been selected as a communication channel of a brand should be adapted to brand values, goals which they wants to achieve through communication with keeping in mind the message which you want to communicate and the habits of the target group to whom the communication is intended. In addition, the representation of the selected media within the media mix should be optimal for achieving as much efficiency as possible in communication. By developing new media and their growing tendency for domination to the traditional media

of choices are growing, but it is also increasingly difficult to make a (right) decision. The basic difference between traditional (press, radio, television, outdoor advertising) and new ones media (websites, social networks) is that new media are interactive. Communication through traditional media is one-way and massive. New media enable two-way communication at three levels: one to one, one towards many and many to many [14].

The main features of new media are:

- (1) Digitality - data processing in digital flash
- (2) Multimediality – extent to which text, graphics, images, sound are decoded and integrated into a common digital form [7], so that it become a means of expression
- (3) Interactivity – It is considered as most important capabilities of the new media [25] and is considered as an information related process in which a person assimilates the meanings and interpretations of symbols during interaction [21].
- (4) Hypertextuality - non-linear association of communicating information linkage [17].

Due the technical development the Internet has intensified the information communication with the help of media communication function. Online editions of newspapers, radio and television programs were just the first step to bringing the Internet closer to those three previously completely different media outlets. The difference between the Internet and the television was quite as long as the video content was data overwhelming for the Internet capacities.

Researchers suggest that the prime drive of Television consumption is related with the peoples' habit, their entertainment, relaxation and pass time [1],[18]; And the information seeking motivations comes after the previous ones [1],[2] . Being low interactive medium, television broadcaster would have to reorganize their advertising message content and presentation structure while communicating via highly interactive internet platform. This synergy between broadcasters and Internet would lead to broadcasters' growth in charismatic way [5]. Previous work has observed at the implications of convergence between television and internet platform [6], Chan-Olmsted and Chang [8].

The digitization seen in new forms of content combining video with text thereby offering more interactivity, multiple layers [26] and also the progression of converged digital instruments (ex. mobile phone/media players and so on).

IV PERCEIVED MEDIA UTILITY

How to choose the optimum mix media? Do you focus entirely on new media?

Possession of some specific characteristic exhibited by any media decides perceptions utility of that media. These constructs are interactivity, richness and social presence of that media [32], [9]. Here interactivity deals with use of multiple, nonverbal signals in simultaneously and continuous way having the ability of spontaneous involvement, interruption, preemption, participative coordination and patterns of turn taking [32]. Richness composites immediate feedback, use of multiple (verbal and nonverbal) cues, language diversity, and capability to personalize messages [10]); while the Social presence concerned with the degree to which a medium lets participants to feel psychologically close or present [11].

New media have so many advantages, provide two-way communication with consumers, easier targeting of the target group, easier to measure their reach (eg number of ad clicks, etc.) and are also more cost-effective. However, when choosing the media, other factors should be taken into account, as well as the degree of penetration of internet within the total

population in the country where your organization operates, then how much internet penetration is the target for your target group, etc. The choice of media mix is considered as one of the most complicated decisions in the marketing strategy communications [16]. Apart from the choice of media it is necessary to make a choice of space, bounce time, or budget level that will be spent for each medium. The next decision is to select the area to be advertised and finally how we will distribute the time we have set for each medium [16]. The organization must keep in mind that a consumer must be open to the technology. Consumer technology readiness is defined as “people’s proclivity to accept and use new technologies for realizing goals in home and work” [23].

V OPPORTUNITIES FOR MARKETERS

Being highly interactive internet generates various new prospects for building partaking opinions [28]. Furthermore it gets together and associates various phases of the communication process such as storing, exchanging, interacting, reproducing and changing communication channels to the unbelievable extent.

In Feb 2018, Mobile Association of India (IAMAI) and Kantar IMRB have come up with a report on internet penetration in India titled, "Internet in India 2017." Report says that the number of internet users in India is expected to reach 500 million by 2018. The aim of Report was to examine Internet penetration in India, demographic characteristics of users, how much time they spend on the Internet and for what purpose. Figure 1 shows the number of the internet users in India over the years, and Figure 2 shows the demographic profile of internet users. And the figure 3 shows the uses of internet among users.

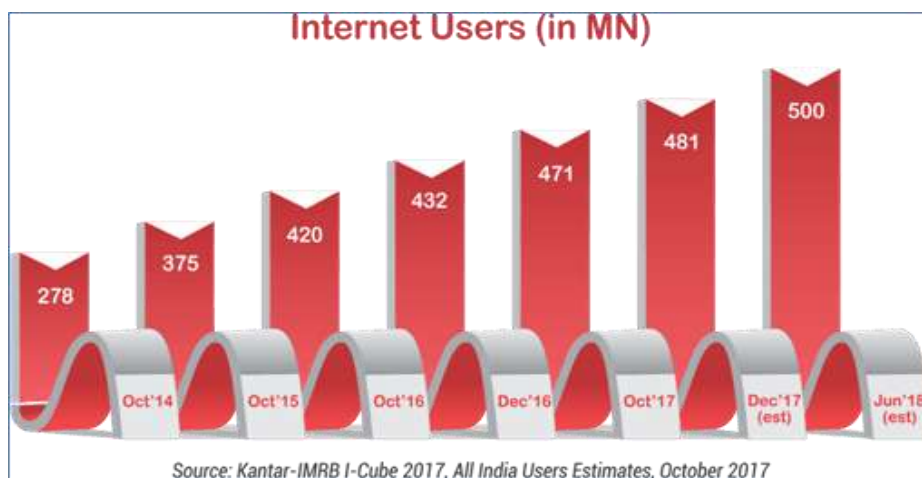


Figure 1: internet users in India

Source://economictimes.indiatimes.com/articleshow/63000198.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

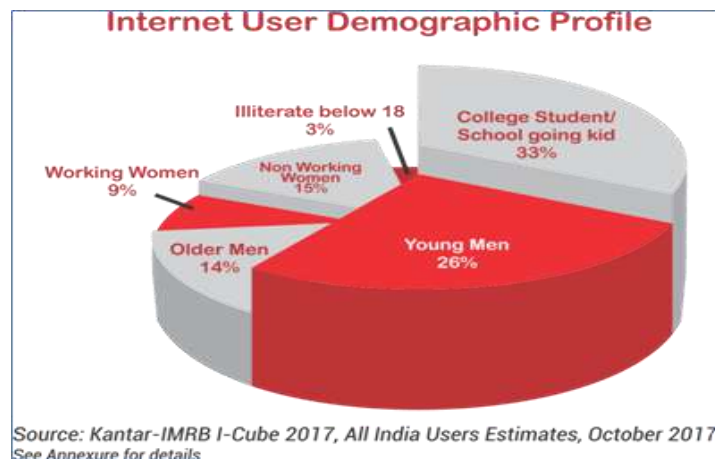


Figure 2: internet user demographic profile

A report released by investment firm Omidyar Network claims that approx. 70 % of average mobile internet user in India spends almost 70 percent of the time on social communication and entertainment purpose.



Figure 3: purpose of internet uses in India

Source: <https://timesofindia.indiatimes.com/business/india-business/indians-spend-70-of-mobile-internet-time-on-social-entertainment/articleshow/62125840.cms>

Based on the displayed internet usage results in India, we can conclude the following: If the target group of an organization as a communicator is within a population of youth (15 to 30 years old), it can be safely stated that some type of online advertising will reach that target group. As the target group moves towards the older age groups, it is necessary to use the mix of traditional and new media with the increasing share traditional. If our target group aged 55 or over then it is better to rely solely on traditional media (e.g. periodically commercial and national television broadcasts) with special discounts for retirees in their media mix for this type of groups in television communication which may leads to almost 100 % of shares, while in the group of literate people it can be combined with the printed catalogs of traders as well. So it can be concluded that it's better to allocate 100 percent of communication budget to new media if we wish to serve the target group of age 15-30. However for some products or services, this will not be optimal. For example, food for all households, regardless of age, is most often procured by only one person - the mother. If the organization is advertising the food product to the teenagers as the primary target group, it is also necessary is to address the

secondary target group, i.e. parents / mothers who, although not necessarily consumers are, in most cases, customers of the product.

VI EXPOSURE OF NEW MEDIA AND ITS PLANNING

The next question, following a decision on the use of new media, is the question of the type of online advertising. We can divide advertising through new media into the following categories:

- Internet advertising - mass communication: banner ads, pop-ups and pop-ups, rich media ads, sponsorships, and keyword advertising on search engines and specialized ad networks.
- Search engine optimization (SEO) enhancements - Activity to customize the company's business content and link to other relevant sites (through links) to make them better positioned on the unanswered part of the search results (domain name, web site title or title tags, text on web pages, number of links that lead to a specific website from other sites, number of web site content streams through social networks, user retention time on page, etc.).
- Direct email - one of the oldest forms of Internet communication
- Social media is a group of internet based applications made that build on the technological base concept of web 2.0 which encourages user connection, involvement, cooperation, and sharing of information and various contents [20]. Examples of social media include social networks (e.g., Facebook), virtual worlds (e.g., Second Life), microblogs (e.g., Twitter), collaborative projects (e.g., Wikipedia), content communities (e.g., YouTube, dailymotion), and various games (e.g., World of Warcraft; [15]. Leading companies like Google also has come up with a vast variety of engagement platforms stretching from various apps(e.g Google Play, Google pay) to physical devices (e.g Goggle Glass, Google Mobile; [4],[3].

If we go back to the study of the Internet users in India, most of the companies try to catch the “Golden segment” of age group ie.16 to 35, that’s why most of the internet advertising campaigns are focused at these age group people [31]. So the proper Attention should also be paid to their usual behavior when using the internet. About 90% of internet user prefer some kind of communication apps regularly in order to stay connected with their belonging people (family, relative, colleagues, friends etc.). According to Nielsen survey [22] Almost 50 per cent of consumers use both WhatsApp and Facebook Messenger, while 20 per cent uses both WhatsApp and Hike application for communication.

The vast capacity of internet for information storage, exploration & retrieval, information customization and interactive communication makes it a resourceful & effective medium for accessing, organizing and communicating information [24].

The other most common activities are online:

- Communications (e-mail "chat")
- Collecting information (monitoring news, searching for information)
- viewing "video clips" of those who visit social networks, they do so at least once or even several times a day.

Facebook is currently one of the most famous social networking application site globally [30], and is available in 37 languages and permits registered users to create profiles similar to a 'wall' like a virtual bulletin board, add friends, and send messages, comment, upload and share videos, photographs, web links. The application favors to the member in following ways like

– Facebook Social Ads for internet Marketplace to post and to get respond for classified advertisements online;

- Facebook Groups used to arranging events and inviting guests and friends for attending that event;
- Facebook Pages to figure and promote personal or business ideas and to involve others in that Topic;
- Advance Technology of Facebook allows interactive chat through video calls and Text for those online on the web site. It can be done for personal as well business purpose.

Another important aspect of marketing communication through new media is the Internet access via mobile devices (smartphones, tablets, etc.) as number of mobile users and their time spend on the internet are increasing day by day. According to Global digital report, 2018[12], Near about two third of the worlds' 7.6 billion populations are using mobile phone out of which more than half of them are smart mobile phones to access internet wherever they are. Number Social media Users in every country are growing at almost 1 million per day during last 12 months, with more than 3 billion user continuously using social media every month, in which 9 out of the 10 people are accessing it on mobile devices.

The question should be now as your business ready for "mobilization"? And immediately gives the answer: whatever the answer may be, be assured that your customers are in your favour. There are still big obstacles in front of m-business and m-marketing² on their way to building their full-fledged marketplace for new media. For example, in order to create smartphone applications, only one application that is supported by all types of smartphones is sufficient, but a version of each smartphone operating system (eg iOS or Android) needs to be made, which complicates the launch of apps, longer and more investment in softwares development is needed.

Before starting the process of planning the media, we need to first analyze the current situation (answer the question of our current position & consumer interests or behavior pattern in order to make marketing consumer oriented as media planning is more about establishing the relationship interaction pattern with consumers rather than merely picking up a media alternative among many [19]), consider the marketing strategy of the brand (mission, vision, value, positioning, target group) and communication strategy (what should be the atmosphere , which are the key messages content that they want to convey, what are the communication goals & objectives.

From the above, goals and media strategies (reach, frequency of broadcasting, continuity and costs) and the types of traditional and / or new media (e.g. TV, radio, Internet, social networks) are defined. Within the selected media type based on various features, also the type of media (e.g. whether they are national or local, or whether social networks are Facebook or Twitter) should also be selected. Simplifiedly, these are e-business and mobile-friendly e-marketing [2]

After making all the necessary decisions, a media plan is created, which includes an overview of the objectives media, broadcasting of different ad formats (jingle for radio, TV and Youtube video, pop-up advertising banner, etc.) through all selected channels, costs and finally deciding when to execute.

If the media uses a larger number of media (especially in TV), it is recommended that a specialized media lease agency be hired for the creation and execution of the media plan.

VII CONCLUSIONS

As there is no unique recipe for a business or marketing strategy, there is no recipe for writing communication strategies, nor for creating media mixes and media plans. Marketing communications in the digital world of new media certainly have its advantages, but there are

also limitations. Organizations that are in the role of communicators must be familiar with both ones and with others. On the other hand, by looking at the aspect of consumers who are in the role of the recipient of a communication message, it should be mentioned that there are ways they can block certain types of Internet advertising from reaching them (eg setting up protection that block pop ups) and that consumers can start communicating with a brand without the company planning it (eg through a Facebook group).

Probably the most famous story of the negative publicity launched by an unsatisfied user is the story of singer Dave Carro and his broken guitar on a United Airlines flight. After United ignored Dave's objections and did not want to compensate for the damage to the broken guitar, Dave wrote a song about how United fired guitars on their flights, made a simple \$ 150 video and set it all on Youtube 2009. Viral information about that event spread uncontrollably and out of all expectations. To date, over 150 million people around the world have been introduced to Dave's story. United had major problems with the confidence of its users after that event, the stock value fell by 10%, and Dave became a viral super star (davecarrolmusic.com). From the Dave and United States stories, organizations have the opportunity to learn that an unsatisfied consumer / user is not just a negligible statistic. On one hand the new media offer a platform for communicating to everyone with everyone, on other hand it make the organization to have concern about consumer who can influence and can do vindictively everything within their consumerism & legal rights after getting frustrated & unsatisfied due to the organizational product & service related matter.

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WORK FROM HOME DURING COVID-19: A CROSS-SECTIONAL ANALYSIS

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ABSTRACT

Coronavirus illness (COVID-19) is an infectious disease and designated as “Public Health Emergency”. COVID-19 has brought drastic changes in the work culture and compelled to do work from home especially in the service industry. Considering, the fact the present study explored the various implications of the work from home during the COVID-19. The present study is descriptive and cross sectional in nature. A sample of 200 respondents engaged in the service sector and doing work from home were included. The analysis was performed with the help of Logit regression, weighted average score (WAS), percentages and frequencies. It was observed that main challenges faced by respondents while doing work from home were

lack of proper communication and coordination among the co-workers, distractions and interruptions, struggling with both work and childcare, lack of motivation, social isolation, technological challenges, work pressure, lack of time management and work-life imbalance. However, main benefits of work from home were balance home and work responsibility, provided work flexibility and saves money. Logit regression provided that the intent to do future work on home was associated with gender, age, marital status, family size, location. On the basis of the present study it was observed that need is to make a balance between personal life and professional life. The success of the work from home depends on the effective communication channels and trust. The adverse impact of work-life imbalance due to work from home can be reduced by the employers by providing their employee flexible work hours, day-offs, family days and digital detox weekends.

Keywords: Association; COVID-19; Benefits; Challenges; Work from home; Experience.

I INTRODUCTION

Coronavirus illness (COVID-19) is an infectious disease caused by a newfound coronavirus and recognized with the status of “*Public Health Emergency*”. As per World Economic Forum (2020), “*Worldwide, economics shock of coronavirus will be more severe as compared to the Great Financial Crisis of 2007–08*” [1,2]. Georgieva (2020) identified that burden of direct economic cost of the Coronavirus disease is much higher as compared to indirect cost [3]. The intangible cost of the pandemic are seldom brought into the consideration by the government and health agencies as it is difficult to measure [4].

World Health Organization (WHO) suggested that mix of social distancing, contact tracing, testing and isolation are essential to curtail the impact of coronavirus [5]. Social distancing is considered as the most crucial preventive measure suggested by healthcare providers, advisories and regulatory bodies [6]. One of the most detectable changes which happened because of the Covid-19 pandemic has been the move of many people from work in office to work from home [7]. The residents in several nations were insisted to stay at home in order to decrease the social contacts to a minimum to contain the spread of COVID-19. The current pandemic has affected almost all the sections of economy [8]. The individual’s those who have not even preferred but has to perform work from home [9].

It was observed in the first time in the modern history that a majority of professionals are doing their work from home. Numerous studies demonstrated the benefits of doing the work from home. It was exhibited that work from home helps to save time as no need to commute to work station [10]. Work from home helps to concentrate on various office and home tasks easily [11]. Studies witnessed that work from home provides a great autonomy to work and lead to job satisfaction. Technology can help people to combine the home and office tasks easily and to accomplish work-life fusion [12].

However, current change to work from home posed a lot of challenges and brought a lot of adjustments not only for employees but for the entire family. The work from home posed the employees to do the work for the long stretches of time [13]. There are various challenges of work from home include lack of focus due to family distractions, less productive and improper communication with co-workers [14]. A stress and fear of COVID-19 has made difficult to manage the working from home. There is a huge pressure among the professionals as of the constant connectivity and responsiveness is concerned. The studies have shown that work from home had made a blurred boundary between home and family which caused a lot of anxiety and stress [15,]. The existing literature on work from home cannot provide a

thorough explanation of the perceptions and experiences of the professional doing work from home during COVID-19. Therefore, the present study will contribute to the existing literature the pandemic perceptions and experiences of the work from home. To achieve the above objective, the present study has been segmented into four broad sections. Section I, discussed the present scenario of the work from home due to COVID-19. Section II, describes the details of the material and methods applied to achieve the desired objectives. The analysis of the data has been described in Section III. Section IV, concludes the discussion along with policy implications.

II MATERIALS AND METHODS

Research Design: The present study was based on descriptive and cross-sectional design and has been conducted in Punjab.

Sample Size and Sampling Technique: The study was based on primary survey for the collection of data. The sample size in the study was 200 respondents. The respondents selected includes, obtained from the rural and urban Punjab. However, convenience approached was used for data collection.

Study Instrument: A structured questionnaire was designed for the collection of the data. The questionnaire consists of socio-economic profile of the respondents, various challenges faced during WFH and benefits of the WFM. These variables were measured on five point Likert scale. The scale was measured as strongly agree, agree, neutral, disagree and strongly disagree.

Statistical Analysis: The various challenges and benefits of WFM were examined with the help of weighted average score (WAS). Logit binary regression was used to find out the willingness of the respondents to do WFM in the future. The dependent variable in the Logit regression assumed 1 if the respondent willingness to do WFM in future and 0 otherwise. The independent variable consists of various socio-economic variables of the respondents. Frequency and percentages were calculated wherever found necessary.

III RESULTS

Table 1 demonstrated that majority of the respondents were male and married. It was observed that 36.5 percent, 33 percent and 30.5 percent of the respondents were of 30-40 years, 20-30 years and 40-50 years of age group. The education wise comparison revealed that most of the respondents were post-graduate followed by Ph.D. and graduation respectively. Majority of the respondents belongs to teaching profession and with a monthly income of ₹30000. It was revealed that 37.5 percent of the respondents had a family size of 6 members and above and belongs to urban area. However, only 10 percent of the respondents have a prior work from home experience.

Table 1: Socio-Economic Profile of Respondents

Variables	N (%)
Gender	
Male	101 (50.5)
Female	99 (49.5)
Marital Status	
Single	84 (42)
Married	116 (58)
Age	
20-30 years	61 (30.5)
30-40 years	73 (36.5)
40-50 years	66 (33)

Education	
Graduation	42 (21)
Post-Graduation	90 (45)
PhD.	68 (34)
Monthly Income	
Up to ₹30000	61 (30.5)
₹30000-₹40000	59 (29.5)
₹40000-₹50000	43 (21.5)
₹50000 and above	37 (18.5)
Occupation	
Teaching	160 (80)
Non-Teaching	9 (4.5)
Working in Corporate	31 (15.5)
Family Size	
Up to 3 members	74 (37)
4-6 members	51 (25.5)
6 members and above	75 (37.5)
Location	
Urban	112 (56)
Rural	88 (44)
Prior Work from Home Experience	
Yes	20 (10)
No	180 (80)

Source: Survey Result

Table 2 exhibited that 65 percent of the respondents were able to follow a good work routine while doing the WFM. However, it was found that 52.5 percent of them were not taking regular breaks while doing WFM. It was observed that 59.5 percent of the respondents were able to create a suitable workplace for WFM. It was observed that a large number of respondents stated that work from home is more secured as compared to work from office during pandemic. It was demonstrated that 67.5 percent of respondents have to incur money in order to upgrade the technology for doing WFM. However, only 46 percent of the respondent felt that they were equally productive as while doing work from office.

Table 2: Experiences of Work from Home During COVID-19

S.No.	Variables	N (%)
1	Are you able to follow a good work routine?	
	Yes	130 (65)
	No	70 (35)
2	Are you taking regular breaks in between the work?	
	Yes	95 (47.5)
	No	105 (52.5)
3	Do you have a suitable workspace?	
	Yes	119 (59.5)
	No	81 (40.5)
4	Do you feel work from home is more secure than work from office?	
	Yes	110 (55)
	No	90 (45)
5	Do you have to upgrade the technology to do work from home such as laptop, printer, broadband, smartphone?	
	Yes	135 (67.5)
	No	65 (32.5)
6	Do you feel that while doing work from home you are equally productive as while doing work from office?	
	Yes	92 (46)

No	108 (64)
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Source: Survey Result

Table 3 revealed the weighted average score of the challenges by respondents during the WFM. Out of the various challenges lack of proper communication and coordination among the coworkers was the first challenge (WAS=4.13) followed more distractions and interruptions in home (WAS=4.07), struggling with both work and childcare (WAS=3.96), lack of motivation (WAS=3.88), social isolation (WAS=3.81), technological challenges (WAS=3.79), more work pressure (WAS=3.62), increased work load (WAS=3.53), no time management (WAS=3.24), work life imbalance (WAS=3.12).

Table 3: Challenges of Work from Home During COVID-19

S.No.	Variable	Weighted Average Score (WAS)	Rank
1	Lack of proper communication and coordination	4.13	1
2	More distractions and interruptions in home	4.07	2
3	Struggling with both work and childcare	3.96	3
4	Lack of motivation	3.88	4
5	Social Isolation	3.81	5
6	Technological challenges	3.79	6
7	More work pressure	3.62	7
8	Increased work load	3.53	8
9	No time management	3.24	9
10	Work life imbalance	3.12	10

Source: Survey Result

Table 4 has shown the weighted average score of the benefits of WFM. The weighted average score was used to rank the various benefits availed from WFM. Out of the various benefits no need to commute (WAS=3.83) was observed as the first followed by flexible work hours (WAS =3.53) fewer distractions (WAS =3.21) convenient (WAS =3.14) feeling safe (WAS =3.02) more saving (WAS =2.96) more productivity (WAS =2.87) more time for family (WAS =2.76) easy to balance home and work (WAS =2.61) and autonomy (WAS=2.53).

Table 4: Benefits of Work from Home During COVID-19

S.No.	Variable	Weighted Average Score (WAS)	Rank
1	No need to commute	3.83	1
2	Flexible work hours	3.53	2
3	Fewer distractions	3.21	3
4	Convenient	3.14	4
5	Feeling safe	3.02	5
6	More saving	2.96	6
7	More productivity	2.87	7
8	More time for family	2.76	8
9	Easy to balance home and work	2.61	9
10	Autonomy	2.53	10

Source: Survey Result

Table 5 demonstrated the willingness to do WFM in the future as measured with the help of Logit regression. Table 5 demonstrated the association of socio-economic variables with the willingness to do work from home in the future. The analysis of the demographic variables shows that gender ($p < 0.01$) was found significant. Thus, it can be concluded on the basis of the coefficient of gender that males were more willing to do WFM as compared to females.

Age ($p < 0.01$) was a significant determinant and it can be concluded on the basis of coefficient of age that young respondent were more likely to do WFM. Marital status ($p < 0.01$) was significant and it can be observed that married respondents were less likely to do WFM as compared to single. Family size ($p < 0.01$) was also associated with the willingness of WFM and it can be concluded that respondents from large family size were less likely to do WFM. Location ($p < 0.10$) was found significant it can be concluded that respondents from rural areas were more likely to do the WFM as compared to urban areas. While, education, occupation, income, prior work experience were not found significant.

Table 4: Determinants of Willingness to do Work from Home in Future

Variable	Coefficient	Std. Error	z-Statistic	Prob
Constant	15.097***	5.573	2.709	0.007
Age	-4.287***	1.398	-3.067	0.008
Gender	5.231***	1.712	3.056	0.002
Education	0.211	1.284	0.165	0.869
Marital Status	-6.419**	2.758	-2.327	0.020
Family Size	-4.313**	1.467	-2.939	0.003
Occupation	1.534	0.988	1.553	0.121
Income	0.419	0.622	0.674	0.500
Location	-0.386*	1.279	-0.302	0.063
Prior work from home experience	-0.058	1.284	-0.046	0.964
Model Summary				
McFadden R-squared	0.912	Mean dependent var	0.490	
S.D. dependent var	0.501	S.E. of regression	0.132	
Akaike info criterion	0.222	Sum squared resid	3.310	
Schwarz criterion	0.387	Log likelihood	-12.244	
Obs with Dep=0	102	Total obs	200	
Obs with Dep=1	98			

Source: Survey Result

Note : *** Significant at 1 percent, ** Significant at 5 percent and * Significant at 10 percent

IV CONCLUSION

One of the most detectable changes which happened because of the Covid-19 pandemic has been the move of many people from work in office to work from home. The analysis of the discussion clearly shows that work from home is not an easy task. As it was observed that majority of the employees were not able to take regular breaks during the working hours, lack of suitable space for the WFM and incurred additional expenses in order to upgrade technology for doing WFM and 64 percent of the respondent felt that they were not equally productive as while doing work from office. The major challenges posed while performing the duties online were distractions and interruptions at home, struggling with both work and childcare, lack of motivation, social isolation, technological challenges, more work pressure, increased work load, poor time management and work life imbalance. Interestingly, it was felt that willingness to do future work from home was associated with gender, age, marital status and family size. The study revealed that time during work from home the employee's productivity was affected and calls for a self-discipline and a need to draw a line between home and work to get the job can be done on time. The respondents have also incurred expenses on laptop, printer, broadband installation and smartphone etc. If you have children who are dependent on you than the work from home becomes more challenging. School closures place an ongoing demand on employees that can be hard to balance. On the basis of the present study it was observed that need is to make a balance between personal life and professional life. The success of the work from home depends on the effective

communication channels and trust. The adverse impact of work-life imbalance due to work from home can be reduced by the employers by providing their employee flexible work hours, day-offs, family days and digital detox weekends.

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INDIAN LIBRARIES ARE RESPONDING TO COVID-19 PANDEMIC: WITH SPECIAL REFERENCE TO NATIONAL LIBRARIES I.E NLI, NDLI, NVLI AND NASSDOC

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ABSTRACT

In epidemics and during the COVID-19 pandemic situation, when information outbreak is enormous, it is the time to remind the society of the importance of libraries and the role of librarians in organizing and disseminating the information". The public is highly dependent

on libraries for reliable information. Libraries have provided the latest research information to users through peer-review academic journals, bibliographies, books, and research reports. These resources should be shared among the public for disseminating latest research results with the help of researchers to make more knowledgeable decisions to mitigate and preparedness to the outbreak. Another major issue is lack of unavailability and non – accessibility of authentic information, the research could not progress well in the right direction. Realizing this need of information, particularly National libraries like National Library of India (NLI), Kolkata, National Digital Library of India(NDLI), Khargapur, National Virtual Library of India(NVLI), Mumbai and National Social Science Documentation Centre(NASSDOC), New Delhi have immediately responded to COVID -19 by creating COVID-19 special resources as well as started to deliver the digital library services i.e solely remotely online, including remote access, free electronic resources, data services, virtual references reachable 24/7 and research support services deliverable online; services of print materials were altered to e-books for conveniences. Besides, have adopted the tools for promotion on awareness of sensitization for curbing perceived effects of COVID-19 Pandemic. The paper describes how libraries, particularly major national libraries in India, have been responded during the pandemic and also discusses some challenges that the epidemic has posed to its digital services. Furthermore, in details how these libraries have adapted some best practices/ new initiatives/ that have enhanced the value of library services and facilitated the required information to their target community users.

Keywords: COVID-19, Digital library, national libraries, virtual references.

I INTRODUCTION

The Coronavirus disease 2019 popularly known as COVID-19 is an infectious disease caused by a virus from the lineage of virus family called SARS-CoV-2. This virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. Currently, there are no specific vaccines or treatments for COVID-19. However, there are many ongoing clinical trials evaluating potential treatments. To address this pandemic the scholars and scientist, virologist etc. are doing studies both individually and institution wise, as a result, there is a huge growth of literature which demands a bibliographical control. Librarians and information professionals disseminate information as often as they have access to authoritative information and resources. In this quest of need, there are big libraries. Particularly national libraries have been playing a greater role by providing the right information at the right time at right user. The present study limited to four major libraries only. Further, information and data collected through exploratory research. The main objectives of these libraries are as below:

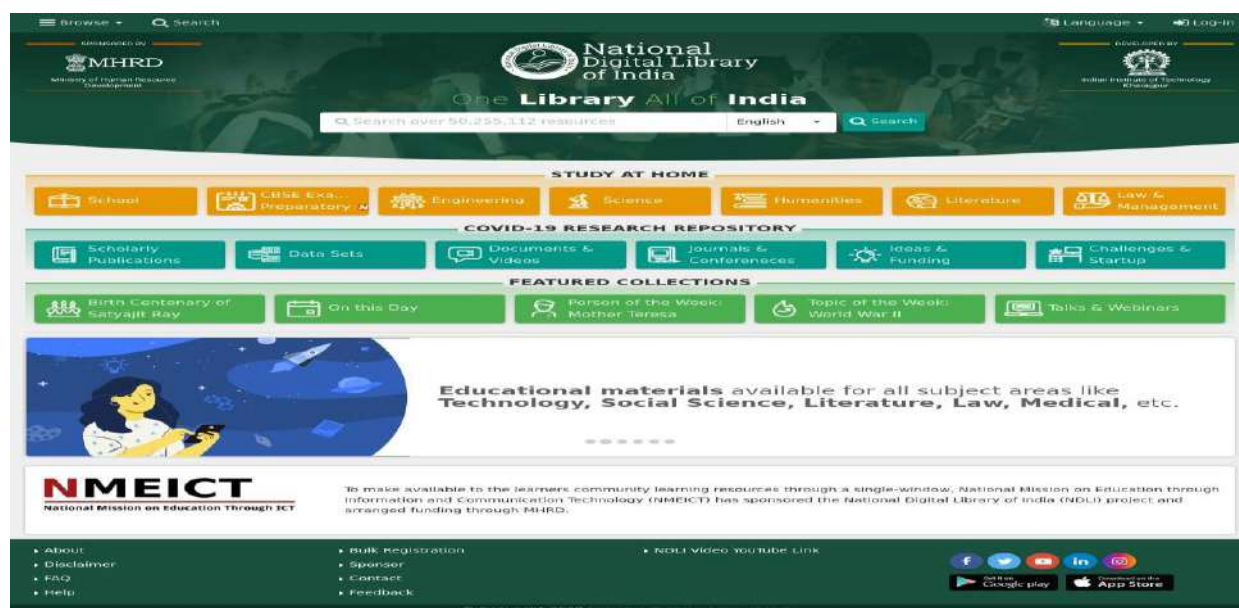
1. to promote and disseminating information relating to preventive measures of the pandemic;
2. to provide and support the regular library users particularly their core needs;
3. to support and facilitate by providing information regarding the latest developments, research and literature to students, research team, researchers and faculty,

1. Profile of National Digital Library of India (NDLI):(<https://ndl.iitkgp.ac.in>)

National Digital Library of India (NDLI) is a pilot project was initiated by the Ministry of Human Resource Development (MHRD) renamed Ministry of Education under its National Mission on Education through Information and Communication Technology (NMEICT) with aim to develop a virtual repository framework with the facility of a single-window search facility.

It consists of a variety of journals, archives, books, lectures, courses, in various media forms curated, collected and created by the best institutions and universities of the country. It is a 'customized service' in an 'integrated environment' to serve users requirement 24x7. 2 crore items were hosted in NDL India repository, out of which 40 lakh are books and has a collection of 1.26 crore articles (Falak, 2018). This project developed at IIT Kharagpur (Das, 2018).

The NDLI has immediately responded to the students during the lockdown. According to the Ministry of Education, Govt. of India has increased the usage of the e-learning activities to threefold during the Lockdown period. Further, It has created a virtual repository of COVID-19 virtual repository and it can be accessed the full text of the scholarly information from any place any time . It has helped the scholar to get the right information at the right time.



(Fig.1- National Digital Library of India Portal)

COVID-19 Research Resources Repository (Scholarly Publications): These are publications in high-quality peer-reviewed journals/conferences collected from publishers' are available in the NDLI under the caption of COVID-19 Research Resources Repository;

Table.1

Name of resources & Its No.(Publications (37,348 resources)	Papers (30,591 resources) Search with coronavirus OR covid-19 OR 2019-ncov OR sars-cov OR mers-cov OR HCoV
ACM Digital Library [COVID-19] (24 resources)	ACM: (5,069 resources)
Cambridge University Press (CUP) [COVID-19] (337 resources)	Cambridge University Press: (283 resources)
Cell Press [COVID-19] (31 resources)	Cell Press: (400 resources)
ChemRxiv [COVID-19] (383 resources)	IEEE Xplore: (567 resources)
Elsevier [COVID-19] (1,081 resources)	JAMA Network: (477 resources)
Emerald [COVID-19] (52 resources)	Nature: (1,576 resources)

IEEE [COVID-19] (390 resources)	New England Journal of Medicine:(203 resources)
JAMA Network [COVID-19] (264 resources)	Oxford University Press: (4,327 resources)
LitCovid [COVID-19] (2,500 resources)	PubMed: (3,171 resources)
Mendeley [COVID-19] (3,883 resources)	SAGE Journals: (2,733 resources)
Nature [COVID-19] (50 resources)	Springer Nature: (185 resources)
Open Science Framework (OSF) [COVID-19] (835 resources)	Taylor-and-Francis: (3,864 resources)
Oxford Academic Journal [COVID-19] (2,067 resources)	The Lancet: (392 resources)
PubMed Central [COVID-19] (3,048 resources)	WHO database: (6,907 resources)
PubMed [COVID-19] (864 resources)	Wiley Online Library: (437 resources)
Research Square [COVID-19] (513 resources)	ACM: (5,069 resources)
SAGE Journals [COVID-19] (188 resources)	Cambridge University Press: (283 resources)
Social Science Research Network (SSRN) [COVID-19] (761 resources)	
Science [COVID-19] (28 resources)	
Scopus [COVID-19] (117 resources)	
Semantic Scholar [COVID-19] (12,193 resources)	
SpringerNature [COVID-19] (42 resources)	
Taylor & Francis [COVID-19] (228 resources)	
The Lancet [COVID-19] (241 resources)	
The New England Journal of Medicine [COVID-19] (93 resources)	
Web of Science [COVID-19] (147 resources)	

2. Profile of National Library of India:

National Library of India is one of the largest public libraries in India which is located at Kolkata, West Bengal India. It has served many ways during the pandemic period. During this period, as per the direction of the Government of India, the library reopened its reader services service to the public on 29th April 2020. Since it is located Alipore Road, Kolkata, most of the times the library is under containment of Zone.

Services of National Library During Covid-19: For the benefits of the users has introduced online registration of the membership, Integrated Open Educational Resources and also allowed 1663 digital documents to the scholars, students and professionals. The integrated search portal allows a number of e-resources which are highly reputable publishers like LISTA, NDLTD, Shodhganga, Project Gutenberg etc. and consists of a number of Books, Journals, Video, research reports etc. These resources can be accessed through a remote login facility. In short, these services namely; 1. Integrated search portal.. 2. Digital documents of National Library of India 3. Online registration Membership and Remote Access of e-Resources

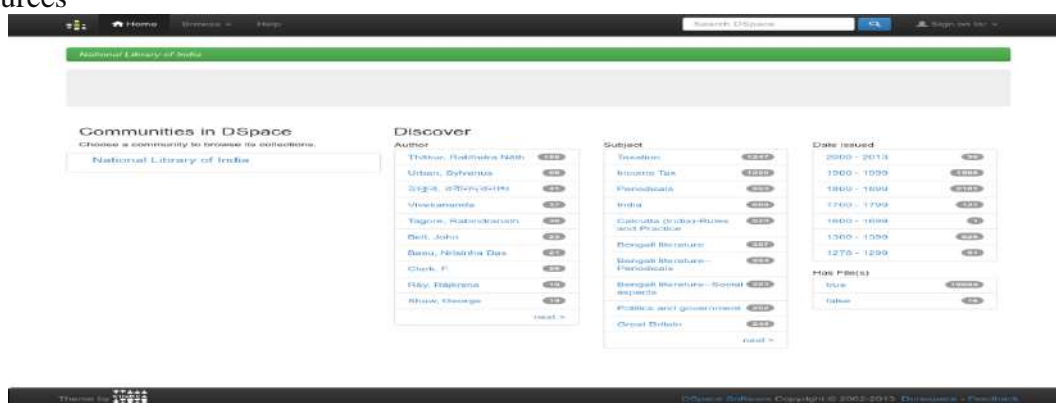


Fig.2 (National Library Digital Repository)

3. *Profile of National Virtual Library of India (NVLI):* The National Virtual Library of India is initiated by the Ministry of Culture, Govt. of India and hosted at IIT Mumbai. It is part of National Mission on Libraries. It can access through online platform covering “tens and hundreds of fields, ranging from arts, music, dance, culture, theatre, science and technology to education, archaeology, literature, museums, cartography maps, e-papers and manuscripts, among others. This portal is opened free access during COVID-19 for the public”.



Fig.3 (National Virtual Library of India)

4. *Profile of National Social Science Documentation Centre (NASSDOC):* The National Documentation Centre is a service unit of the Indian Council of Social Science Research It provides with state of the art social science information services at national and international level. It has been extended the various value-added services during the lockdown to its stakeholders. Library staff has been delivered their support remotely in research, and regular

library services — such as research consultations, e-resources access including training and statistical including data set drop-in support hours — are available via email, Google forms, Zoom, RemoteXs and Responsive Website

i. *Libraries responded to COVID-19 through Digital library services:*

A. *Promotion of Sanitisation activities through the website and social media:*

To create awareness of the necessity of sanitization against COVID-19, different posters were created and put on ICSSR'S website and circulated on social media.



Fig.4 (Promotion of Sanitisation activities)

B. *Extending of Access to Social Science e-resources remotely:* Access to subscribed e-resources, comprising of approximately 8000 social science research journals and socio-economic databases, was provided to faculty members/ research scholars of ICSSR supported research institutes and NASSDOC library registered members through Online Digital Resource Access Portal



Fig.5 (Extending of Access to Social Science e-resources remotely)

C. *Online Datasets services extended:* Facility of data sets available with ICSSR was extended to research scholars. During this period, 3000 datasets have been provided to the scholars who are from various reputed institutions like Tata Institute of Social Sciences, IIT Bombay, IIT Delhi, Jawaharlal Nehru University, Presidency University, Lovely Professional University, Delhi School of Economics, etc

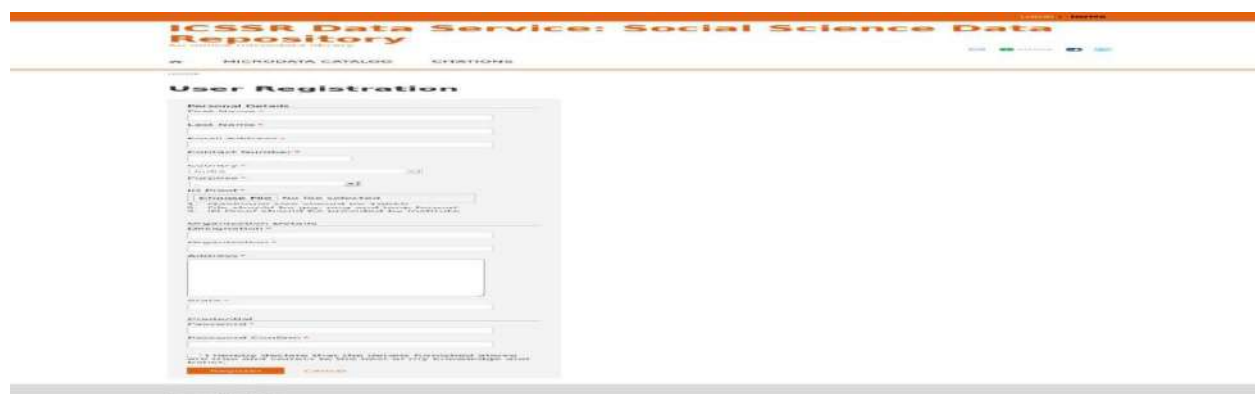


Fig.6 (Online Datasets services)

II CHALLENGES

The study shows, the delivering the digital services was not smooth because the biggest challenges were:

1. Lack of access to the library's physical collections and ambience space is always crucial to the users.
2. Access to original copies of rare books is crucial for researchers and these resources cannot be digitized due to copyright issues.
3. Technological challenges for users. Many of the users are not able to compatible with latest technology. Therefore, a greater hindrance to access the information.
4. Budget fall. These technologies involved the huge cost but due to pandemic the budget already drastically reduced.
5. Lack of proper Staff skill set. This is serious issues from the service provider side where need appropriate skills set so that better services will be delivered.

III CONCLUSION

Modern libraries are well equipped with latest technology and became indispensable in the era of the information dissemination by providing easy access to authoritative information at the right time and disseminating to the need of user in required formats particularly the national libraries have more responsible to the targeted community and also delivered good services like Promotion of Sanitisation activities, Covid-19 digital resources, facility of remote access to the scholarly resources etc. Further, to improve the dissemination of information, in a time of great need for accurate health-related information resources and services in an ever-increasing digital environment, libraries should establish professional relationships with appropriate health agencies and communication organizations for benefits of the end-users.

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ECONOMIC IMPACT OF COVID-19: THE CASE OF UZBEKISTAN

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ABSTRACT

COVID-19 is the most infectious disease in recent times caused by coronavirus. This new virus and the disease caused by it started spreading throughout the world like wild fire through the outbreak in Wuhan, China, in December 2019. Along with many nations in the world like USA, Italy, Russia, India, Iran among others, it has hit Uzbekistan, the fastest growing economy in central Asia. The focus of the study is on the impact of COVID 19 in the different sectors of Uzbekistan economy. The study extends suggestions and some measures to tide over the current crisis by the government of Uzbekistan.

Keywords: Pandemic, COVID-19, Gross domestic product (GDP), Economic sector, word bank, International Monetary fund (as IMF)

I INTRODUCTION

It's been 6 months that World Health Organization (WHO) declared a global pandemic. The spread of Covid 2019 has paralysed the economy worldwide. As per the latest forecast (June 2020), by International Monetary Fund (2020), the contraction in economy would be 4.9 percent in 2020, which was forecasted 3 percent in their first report. global economy would contract by about 3 percent in 2020. this fallout will be worse than the 2008-09 crisis. Tremendously scaled down economic activities during lock down, lower production in firms and uncertainty are the reasons cited by IMF to revise their report. World Bank (2020) forecasts a 5.2 percent contraction in global GDP. Similarly, OECD (2020) forecasts a fall in global GDP by 6 percent to 7.6 percent, depending on the emergence of a second wave of COVID-19.

The economic fallout of the pandemic in most emerging and developing economies is likely to be far worse than developed countries. Experts from the United Nations (UN), United Nations Development Program (UNDP), and the World Health Organization (WHO) have expressed deep concern about the long-term impact the pandemic could have on these nations. Developing countries rely on mostly agriculture and other primary sector industries hence they are adversely affected by disrupted supply chains and lower demand for their goods (Hawker, M. June 2020). Going by the report of United Nations Development Program (UNDP) developing countries could see income losses in excess of \$220 billion.

The current study focusses on the economic impact of Covid-19 in the Central Asian fast developing country Uzbekistan, which is no exception of other developing Asian specifically central Asian country who are shocked with the situation which has paused their ambitious growing rate of development.

Background: Uzbekistan is located in central Asia and shares territorial borders with Kyrgyzstan, Kazakhstan, Tajikistan, Afghanistan and Turkmenistan. It has an area of 447,400 square kilometres and a population of approximately 33,447,084. Like almost all the countries in the world, the disease has also hit Uzbekistan. Though death rate is not

significantly high, infection could not be contained yet. The details of Covid-19 situation in Uzbekistan till 16th of June is shown below in table 1.

Table 1: COVID Situation in Uzbekistan (as of 16th June,2020)

Details	Infected
Overall infected cases	5,561
No of Cured	4,096
Total Death	19

Source: World Health Organisation

II MEASURES AND RESTRICTION OF GOVERNMENT OF UZBEKISTAN

After the government of Uzbekistan announced confirmed cases of Covid-19 in the country ((March 15, 2020) following measures and restrictions were applied by the Government.

Table 2:

Measures and restrictions of the government or other competent institutions	All public gatherings places, Schools and higher educational institutions, secondary schools remained in vacation status. Penalty on not wearing facial masks in public places and not practicing social distancing.
Travel restrictions	International flights were cancelled and would resume after next order (as per the decision of the Special Republican Anti-Coronavirus Commission.) Flights shall be restored with countries where there is a stable sanitary and epidemiological situation
Entry and Exit from Uzbekistan	Entry and exit from Uzbekistan was allowed for: employees of embassies and their family members; employees of foreign firms and other organizations working in Uzbekistan as part of investment projects; persons travelled for treatment of them or their close relatives; persons traveling to other countries in transit through Uzbekistan, at the request of embassies and consulates of foreign countries; foreign citizens with residence in Uzbekistan; stateless persons; as well as citizens of Uzbekistan with registration in other countries. In addition, you can fly from Uzbekistan to other countries for study or work.
The flights were categorised into three types:	
1.Green flights:	The category of countries with stable sanitary and epidemiological situation (Green flights) included Japan, South Korea, China and Israel. Those who arrived from these countries stayed there for 14 days, then upon arrival they were quarantined.
2. Yellow flights	The category of countries where the incidence of COVID-19 is declining – the European Union, Malaysia, Thailand and Singapore (Yellow flights). Passengers travelling from these countries were home

	quarantined (self-quarantine).
3. Red flights	Other countries, including the United Arab Emirates, Turkey, Iran, Afghanistan, Russia and other CIS countries (Red, Evacuation flights) were in the category of countries where the number of cases of coronavirus was not decreasing. Passengers were quarantined by the Government of Uzbekistan for 14 days.
The most important contact centres for citizens	Common telephone number for an ambulance-103 Common Telegram channel for info on COVID-19 related measures. The channel can be found at https://t.me/koronavirusinfouz .

Background of Economy of Uzbekistan

Uzbekistan is a fastest growing country among other central Asian countries. In 2019 GDP grew by 5.5 percent against the forecast of 5.4 percent (Source the Ministry of Economy and Industry reports). Before the pandemic disaster, 5.6 percent growth had been expected as per World Bank, now under revised prediction by World Bank, GDP projected growth for Uzbekistan was 4.7% in 2020. According to IMF report, uncertainty about the severity and length of the global downturn and its impact on Uzbekistan’s economy would be huge.

Table 3: GDP and Annual Growth Rate from 2015 to 2019

Year	Growth Rate (%)	GDP (in Billion)
2015	7.45	\$81.85B
2016	6.09	\$81.78B
2017	4.46	\$59.16B
2018	5.12	\$50.50B
2019	5.50	\$60.49B

Data Source: Asian Development Bank

The four sectors of Uzbekistan economy that were impacted by the pandemic are Agriculture, Industry, service and the Open sector. Persual of table 4 and 4.1 provides a brief explanation of these four sectors. The following table shows sectoral participation of the economic sectors in the growth of the economy along with their trading partners and the main products.

Table 4: Sector wise Economic Activity (latest available data) FY 2019

Sector	Participation in GDP	Employment	Products
Agricultural	28.7%	33.1%	cotton, vegetables, fruits, grain, and livestock, silk and wool
Industry	28.4%	30.3%	textiles, food processing, machine building, metallurgy, mining, hydrocarbon

			extraction, and chemicals
Service	31.6 %	36.4	transportation and Tourism

Source: World Bank and Nordea.com

Table 4.1

Open sector (Foreign Trade)	Product	Trading countries
Import	Imports include machinery and equipment, food, chemicals, ferrous and nonferrous metals.	Imports generally arrived from China, Russia, South Korea, Kazakhstan, Turkey and Germany.
Export	Export included cotton, gold, minerals, fertilizers, ferrous and nonferrous metals, textiles, food, machinery and automobiles.	Major export destinations included Switzerland, China, Russia, Turkey, Kazakhstan, Bangladesh, and Afghanistan.

Source: World Bank

III Major Economic Sectors:

Agriculture: Agriculture has leading participation in economy of Uzbekistan. Uzbekistan has long prided itself on being the breadbasket of Central Asia, but the expansion of the coronavirus crisis has raised worries that the country may have to be ready to endure troubles with food security. The contribution of the agricultural sector to Uzbekistan’s GDP was 28.8% in 2018. 3.7 million people worked in the agricultural sector in 2017 (27.2% of the total number of employed).

Industry: Uzbekistan’s Industrial sector has been rising up fast. Its contribution to the economic activity of Uzbekistan till now was 28.4%. The main industrial products dealt with here are textiles, food processing, machine building, metallurgy, mining, hydrocarbon extraction, and chemicals. Recent development in this arena is the growing participation of automobiles and telecommunications. Among the Commonwealth of Independent States (CIS) Uzbekistan comes third in the production of gas.

Service: The service sector has been one of the main sources of employment both in cities and in rural areas. It’s share in the GDP of Uzbekistan was 35 percent.

According to report of World Bank services sector accounted for 31.6% of GDP and employs 36.4% of the total workforce (World Bank). Key services include transportation and tourism. Uzbekistan was the fourth fastest growing country for tourism in 2019 (+27.3%), receiving 6.7 million tourists (United Nations World Tourism Organization).

Open Sector / Foreign Trade: Foreign trade had 87.6% participation in GDP of Uzbekistan economy (Word Bank, 2018).The exported items of country are cotton, minerals, fertilizers, ferrous and non- ferrous metals, textiles, food, machinery and automobiles. Switzerland. China, Russia, Turkey, Kazakhstan, Bangladesh and Afghanistan have been the major customers of Uzbekistan.

Main import Items includes machinery and equipment, food products, chemicals, ferrous and non -ferrous metals. China (23.7% and Russia (22.5%) are the leading import partners of country followed by Kazakhstan (10.7%) South Korea (9.8%) Turkey (5.8%) and Germany (5.6%). (World Bank report, 2017)

As per the report of Ministry of Investments and Foreign Trade, Uzbekistan, for financial year 2019 , Uzbekistan exported \$ 4.2 billion and imported \$ 1.2 billion worth services. The

exports of goods amounted to \$ 14.3 billion, while exports of services reached \$ 3.6 billion. Imports of goods reached \$ 21.8 billion while imports of services amounted to USD 2.4 billion. During 2019, 2,700 new enterprises were involved in export activities, and sales of 206 new types of products to the markets of 42 countries have been mastered. High growth in imports is associated with imports of products to increase production capacities for the purpose of large-scale modernization of the industrial sector, such as machinery and transport equipment.

The pandemic has crippled the whole globe and Uzbekistan is no exception. Though lack of sufficient data stands in the way, search for the intensity of the social and economic impact in Uzbekistan of the virus has been the subject matter of this study which though challenging, is not impossible.

COVID-19 in the Economy: Due to the pandemic, a slowdown in international integration was observed in almost all countries of the world. Looking at Uzbekistan, situation seemed to be no better. The pandemic has severely impacted Uzbekistan's dream of economic reforms. Due to significantly lower external trade and widespread domestic economic disruption, the economic growth was projected to slow down to 1.5 percent in 2020 (Report by IMF published on 19th May 2020).

The country was mostly experiencing 'stay-at-home orders' and there were temporary closures of non-critical businesses. Non-essential construction work is also being adversely affected, either because of containment policies affecting labour availability or because of temporary reductions in investment. A downside scenario was that an increasingly more prolonged disruption could cause the domestic economy to contract in 2020.

As per the reports received till now from various national and international agencies, sector wise outcomes have been prepared and given in the following paragraphs.

Agriculture: According to trend economics report, GDP from Agriculture in Uzbekistan decreased to 25228.50 UZS billion in the first quarter of 2020 from 224288.80 UZS billion in the fourth quarter of 2019. Export of agricultural product which was 11.2% of total export during January and February months of 2020 would have been certainly negatively impacted due to the ban imposed by the Eurasian European Union. After ban on exports of sunflower seeds by the Eurasian Economic Union, domestic production of vegetable oil in Uzbekistan was hampered and there was an increase in the import of vegetable oil in its finished form. Flour imports decreased by 50 percent and grain by 31 percent in the past three months, as compared to the same period the year before. The impact of COVID-19 in the domestic sector of Uzbekistan could be seen from the expected requirement of additional external financing of about US\$ 4 billion (7 percent of GDP). The near balance fiscal deficit of the country is expected to widen to about 4 percent of GDP due to less than expected revenue collection on the one hand coupled with additional expenditure incurred by the government to fight the current crisis. Uncertainty is looming large over the severity of the pandemic and its continuance in the globe and in the country as well. Lower exports and remittances are expected to widen. The current account deficit is expected to rise to almost 10 percent of GDP, following lower exports and lower remittances following the unfortunate pandemic. Supply side of the economy of the country was under pressure since mid-March following lockdown. Some shorter-term turbulence in the supply of goods has been caused by the lockdown regimes as a defensive measure against the spread of coronavirus. There was shortage of particularly one food item that is potato which necessitated increased imports. Demand for another food item, garlic shot up as people started to believe that by increasing its consumption will they be protected from the potential impact of the virus.

Industry: The direct impact of lockdown measures was smaller in manufacturing sectors, some of which were less employment intensive. Complete shutdowns were being experienced by producers of transport equipment, often because of difficulties in obtaining necessary inputs from suppliers of other countries. According to preliminary data, in January-March 2020, enterprises in Uzbekistan produced industrial products worth 82.2 trillion sum compared to the production of industrial products during the same period in 2019 that amounts to 104%. Manufacturing enterprises comprise biggest share in the structure of production (78.6%) in the country.

Service: According to the International Labour Organization, an increase in the service industry by 1 percent will reduce the number of poor by 1.5 percent. This simple statistic speaks about the importance of service sector in any economy, not just Uzbekistan.

Services like hospitality, travel and tourism, beauty and entertainment, restaurants and cinema are those that had been hit hard due to restrictions in movement and social distancing. On line and take away sales will give respite to some business, though.

According to Asian Development Bank, service sector is among the worst affected sectors as the crisis has wiped out the tourist and high-value horticulture export seasons. Travel restrictions affected the developing tourism sector; tourism sector alone has lost 31 million US dollars due to the cancellation of spring bookings. (As stated by Deputy Prime Minister Aziz Abdukhakimov). Maximum tourist loss had occurred from China. As per state committee report, 61.9 thousand tourists visited Uzbekistan from China in 2019.

Foreign Trade: Foreign trade turnover of Uzbekistan reached \$12.9 billion in January-May 2020, which was less by \$2.4 billion compared to the same period last year((State Statistics Committee reports 2020)

Central bank of Republic of Uzbekistan releases data for international trade and investment. In order to understand foreign trade of the nation, structure of export and import in terms of expenses and revenue has been displayed in the following table (table 5)

Table 5: Structure of current income and current expenses

Indicator	2018	2019	Q1	Q1	Changes (in Regards of Q1 of 2019)
			2019	2020	
Income receivable	22143,0	25987,3	5448,1	5093	-6.5%
Export	14135,1	16993,4	3681,1	3310,3	-10.1%
Goods	11385,6	13898	3045,0	2714,1	-10.9%
Gold	8476,1	8980,4	1813,6	1708	-5.8%
services	2749,5	3094,8	636,1	596,2	-6.3%
Primary Income receivables	3184,9	2953,5	759,5	634,5	-16.55
Secondary income receivable	4022,9	6040,3	1007,4	1140,6	14.0%
Expenses payable	25736,7	29215,1	6498,0	5905,6	-9.1%

Import	23443,5	26550,8	5931,9	5348,4	-9.8%
Goods	18252,4	21190,0	4741,8	4293,1	-9.5%
Services	5191,1	5360,9	1190,2	1055,3	-11.3%
Primary Income payable	1677,9	2078,5	421,3	426,7	1,3%
Secondary Income payable	615,2	585,7	144,7	130,5	-9.8%
Current Account Balance	-3593,7	-3227,8	-1049,9	-812,2	-22,6%

Source: Central Bank of the Republic of Uzbekistan

The table above shows negative trade balance for first quarter, international services has also negative balance, according to the BPM6 methodology, which amounts to USD 2.0 billion. At the same time, the positive balance of primary and secondary income equalled USD 1.2 billion.

The bank reported that the volume of exports of goods decreased by 11% as compared to the I quarter of 2019. Shares of gold and gas in exports amounted to 37% and 9% respectively. Furthermore, there was a decrease in the export volume of gas by 30% in comparison with the I quarter of 2019. The volume of export of goods (without export of gold and adjustments), in the I quarter of 2020 compared to the previous year, reduced by 6 % (growth in the I quarter of 2019 was equal to 9%).

Volume of import of goods reduced by 9% compared to the I quarter of 2019 (in the I quarter of 2019, an increase of 27% was observed)

Further, **figure 1** depicts the 1st quarter import position in comparison to 1st quarter of 2019 with neighbouring and other countries. Belonging in the neighbourhood of China, where Covid-19 had started showing its effect from the beginning of 2020, the effect could be clearly seen in the first quarter results of import with different countries. Imported goods from China reduced by 9%, from Korea – 30%, from Kazakhstan – 15%, from Turkey – 36% and from Lithuania – 18% (Figure 1). The total share of these countries in imports in the I quarter of 2020 amounted to 72% ; 24% of which accounted for Russia, 21% for China, 11% for the Republic of Korea, 10% for Kazakhstan, 4% for Turkey and 3 % for Lithuania. (In the I quarter of 2019, the total shares of these countries in the volume of imports was 73%, of which 18%, 21%, 14%, 10%, 6% and 3% accounted for each respectively). At the same time, the share of European countries decreased from 23% to 22%, which was related to an increase in the shares of main trading partners in the volume of imports.



Figure:1

Source: Central Bank of the Republic of Uzbekistan

The deficit in international trade with services recorded a decrease by 17% compared to the I quarter of 2019 and amounted USD 459,1 million. exported services amounted to USD 596,2 million (USD 636,1 million in the I quarter of 2019), while their imports amounted to USD 1.1 billion (USD 1.2 billion in the I quarter of 2019). Transport services and services related to tourism (travel) accounted for about 88% of the total export and import of services. The reduction in the deficit of international services in quarter I of 2020 was associated with a relatively large reduction in imports of transport and travel related services compared to the export of these types of services.

IV DISCUSSION

After careful analysis of the financial results it is clear that post breakup of the Soviet Union in 1991, The COVID-19 outbreak is the most severe disruption in Uzbekistan's economy. The spread of the virus has paralyzed almost all the economic sectors of Uzbekistan. Among others, the most affected businesses are transport, trade, tourism industry, restaurant business, and educational services as these face quarantine rules. Uzbekistan Government had implemented some important measures to arrest the downturn of the economy due to the continuation of the current pandemic. (Report published by White & Case: 18th May 2020)

Measures taken by the Uzbekistan Government

Following are some of the important measures implemented:

- To support liquidity position of economy Central Bank reduced refinancing rate from 16% to 15%.
- Commercial banks have been allowed to reconstruct loan repayment for those businesses which are facing financial crisis (decline in economic activity valued at UZS 7 trillion (equivalent of USD 700 million) due to measurement policies of government and other countries to discourage the spread of COVID-19.

- Credit period was extended for individuals and solo entrepreneurs due in next six months of 2020, valued at UZS 4.7 trillion (equivalent of USD 470 million).
- The Fund for Reconstruction and Development of the Republic of Uzbekistan was extended. The maturity periods of loan resources, allocated to commercial banks for refinancing such loans, were deferred for repayment.
- The Ministry of Finance was instructed by the Government to extend the terms of autonomous guarantees granted under relevant loans, the payments of which were extended.
- The Ministry of Finance had been instructed by the Government to provide monthly support, on the account of the Anti-Crisis Fund, to local state authorities to replace the shortfalls incurred as a result of deferrals (instalment plans) for the payments of property tax, land tax and tax for the use of water resources.
- For the period from 1 April 2020 to 1 October 2020: the minimum amount of social tax for individual entrepreneurs was reduced to 50% of the base calculated amount (“BCA”) per month. the amount of mandatory payments for wholesalers of alcoholic beverages was reduced from 5 to 3%; and fees for the right to retail sale of alcoholic products by catering enterprises were reduced by 25% of the amounts set under law.
- An important measure for supporting farming, tax on Water resources used for irrigation purpose was reduced by 50% of rates projected for 2020.
- Businesses experiencing temporary hardships had been relaxed from payment of interest on property tax, land tax and tax for the use of water resources.
- Tourism sector, most affected sector due to quarantine policy; to support tourism industry, Government of Uzbekistan introduced the following tax benefit measures.
- For the period from **1 April to 31 December 2020**, tour operators, travel agents and hotels, JSC “Uzbekistan Airways” (the national airline of Uzbekistan) and its structural divisions, JSC “Uzbekistan Airports” and State Enterprise “Uzaeron avigation Center” were exempt from property tax and land tax with social tax rate reduced to **1%**.
- To support import of construction materials, as well as special equipment and consumable spare parts to be used for the construction and functioning of medical and quarantine facilities to combat the coronavirus pandemic **were exempted** from customs payments, including value-added tax (“VAT”). Import of express tests for coronavirus was exempted from customs fees. These exemptions will apply until **31 December 2020**.
- “Uzbekistan and Kazakhstan were granted a 50 percent discount on railway transportation to support the transportation of import and export of goods and tourism.
Government also announced certain relief measures to export business, thereby allowing:
 - export goods with no payment guarantee while having an overdue receivable **not exceeding 10%** of the total exports of goods for the reporting year; and
 - conduct one-off operations in 2020 on the import of technological equipment and raw materials in exchange for repayment of overdue receivables under the foreign trade operations.

President Mirziyoyev emphasized on 10 percent increase in cotton crops and 20 percent of more grain by stating , “Now, it is the earth and the earth alone that can feed us. All countries have suspended trade. For this reason, we talk about food production, everywhere needs grain, and poultry farming, and cattle breeding, and fishing,”

V CONCLUSION

Among the various sectors of the economy of Uzbekistan, the most affected sector was found to be the service sector, which used to have a higher linkage effect in terms of income and employment generation in the economy. As the country experienced lockdown since mid-March, Industry sector seemed to have escaped the severe hit. It is a matter of concern for the country as the severity of impact of the pandemic is uncertain and can worsen if situation does not improve and the country's downturn continues. According to David Beasley, United Nations World Food Program leader, a steady rise in the different countries in restraining or prohibition of food exports can have possible unruly effects on the global food supply. The government is also imparting pressures on the farmers for meeting production quotas of selected goods and dominating the market to ensure regular supplies. Govt has to motivate private sectors more and liberalize open economy policies, In order to further curb inflation, the report encourages the government to continue to promote private sector involvement in the transportation, education, and health care industries, and streamline customs clearance procedures to avoid price escalation for imports. He also suggested that the solution could lie in adopting the methods that have recently fallen out of favour as the government seeks to open its economy. Considering the negative impact of the pandemic in the world economy in general and Uzbekistan in particular, the second and third quarter data that reflects the health of the economy will be of interest to many researchers. Government of Uzbekistan has adopted strong measures which are expected to be more effective with the assistance and cooperation of development partners who are looked upon to help offset the crisis, the economy is currently going through.

LIMITATIONS OF THE STUDY

- As only first quarter results of economy were available at the time of study, when the pandemic effect might not be significant as major restrictions worldwide started from mid-March, the researchers had to rely on the predictions of international agencies like World Bank, IMF, ADB and various national agencies reports.
- Pandemic is still on, the transitional phase is not ideal enough to throw sufficient light on the happenings in the economy quantitatively.

As a result, most of the discussions in this paper are based on the predictions shared by various international agencies.

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IMPACT OF COVID-19 ON LOGISTIC AND SUPPLY CHAIN OF INDIAN FISHERIES SECTOR

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ABSTRACT

India houses nearly 10 per cent of the global diversity in fish, and the second largest producer of aquaculture, also fourth largest producer of fisheries. About 14 million people are engaged either directly or indirectly in fisheries activities. COVID 19, pandemic disease started its outbreak since December 2019. It hampers fisheries and its allied activities in many ways, especially from logistic and supply chain point of view. Therefore, this paper aims to address the difficulties faced by the fisheries logistic and supply chain activities during disease outbreak and also suggests the possible ways to mitigate such issues in its future occurrences.

I INTRODUCTION

India houses nearly 10 percent of the global diversity in fish, and the second-largest producer of aquaculture, also the fourth-largest producer of fisheries. The share of the fisheries sector in India's Gross Domestic Product is about 1.03 % as of 2017-'18, and it contributed Rs 1.75 trillion during 2017-'18.[1] It accounts for about 6.58% share of India's agricultural gross domestic product. According to the government's estimates, the sector provides livelihoods to about 16 million fishers and fish farmers at the primary level and almost twice the number along the value chain. Aquaculture being the livelihood of coastal people in India. It also includes Freshwater aquaculture contribution of over 95 percent of the total aquaculture production. The COVID 19, a kind of pandemic disease, severely affected the nation across the world due to its severity of contagiousness. It almost stopped the economic engine of the whole world for some time. This crisis influenced various sector in both positive and negative. It has created opportunities for many digital initiatives to flourish as such education,

grocery and food purchase, etc., Its adverse effects include many strategic fields which include the fisheries sector also. The lockdown has started since March 25, 2020 in India and continues with many relaxations. Meantime, the Government of India provided many relaxations and restrictions to the Agro and Food industry viz., Agriculture, fisheries, dairy, and poultry. However, still, the normalcy in the market conditions are not yet returned, which troubles the farmers and fishers tremendously. Hence concerning the nutritional security of the people and the livelihood of people who rely on the food sectors, the Government of India has allowed fisheries and aquaculture activities with Standard Operating procedures and hygienic guidelines. The fisheries sector, which serves as the promising source for 16 million people of our country as a fallback with several governmental restrictions viz., social distancing, minimal freights, reduced human resources and logistics, and minimal movement between states and across nations. Coupling with the lockdown, fish ban period also made the situation difficult to the fisheries and its related activities

Hence, this study gives the detailed analysis of the impact of COVID 19 on logistic and supply chain aspect of Indian Fisheries sector. It also encounters the farmers requirement and rehabilitation measures needed to sustain the fisher folks life without the risk.[2]

II SURVEY-IMPACT ON FISHERIES

2.1 Strategic challenges on Fisheries Supply chain operations by COVID

This section discusses the regular supply chain activities viz. harvesting, Processing operations, and export of commodity carried over in the fisheries sector and the impact of COVID 19 on these operations by hampering the routine practice.

2.1.1 Harvesting:

The harvesting is the initial step towards supply chain operations in the fisheries sector. It includes harvesting the animals which are stocked, reared up to market size on the farm level, and the another one is capturing from the open ocean. This process should be carried out with the utmost accuracy to sustain the profit until the marketing stage. The capture fisheries include the operations with fishing crafts and gears viz., purse seine, trawling, etc, and the culture fisheries include the variety of aquaculture practices viz., Brackish water culture, freshwater, and Mariculture. The shrimp, which is having high demand for the export market, contributes about 80%.

Usually, based on the climatic conditions with taking disease outbreak as a concern, Indian aqua farmers will never stock the seed between November and December of every year because these were the rainy seasons. So, after that India aquafarmers were started stocking their farms in the month of January. But the issues started here with the pandemic outbreak. The supply chain aspects were shut off immediately without any prior notification. The minimum grows out period for shrimp culturing is about 90-120 days; when calculating from the day of stocking march end will be the harvesting time for every Indian aquafarmer, but from March 25,2020 nationwide lockdown announced, and its disturbed the whole process.

However, shrimps are highly sensitive animals, which will be harvested at a size of even 10 grams amid disease outbreak, if any, to minimize the loss. Due to this lockdown, the labour-intensive harvesting operation of Aquaculture was suffered because of labour unavailability. However, the delay of a single day can disrupt the whole culture system tremendously and incur more cost for feeding, which ultimately causes the loss as a result. As shrimps are highly cannibalistic, they kill or eat other weak/ molted / small fish. Moreover, as mentioned, without harvesting, farmers have to hold the culture and feeding the culture, which causes extra expenses. Keeping culture for an extra period exceeding the harvest date can be a

chance for disease spread. The disease spreads rapidly throughout the entire farm, and it can cause a significant loss to the entire culture and lead to economic distress. Like many farmers, mainly small-scale farmers holding their culture, need thrash Fish to feed the culture species. There is no availability of thrash fish, and it becomes difficult for the fish farmers. Farmers harvesting the culture are not able to sell them as buyers are not coming forward to procure fish and fishery products as there is no market. While taking Inland Aquaculture as a concern, the significant carps grown popularly all over India suffered from logistic and market challenges. However, these productions merely contribute to the export market. However, since the governmental norms strictly reject the movement between the districts and states caused the logistic issue and thereby eliminated the whole inland fisheries market.[3]

2.1.2 Processing

Processing is a transformation of raw ingredients by a periodic set of activities that interact to produce a result (i.e., food). Processing also includes toxin removal, preservation, and deactivating spoilage and pathogenic micro-organisms. It is done by either physical or chemical means such as drying, extrusion, pasteurizing, uses of preservatives, etc.

Fish is a highly perishable food that needs proper handling and preservation. Fish processing refers to the processes associated with fish and fish products between the time fish are caught or harvested, and when the final product is delivered to the customer. The term fish processing, although it refers to fish, in practice, it includes any aquatic organisms. The harvested fish should be cleaned and appropriately cooled as soon as possible to prevent fish spoilage, off-flavor, and color. The main objective of fish processing is to prevent fish from spoilage and maintain its freshness for a longer time. Fish processing is divided into primary and secondary processing. Fish handling is the primary or preliminary processing of raw fish and the manufacturing of value-added fish products. Secondary processing produces chilled, frozen, and canned or value-added products for retail. The processing plant operations were already hampered because they relied on migrant workers who make up 50% of the workforce in Andhra Pradesh. Many workers returned to their home states when the lockdown was announced, and are now unable to return to work due to continued restrictions on movement.

2.1.3 Transport and Exportation

During this complete lockdown period transportation is one of the fields which was completely shut down. Due to this condition the farmers suffered a lot because they cannot be able to transport the cultured products for sales. Transportation for labour is also difficult, it leads to stagnation of harvested culture and culture cannot be sold in proper time. Generally, local fish traders come to the farm to collect the harvested fish as there is a constraint in transport, local vendors are not able to buy the cultured fish. Due to the lockdown, the supply chain of fish farming activities was collapsed. Export of aquaculture and fisheries products are affected as the whole world is facing the pandemic even the exporting countries like UK, USA, China etc. are also struggling due to this lockdown. Sluggish in global demand affected the export in the country. Generally, frozen shrimp contribute 70% of the total export. But now, while there are difficulties in harvesting shrimp. To overcome this situation some farmers, preserve their products in cold storage. Some small-scale farmers do not have the facility to store their products, and they are pulled to sell their products in the local market like the prices of fish, shrimp, and mud crabs have fallen. Mud crab weighing above 750 g would fetch INR 1,200 per kg. It is now being sold for INR 300. Sea bass, which is generally sold for INR 500 per kg, is being sold for INR 250 per kg. [3]The import of Vannamei

shrimp brood stock from the United States has been halted, delaying the breeding cycle, with a potential 20-30% fall in shrimp production as a consequence. [3] Besides, it was estimated that millions of shrimp seed and tens of thousands of brood stock might have been lost due to factors including the abrupt lockdown.

2.2. Other challenges imposed by COVID 19 on Fisheries

2.2.1 Price fixation

The state governments have attempted to set the price of shrimp at INR 180 (\$2.4) per kilogram. However, still, traders and factories have refused to purchase at this rate, marking discrepancies between policy and practice. The state governments have facilitated the continuation of fish sales while enforcing social distancing measures by drawing circles on the ground at markets, indicating where people should stand. Online sales and home deliveries have surged, whereas the demand for farmed tilapia is reported to have grown as supplies of marine fish have been constrained. Some fishers have also reported they dry their fish and store them until the lockdown is over.

2.2.2 Fuel and maintenance

Diesel is essential in any form of fisheries like for run pumps in farms and mechanized boats, due to lockdown it is difficult based on financial constraints of the individual. Even mechanics and electricians also unavailable due to lack of transportation and also the rules which doesn't allow any individuals to travel. Farm types of machinery repair and maintenance faced drag due to lockdown. The non-availability of JCBs for renovation and digging of new fish ponds is another issue. Even if farmers manage to get a JCB, availability of labour is to hard or too costly compared to normal days.

2.2.3 Women vendors

Fisher Women, who are actually involved in small level auction work and dryfish making and other small-scale business in fisheries sector. Fish vendors, the majority being women, are unable to continue with their usual door to door selling activities. Due to this complete lockdown no one is allowed to do those doors to door selling even though peoples are also not willing to buy that kind of fish considering unhygienic. So women who earns for the family through this are often affected and they suffered with no income to their family.

2.3.4 Capture fisheries

Capture fisheries is severely affected during the lockdown the fisherman went for fishing before the lockdown order could not sell their captured fish as the markets are all shut down, and There are no laborers and ice to store fish and all the cold storage were closed. The fisherman had to sell their catch around half of the original market price. Like mackerel, cost Rs.70/ kg was sold at Rs.38/ kg. Many fishers were not as lucky as the central government announced a day-long curfew on 22 March 2020 followed by a 21-day lockdown starting March 25 2020. The measures to control the spread of corona virus, social media, and news sites are streaming with first-hand accounts of fishers across the west coast of India, throwing away their fresh fish catch. In the absence of ice, there can be no storage. In the absence of exporters and traders, there can be no selling. In the absence of fish workers, works like loading and unloading of fish, transport of stock and ice, and other jobs that are labor-intensive and integral cannot be performed. The fisher folk who had just returned from the sea did not know what to do with their stock, so they threw it away or sold it at low prices. On March 24, 2020, the fishermen who went fishing before the curfew returned to the landing center. More than a thousand boats are there to unload the catch. Due to the lockdown, the fishers are not allowed to unload their catch faced significant threats. [4]

On regular days, 80% of the catch goes to exporters, but the export market also stopped during the lockdown. To make situations worse, the annual monsoon ban beginning after the first lockdown. The seafood export business in Mumbai is severely affected due to lockdown. The export companies generally export wild-caught seafood like shrimps, prawns, and lobsters to hotels in tourist destinations like Mauritius, Seychelles, Maldives, and Thailand. The seafood export market completely stopped. In addition to lockdown cyclone also affected some parts of India which was also affected the livelihood of peoples especially fisher folks. The cyclone also affected the seafood export business as fishing and exportation were not happening. The seafood export market severely affected by those things already, then lockdown did its part. The seafood export business needs around one year to back every day. Small-scale fisheries affected both in inland and marine. They faced difficulties in unloading catch and selling them. The daily basis customer and traders were shut off due to lockdown. It was hard to continue fishing over these many barriers. The income source is severely affected. To make the best of the worst time, some fishermen are storing their catch as dry fish which they will sell as feed once lockdown is lifted. The whole supply chain is severely impacted. They are not getting essential services or compensation. Only some people have got a little compensation so far. If the issue is not addressed soon, it will also affect the Indian economy as well as fisher folks livelihood

2.3 Governmental measures and regulations

2.3.1 Relaxation

In the process of step by step unlocking relaxation was received on fisheries and marine activities imposed by the federal government in April 2020. In its fifth addendum to its lockdown guidelines, the home ministry suggested these activities under the exempted categories and various other related works, including operation of processing, packaging, cold chain, sale and marketing, hatcheries, feed plants, and commercial aquaria in the marine fishing sector. The government also lifted fish, shrimps, and other seafood products and workers related to fisheries and aquaculture industries.

2.3.2 Monsoon ban

Every year, the central government issues an order imposing a uniform ban on fishing by all fishing vessels in the Indian Exclusive Economic Zone. This is done to ensure sea safety, as the waters tend to be rough during the monsoon, and for conservation, as this is the spawning season for several marine species. On the East coast, the ban is imposed from April 15 till June 20, while on the West coast, it is imposed from June 1 to July 31. On the East coast, the monsoon ban begins immediately after the currently ongoing lockdown is over. On the West coast, the ban begins a month and a half later. However, various boat owners in the mechanized sector of the West coast feel that fishing may not resume during this window, as most of the migrant fish workers who work as crew on boats have gone back to their home states. Generally during this ban period central government and state government provide some subsidiary for helping the fisher people livelihood this time also it was provided it somehow helped them during this worst condition.

2.3.4 Government Relief fund status amid COVID

After the lockdown, a Rs 1.7-lakh crore relief package was announced for farmers under the Pradhan Mantri Kisan Samman Nidhi. It left out traditional fish workers, prompting a letter from the National Fish workers Forum on March 26 2020, demanding a relief package. The union ministry of fisheries sent letters to the fisheries departments of all states on March 26 and 30, requesting details of fish workers in their states, so that relief measures could be worked out. In that regard, a letter dated April 1, 2020, the National Fish workers' Forum

wrote to the Union ministry, stating that the delay in addressing their hardship is highly regrettable. It reiterated their demand for a monthly allowance of Rs 10,000 per month for up to three months is provided to each fishing household in advance. It should be uniform to all workers across the fisheries value chain. The women engaged in fish vending and other allied activities should be specially mentioned in the relief package. It should be ensured that relief is provided to them on a priority basis. In several areas' fishermen are staying in their boats in harbours to avoid restrictions of the lockdown. This situation needed to be addressed; otherwise, the whole system will collapse. The asked compensation is less than the minimum wages set by the government. Fishermen not just take care of food security, but we also protect the country's coast from intruders and earn foreign currency from exports. Fishermen obeyed the prime minister's order on the lockdown period. Now fishermen are looking for help from the government.

III DISCUSSION

Fisheries is an important sector which contributes 4.85 % to the GDP of the nation. And also directly and indirectly it supporting the Indian economy in many ways . but due to this current situation this sector is heavy affected to overcome this situation in fisheries field they need to be concentrated and some welfare scheme should be announced by the government to support the fish farmers and fisher mans to bring it back. And government also should hear out the needs and requirements of those peoples. The farmers humble request to the government is to provide fingerling and feed to fish free of cost and provide loans up to 1 lakh without interest. They require transport facilities to move the fish to the market. The lockdown completely sealed villages and restricted the movement of people, affecting fish farm activities severely. Since it is the fish harvesting period, and it is complicated to harvest fish without labourers and transport and feeding the fishes in the ponds. Aqua farmers are in deep crisis as many are in debt due to repeated failure of shrimp culture. They have invested total earnings and borrowed money from moneylenders. There are no buyers, and prices have come down due to local logistics and supply chains.[5] They will lose confidence if there is no procurement of shrimps as per government guideline prices. Many farmers like this may leave shrimp farming in the future, and the impact will be very severe if the lockdown continues for some more time, and people may starve due to lack of income.

IV CONCLUSION

To overcome this situation and preparedness for future issues, some schemes and measures that should help the farmers and fisherman and needs that are helpful in making the situation better are listed out.

- The procurement of shrimp as per government fixed prices needs to be monitored and implemented. The Andhra Pradesh government, for instance, has announced price. Other governments also should announce similar schemes to procure them.
- Relaxation in transportation to market produce immediately after the harvest in the nearby towns allows laborers to travel and work in the farms.
- Exploring options and promotion of shrimp sales in the Indian markets rather than looking at international markets. Even after lockdown, many countries may likely not import shrimps, and it is time to increase quality supply to Indian consumers.

- Insurance policy needs to be reassessed. It is tough to get insurance coverage as per existing schemes for shrimp farming, and the premium is also high. A viable insurance cover should be provided for these small farmers.
- Increasing cold storage facilities in major hubs and also processing plants to meet these disasters in the future. With the support of NFDB, the state fisheries department should establish mega cold storage facilities in significant aquaculture hubs to store the fishes/shrimps for a considerable time.
- Immediate arrangements should be made from the Government procurement center for procuring freshwater catch.
- Ensure transport facility to connect the supply chain of the products ensuring smooth flow without any restrictions.
- Provide arrangements to issue fish fingerlings and seeds for the farms free of cost.
- A separate supply time through token systems could be arranged for diesel supply for the farm activities to prevent crowding and ensure it is streamlined. [1]

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A STUDY ON PERFORMANCE EVALUATION OF CLOSE ENDED MUTUAL FUND SCHEMES IN INDIA

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ABSTRACT

The present study attempts to evaluate the performance of top 7 mutual fund houses. The sample includes a total of 35 close ended income schemes, 5 each from 7 mutual funds houses. Benchmark and risk free rate used for comparing the performance. Period of the study is 3 financial years i.e. from 2015-16 to 2018-19. For analysis, monthly NAV of selected schemes took along with monthly closing value of CRISIL 10 Year Gilt Index as market index and 91 days treasury bills taken as risk free return. Sharpe ratio, Treynor ratio and Jensen measure has been used for the purpose of risk return analysis. The findings of the study revealing that 15 close ended schemes out of 35 outperformed and 20 schemes underperformed as compare to benchmark CRISIL 10 Year Gilt Index by average return. HDFC FMP 1190D March 2016-17 (1) (35) ranked 1st by Sharpe ratio, UTI Fixed Term Income Fund- Series XXII - Plan X - (1098 days) ranked 1st by Theynor Ratio, Kotak FMP Series 172 - (1126D) 1st by Jensen ratio. Out of selected 35 income schemes 35, 17, 19 schemes outperformed as compared to Benchmark CRISIL 10 Year Gilt by Sharpe, Treynor and Jensen Ratios. Overall performance of selected schemes is satisfactory.

Keywords: Risk-Return Analysis, Performance, Sharpe, Treynor, Jensen, Beta.

I. INTRODUCTION

Future is uncertain, no one can estimate accurately what will going to happen in the near future. Everyone do some sort of investment in the present to safeguard the future. Investment means sacrificing something in present to get its benefits in future. Most of the investors don't have skills, time and knowledge to manage their money even they can't predict the movement of stock market. Investment in one basket is always risky so need to go for diversification i.e. investment in different companies of different sectors at the same time. Diversification is one of tool to reduce risk. Mutual Fund is one of the good options for investment in such cases. Mutual funds also carry some sort of risks but it is diversified by expert fund managers and professionals by investing funds in different companies. Professional fund managers working on behalf of mutual funds and charge management fee for managing the money of investors. AMC (Asset Management Company) are the organisations who manage the investment. The Present study Seeks to evaluate the Performance of close ended mutual funds in India. It tries to evaluate the performance of different schemes of mutual funds.

According to Securities and Exchange Board of India (SEBI) Regulations 1996, "Mutual Fund means a fund established in the form of a trust to raise money through the sale of its units to the public or a section of the public under one or more schemes for investing in securities, including money market instruments."

History of mutual fund in India

Mutual fund Industry Started in India with the initiative of the Government of India and Reserve Bank of India with the formation of Unit Trust of India in 1963. The AUM of UTI had increased from Rs. 24.67 crore in 1964-65 to Rs. 4563.68 crore in 1986-87.

First Phase (1964-1987) In 1963 Unit Trust of India (UTI) was established by an act of parliament and functioned under RBI (Reserve Bank of India). From 1987 to 1992-93, Indian Mutual fund Industry expanded seven times in terms of AUM. Till 1993, mutual fund Industry had AUM of Rs. 47004 crore.

Second Phase (1987-1993, Public Sector Funds Entry) In 1987 non-UTI, public sector mutual funds came into existence by Public sector banks. There were total 33 mutual fund companies with AUM of Rs. 121805 crore and UTI with AUM of Rs. 44541 crore till January 2003

Third Phase (1993-2003, Entry of Private Sector Funds) Kothari Pioneer (now merged with Franklin Templeton) was the first private sector mutual fund registered in July 1993.

Fourth Phase (since February 2003) In February 2003, the UTI act was repealed and bifurcated into 2 entities UTI mutual fund and specified undertaking of the Unit Trust of India. Indian mutual fund industry has witnessed impressive growth with their number of schemes increased from 1 in 1964 to 2042 in 2019, with 43 players i.e. mutual fund companies in the market. The total AUM had also increased from Rs. 24.67 crore in March 1965 to Rs. 23,93,486 crore in September, 2019.

II. REVIEW OF LITERATURE

Treynor (1965) discussed market influence on portfolio returns and investors' aversion to risk. He relates the rate of return of a fund to rate of return of a suitable market average on a characteristics line, graphically. While composing the mutual fund performance measure, investment risk was taken into consideration. He developed a single line index, T_n , called Treynor index.

Symbolically:

$$T_n = (AR_p - R_f) / \beta_p$$

AR_p = average return on portfolio n,

R_f = riskless rate of interest/return

β_p = beta value of portfolio n

Risk premium of the portfolio measured by his index, where difference between the return of the portfolio and riskless rate is equals to risk premium. Higher the value of T_n , the better performance of the fund.

Sharpe (1966) evaluated the average annual returns of 34 mutual funds for the period 1944 to 1963. On the basis of past performance he tried to predict the future performance of the funds and ranked the sample of mutual funds over two periods i.e. from 1944-53 & 1954-63. Actual return and standard deviation was applied to predict the performance of funds. Sharpe developed a composite measure of risk and returns as the reward to variability which defines higher the ratio, higher the performance.

Symbolically:

$$S_t = (AR_{pt} - R_f) / \sigma_t$$

AR_{pt} = average return on portfolio t.

R_f = riskless rate of interest/return

σ_t = Standard deviation of return on portfolio t

Jensen (1968) developed a composite portfolio evaluation technique to measure the absolute performance of funds on the risk-adjusted basis. 115 open ended mutual fund were studied from 1945-1964. Codes were denoted according to the scheme like 0-Growth, 1-Income, 2-Balanced, 3-Growth-Income and 4-Income-growth. Results indicated that 39 funds had positive alpha and 76 had negative alpha if net return is taken into consideration. 48 funds gave positive alpha and 67 funds gave negative alpha if the gross return is taken into consideration. The study concluded that prediction ability of fund managers was poor and found little evidence about individual funds to perform better than expected return.

Pendaraki and Zopounidis (2002) evaluated the mutual fund performance measures and explained various problems/ restrictions observed while application of these measures. Return, Risk, Beta, Sharpe, Treynor, Jensen, Fama, Treynor & Mazuy, Henriksson & Merton, Modigliani measures taken into consideration. Drawback of these measures was the use of proxy variable. The researchers concluded that investment manager's performance can be

judged in long term at the place of the short term because in the short term it can be impacted by certain events.

Tariq et al; (2009) evaluated the performance of 13 selected mutual funds and ranked them on the basis of Sharpe, Treynor, Jensen ratios. The empirical research design was used and with the help of judgmental sampling technique 13 equity diversified-growth funds were chosen as a sample. NAV was used to measure the risk on daily basis. Secondary data was used to collect the required information. Findings of the study revealed that Sharpe and Treynor ratios gave approximate same rank to all the funds but opposed to the Jensen ratios. There was not any linear relationship between risk and return.

Patil and Prakash (2011) studied 15 mutual fund schemes to find correlation between schemes and market indexes. 5 Growth and 10 Index schemes had taken under study. Period of the study was 2007-08 to 2009-10. Most of the schemes had a positive correlation with market indexes near to perfect. Return under mutual funds was 34% as compared to 24% in the market. Mutual fund performed better in the 2007-08 financial year as compared to other financial years due to the crisis.

Bantwa and Krunal (2012) evaluated the performance of 20 selected Equity schemes with various techniques like portfolio return, Sharpe, Treynor, Jensen, Fama, diversification (R^2), systematic risk (Beta) and unique risk. Monthly NAV was used from June 2007 to May 2012 for analysing the data. Sharpe and Treynor had .99 correlations for the selected schemes. 11 schemes out of 20 had positive results. 11 schemes had beta more than 1: showed more volatility. The correlation was .79 between return & risk in case of schemes having a return greater than 7% and .23 in case of return less than 7%. Jensen & portfolio return had .89 and Fama & portfolio return had .98 correlations.

Jain (2012) analysed the 45 schemes of 2 private sector (LIC, UTI) and 2 public sectors (ICICI, HDFC) mutual fund companies. Comparison of the performance of the public sector and private sector mutual fund schemes was objective of the study. CAPM model and risk-return relationship applied for analysing the performance. Period of the study was 15 years from 1997 to 2012. Sensex closing, Nifty closing and Daily NAV closing were taken for analysis the performance. Private sector mutual fund performed better as compared to public sector mutual fund. 6 schemes out of 9, 11 schemes out of 16, 4 out of 11 schemes of HDFC, ICICI and UTI over performed respectively. Study concluded that no any scheme of LIC over performed. LIC performed worst out of selected mutual fund companies.

Zaheeruddin et al (2013) evaluated the performance of mutual funds with the return, beta and standard deviation. 3 private sector mutual funds scheme compared with S & P CNX Nifty index and ranked those funds on the basis of Sharpe, Treynor and Jensen ratios. NAV was taken on the quarterly basis for analysis. Null Hypothesis was set as performance ratios enable the investors to choose the benchmark companies. ICICI equity fund was best performer fund out of 3 selected mutual funds as the average return was higher and the standard deviation was low as compared to other funds. Sharpe, Treynor and Jensen gave the same ranking to the selected funds. Null Hypothesis was accepted and study concluded at the last that evaluator can easily assess the performance by using financial ratios.

Gandhi and Perumal (2015) compared the performance of selected mutual fund schemes and ranked them. 2 private (HDFC, ICICI) and 2 (SBI, Canara) public sector mutual fund schemes of Equity diversified & Equity mid-cap were taken under study. Beta, Alpha, Standard Deviation, Sharpe, Treynor and Information ratios were applied for evaluation. Canara Robeco Equity diversified (Equity-Diversified) and HDFC Capital Builder (mid-cap) schemes ranked 1 by Sharpe, Treynor, Jensen and Information Ratio. ICICI Prudential

growth scheme had the highest beta .888 i.e. aggressiveness and SBI magnum equity fund had highest standard deviation 3.177 i.e. riskiness.

Raju et al (2015) evaluated performance of equity based mutual fund schemes. Daily NAV was taken from January 2012 to December 2014 for comparing the performance of selected funds with BSE 100 index. Techniques like Return, Standard Deviation, Beta, Sharpe, Treynor and Jensen ratios were applied to evaluate the performance. Franklin Asian equity fund had least standard deviation and Axis Equity had least Beta i.e. 0.04%. Reliance Equity Opportunities fund had the highest return of 48.73% as compared to benchmark 28.32%. Sharpe and Treynor ratios gave rank 1 to Axis Equity fund and Jensen gave rank 1 to Reliance Equity Opportunities fund.

III. OBJECTIVES OF THE STUDY

The study aims at gaining insight into the financial performance evaluation of mutual fund schemes.

- To evaluate the performance of the selected close ended mutual fund's scheme in terms of risk and return relationship by using Sharpe, Treynor and Jensen ratio.
- To rank the selected close ended mutual fund schemes on the basis of Sharpe, Treynor, Jensen ratios.

IV. RESEARCH METHODOLOGY

Research Design- In this study, Descriptive research design is applied.

Sampling Design- Sampling design describes the way of selecting the sample for the study.

Multistage sampling technique is applied. In first stage, top mutual fund houses are selected on the basis of highest AAUM i.e. more than 5% share. Only 8 mutual fund houses having more than 5% share. Out of 8 mutual fund companies only 7 have close ended schemes during 2015-16 financial year. In second stage, 5 schemes from each fund selected on the basis of highest AUM in respective fund. Selected 7 mutual fund companies are as follows-

1. SBI funds Management Private Limited
2. Unit Trust of India AMC Limited
1. ICICI Prudential Asset Management Company Limited
2. HDFC Asset Management Company Limited
3. Reliance Nippon Life Asset Management Limited
4. Aditya Birla Sun Life Asset Management Company Limited
5. Kotak Mahindra Asset Management Company Limited

Period of study- The income oriented close ended schemes, which have been floated by selected 7 mutual funds during 2015-16 to 2018-19 have been considered for the purpose of the study. Most of the close ended schemes have operational life of 3 years.

Sources of data- The study is based on secondary data. Secondary data is collected from various websites like AMFI, SEBI and other company websites to compare the performance of selected funds with various benchmarks, Monthly NAV used for performance evaluation.

Benchmark Index- CRISIL 10 Year Gilt Index taken as benchmark index for this study because all the selected close ended schemes considered CRISIL 10 Year Gilt Index for their performance comparison.

Tools for Data Analysis- Sharpe, Treynor and Jensen Ratios

Classification of selected mutual fund schemes- Table 1.1

Sr. No	Scheme Name	Date of Inception	AUM
1	HDFC FMP 1114D March 2016 (1) (35)	22-Mar-16	2289.65
2	HDFC FMP 1167D January 2016 (1) (35)	29-Jan-16	1330.52
3	HDFC FMP 1161D February 2016 (1) (35)	26-Feb-16	849.61
4	HDFC FMP 1107D March 2016 (1) (36)	29-Mar-16	685.74
5	HDFC FMP 1190D March 2016 (1) (35)	23-Mar-16	642.31
6	ICICI Prudential FMP - Series 78 - 1115 Days Plan X	29-Mar-16	319.14
7	ICICI Prudential FMP - Series 78 - 1281 Days Plan V	30-Mar-16	312.84
8	ICICI Prudential FMP - Series 77 - 1129 Days Plan W	24-Sep-15	281.9
9	ICICI Prudential FMP - Series 78 - 1190 Days Plan C	30-Dec-15	238.84
10	ICICI Prudential FMP - Series 78 - 1150 Days Plan N	2-Mar-16	238.67
11	SBI Debt Fund Series B - 36 - Regular Plan	30-Mar-16	488.8
12	SBI Debt Fund Series B - 18 - Regular Plan	26-May-15	297.39
13	SBI Debt Fund Series B - 16 - Regular Plan	12-May-15	286.56
14	SBI Debt Fund Series B - 26 - Regular Plan	20-Oct-15	266.52
15	SBI Debt Fund Series B - 27 - Regular Plan	17-Nov-15	260.29
16	Aditya Birla Sun Life Fixed Term Plan - Series MX (1128D)	22-Sep-15	365.59
17	Aditya Birla Sun Life Fixed Term Plan - Series NI (1163D)	11-Feb-16	159.22
18	Aditya Birla Sun Life Fixed Term Plan - Series MP (1141D)	26-May-15	236.98
19	Aditya Birla Sun Life Fixed Term Plan - Series NG (1196D)	29-Jan-16	168.16
20	Aditya Birla Sun Life Fixed Term Plan - Series NB (1099D)	17-Dec-15	159.73
21	Reliance Fixed Horizon Fund 30 - Series 4	4-Feb-16	649.38
22	Reliance Fixed Horizon Fund 29 - Series 8	26-Sep-15	534.56
23	Reliance Fixed Horizon Fund 29 - Series 9	6-Oct-15	510.03
24	Reliance Fixed Horizon Fund 30 - Series 17	30-Mar-16	459.47
25	Reliance Fixed Horizon Fund 29 - Series 16	3-Dec-15	436.07
26	UTI Fixed Term Income Fund- Series XXII - Plan VI - (1098 days)	26-Jun-15	466.45
27	UTI Fixed Term Income Fund- Series XXII - Plan X - (1098 days)	8-Jul-15	445.13
28	UTI Fixed Term Income Fund- Series XXII - Plan IX - (1098 days)	30-Jun-15	442.31
29	UTI Fixed Term Income Fund- Series XXII - Plan XIV- (1100 days)	12-Aug-15	365.67
30	UTI Fixed Term Income Fund- Series XXIII - Plan III- (1098 days)	11-Sep-15	340.49
31	Kotak FMP Series 183 - (1204D) - Regular Plan	23-Dec-15	563.01
32	Kotak FMP Series 178 - (1099D) - Regular Plan	20-Aug-15	421.92
33	Kotak FMP Series 187 - (1146D) - Regular Plan	24-Feb-16	497.87
34	Kotak FMP Series 172 - (1126D) - Regular Plan	27-Mar-15	488.58
35	Kotak FMP Series 176 - (1100D) - Regular Plan	15-Jul-15	320.67

V. Data Analysis and Interpretation

Table 1.2- Sharpe Ratio of Various Income Close Ended Mutual Fund Schemes

Sr. No	Scheme Name	Sharpe Ratio	Ranking
1	Aditya Birla Sun Life Fixed Term Plan - Series MP (1141D)	0.388	27
2	Aditya Birla Sun Life Fixed Term Plan - Series OI (1120)	1.495	13
3	Aditya Birla Sun Life Fixed Term Plan - Series MX (1128D)	0.466	24
4	Aditya Birla Sun Life Fixed Term Plan - Series NG (1196D)	1.987	9
5	Aditya Birla Sun Life Fixed Term Plan - Series NB (1099D)	0.377	28
6	HDFC FMP 1161D February 2016-17 (1) (35)	3.863	3
7	HDFC FMP 1114D March 2016-17 (1) (35)	2.121	8
8	HDFC FMP 1167D January 2016-17 (1)	1.935	10
9	HDFC FMP 1107D March 2016-17 (1)	2.636	6
10	HDFC FMP 1190D March 2016-17 (1)	4.819	1

11	ICICI Prudential FMP - Series 78 - 1281 Days Plan V	4.259	2
12	ICICI Prudential FMP - Series 78 - 1115 Days Plan X	3.380	4
13	ICICI Prudential FMP - Series 77 - 1129 Days Plan W	0.145	35
14	ICICI Prudential FMP - Series 78 - 1190 Days Plan C	0.234	30
15	ICICI Prudential FMP - Series 78 - 1150 Days Plan N	2.426	7
16	Kotak FMP Series 178 - (1099D) - Regular Plan	0.617	18
17	Kotak FMP Series 183 - (1204D) - Regular Plan	0.463	25
18	Kotak FMP Series 187 - (1146D) - Regular Plan	3.157	5
19	Kotak FMP Series 172 - (1126D) - Regular Plan	0.930	16
20	Kotak FMP Series 176 - (1100D) - Regular Plan	0.505	22
21	SBI Debt Fund Series B - 18 - Regular Plan	0.203	34
22	SBI Debt Fund Series B - 36 - Regular Plan	0.366	29
23	SBI Debt Fund Series B - 16 - Regular Plan	0.211	33
24	SBI Debt Fund Series B - 26 - Regular Plan	0.229	31
25	SBI Debt Fund Series B - 27 - Regular Plan	0.213	32
26	UTI Fixed Term Income Fund- Series XXII - Plan X - (1098 days)	0.516	21
27	UTI Fixed Term Income Fund- Series XXII - Plan VI - (1098 days)	0.975	15
28	UTI Fixed Term Income Fund- Series XXII - Plan XIV- (1100 days)	0.482	23
29	UTI Fixed Term Income Fund- Series XXIII - Plan III- (1098 days)	0.414	26
30	UTI Fixed Term Income Fund- Series XXII - Plan IX - (1098 days)	0.763	17
31	Reliance Fixed Horizon Fund 30 - Series 4	1.433	14
32	Reliance Fixed Horizon Fund 29 - Series 8	0.578	19
33	Reliance Fixed Horizon Fund 29 - Series 9	0.540	20
34	Reliance Fixed Horizon Fund 30 - Series 17	1.715	11
35	Reliance Fixed Horizon Fund 29 - Series 16	1.654	12

Interpretation: The table 1.2 reflects the Sharpe's value for the selected income close ended schemes of selected companies during 2015-16 to 2018-19. 35 out of 35 schemes have positive Sharpe value which depicts the good performance of income close ended schemes in the market. As per Sharpe, HDFC FMP 1190D March 2016-17 (1) (35) has highest positive values which rank 1st where as ICICI Prudential FMP - Series 77 - 1129 Days Plan W rank 35th because of least Sharpe ratio.

Table 1.3- Treynor Ratio of selected Income Close End Mutual Fund Schemes

Sr. No	Scheme Name	Treynor Ratio	Ranking
1	Aditya Birla Sun Life Fixed Term Plan - Series MP (1141D)	-0.0025	22
2	Aditya Birla Sun Life Fixed Term Plan - Series OI (1120)	0.0023	4
3	Aditya Birla Sun Life Fixed Term Plan - Series MX (1128D)	0.0008	9
4	Aditya Birla Sun Life Fixed Term Plan - Series NG (1196D)	-0.0046	27
5	Aditya Birla Sun Life Fixed Term Plan - Series NB (1099D)	0.0005	12
6	HDFC FMP 1161D February 2016-17 (1) (35)	-0.0089	33
7	HDFC FMP 1114D March 2016-17 (1) (35)	-0.0049	28
8	HDFC FMP 1167D January 2016-17 (1)	-0.0045	26
9	HDFC FMP 1107D March 2016-17 (1)	-0.0061	30
10	HDFC FMP 1190D March 2016-17 (1)	-0.0111	35
11	ICICI Prudential FMP - Series 78 - 1281 Days Plan V	-0.0098	34
12	ICICI Prudential FMP - Series 78 - 1115 Days Plan X	-0.0078	32
13	ICICI Prudential FMP - Series 77 - 1129 Days Plan W	0.0003	16
14	ICICI Prudential FMP - Series 78 - 1190 Days Plan C	0.0003	17
15	ICICI Prudential FMP - Series 78 - 1150 Days Plan N	-0.0056	29
16	Kotak FMP Series 178 - (1099D) - Regular Plan	0.0016	7
17	Kotak FMP Series 183 - (1204D) - Regular Plan	0.0007	11
18	Kotak FMP Series 187 - (1146D) - Regular Plan	-0.0073	31
19	Kotak FMP Series 172 - (1126D) - Regular Plan	-0.0019	20

20	Kotak FMP Series 176 - (1100D) - Regular Plan	0.0022	5
21	SBI Debt Fund Series B - 18 - Regular Plan	-0.0011	18
22	SBI Debt Fund Series B - 36 - Regular Plan	0.0005	13
23	SBI Debt Fund Series B - 16 - Regular Plan	-0.0012	19
24	SBI Debt Fund Series B - 26 - Regular Plan	0.0004	14
25	SBI Debt Fund Series B - 27 - Regular Plan	0.0003	15
26	UTI Fixed Term Income Fund- Series XXII - Plan X - (1098 days)	0.0241	1
27	UTI Fixed Term Income Fund- Series XXII - Plan VI - (1098 days)	0.0068	2
28	UTI Fixed Term Income Fund- Series XXII - Plan XIV- (1100 days)	0.0015	8
29	UTI Fixed Term Income Fund- Series XXIII - Plan III- (1098 days)	0.0008	10
30	UTI Fixed Term Income Fund- Series XXII - Plan IX - (1098 days)	-0.0032	25
31	Reliance Fixed Horizon Fund 30 - Series 4	0.0020	6
32	Reliance Fixed Horizon Fund 29 - Series 8	-0.0031	24
33	Reliance Fixed Horizon Fund 29 - Series 9	-0.0026	23
34	Reliance Fixed Horizon Fund 30 - Series 17	-0.0020	21
35	Reliance Fixed Horizon Fund 29 - Series 16	0.0025	3

Interpretation: The table 1.3 reflects the Treynor's value for the selected income close ended schemes of selected companies during 2015-16 to 2018-19. 17 out of 35 schemes have positive Treynor value which depicts the good performance of income close ended schemes in the market. As per Treynor, UTI Fixed Term Income Fund- Series XXII - Plan X has highest positive values which rank 1st where as HDFC FMP 1190D March 2016-17 rank 35th because of least treynor ratio.

Table 1.4- Jensen Ratio of selected Close End Mutual Fund Schemes

Sr. No	Scheme Name	Jensen Ratio	Ranking
1	Aditya Birla Sun Life Fixed Term Plan - Series MP (1141D)	0.033	16
2	Aditya Birla Sun Life Fixed Term Plan - Series OI (1120)	-0.039	23
3	Aditya Birla Sun Life Fixed Term Plan - Series MX (1128D)	-0.085	29
4	Aditya Birla Sun Life Fixed Term Plan - Series NG (1196D)	0.060	6
5	Aditya Birla Sun Life Fixed Term Plan - Series NB (1099D)	-0.141	33
6	HDFC FMP 1161D February 2016-17 (1) (35)	0.088	2
7	HDFC FMP 1114D March 2016-17 (1) (35)	0.040	10
8	HDFC FMP 1167D January 2016-17 (1)	0.051	8
9	HDFC FMP 1107D March 2016-17 (1)	0.031	17
10	HDFC FMP 1190D March 2016-17 (1)	0.067	4
11	ICICI Prudential FMP - Series 78 - 1281 Days Plan V	0.044	9
12	ICICI Prudential FMP - Series 78 - 1115 Days Plan X	0.026	18
13	ICICI Prudential FMP - Series 77 - 1129 Days Plan W	-0.082	27
14	ICICI Prudential FMP - Series 78 - 1190 Days Plan C	-0.156	34
15	ICICI Prudential FMP - Series 78 - 1150 Days Plan N	0.038	13
16	Kotak FMP Series 178 - (1099D) - Regular Plan	-0.056	26
17	Kotak FMP Series 183 - (1204D) - Regular Plan	-0.166	35
18	Kotak FMP Series 187 - (1146D) - Regular Plan	0.060	5
19	Kotak FMP Series 172 - (1126D) - Regular Plan	0.114	1
20	Kotak FMP Series 176 - (1100D) - Regular Plan	-0.027	21
21	SBI Debt Fund Series B - 18 - Regular Plan	0.040	11
22	SBI Debt Fund Series B - 36 - Regular Plan	-0.109	31
23	SBI Debt Fund Series B - 16 - Regular Plan	0.040	12
24	SBI Debt Fund Series B - 26 - Regular Plan	-0.097	30
25	SBI Debt Fund Series B - 27 - Regular Plan	-0.110	32
26	UTI Fixed Term Income Fund- Series XXII - Plan X - (1098 days)	0.005	19
27	UTI Fixed Term Income Fund- Series XXII - Plan VI - (1098 days)	-0.014	20

28	UTI Fixed Term Income Fund- Series XXII - Plan XIV- (1100 days)	-0.048	25
29	UTI Fixed Term Income Fund- Series XXIII - Plan III- (1098 days)	-0.084	28
30	UTI Fixed Term Income Fund- Series XXII - Plan IX - (1098 days)	0.056	7
31	Reliance Fixed Horizon Fund 30 - Series 4	-0.043	24
32	Reliance Fixed Horizon Fund 29 - Series 8	0.035	15
33	Reliance Fixed Horizon Fund 29 - Series 9	0.036	14
34	Reliance Fixed Horizon Fund 30 - Series 17	0.075	3
35	Reliance Fixed Horizon Fund 29 - Series 16	-0.031	22

Interpretation: The table 1.4 shows the Jensen's value for the selected income close ended schemes for the period 2015-16 to 2018-19. 19 out of 35 have positive Jensen value describing the outperformance of selected income close ended schemes in the market. As per Jesnen Kotak FMP Series 172 - (1126D) rank 1st whereas Kotak FMP Series 183 - (1204D) rank 35th because of least Jensen ratio.

Table 1.5 Ranking of funds by all the selected ratios

Sr. No	Scheme Name	Sharpe	Treynor	Jensen
1	Aditya Birla Sun Life Fixed Term Plan - Series MP (1141D)	27	22	16
2	Aditya Birla Sun Life Fixed Term Plan - Series OI (1120)	13	4	23
3	Aditya Birla Sun Life Fixed Term Plan - Series MX (1128D)	24	9	29
4	Aditya Birla Sun Life Fixed Term Plan - Series NG (1196D)	9	27	6
5	Aditya Birla Sun Life Fixed Term Plan - Series NB (1099D)	28	12	33
6	HDFC FMP 1161D February 2016-17 (1) (35)	3	33	2
7	HDFC FMP 1114D March 2016-17 (1) (35)	8	28	10
8	HDFC FMP 1167D January 2016-17 (1)	10	26	8
9	HDFC FMP 1107D March 2016-17 (1)	6	30	17
10	HDFC FMP 1190D March 2016-17 (1)	1	35	4
11	ICICI Prudential FMP - Series 78 - 1281 Days Plan V	2	34	9
12	ICICI Prudential FMP - Series 78 - 1115 Days Plan X	4	32	18
13	ICICI Prudential FMP - Series 77 - 1129 Days Plan W	35	16	27
14	ICICI Prudential FMP - Series 78 - 1190 Days Plan C	30	17	34
15	ICICI Prudential FMP - Series 78 - 1150 Days Plan N	7	29	13
16	Kotak FMP Series 178 - (1099D) - Regular Plan	18	7	26
17	Kotak FMP Series 183 - (1204D) - Regular Plan	25	11	35
18	Kotak FMP Series 187 - (1146D) - Regular Plan	5	31	5
19	Kotak FMP Series 172 - (1126D) - Regular Plan	16	20	1
20	Kotak FMP Series 176 - (1100D) - Regular Plan	22	5	21
21	SBI Debt Fund Series B - 18 - Regular Plan	34	18	11
22	SBI Debt Fund Series B - 36 - Regular Plan	29	13	31
23	SBI Debt Fund Series B - 16 - Regular Plan	33	19	12
24	SBI Debt Fund Series B - 26 - Regular Plan	31	14	30
25	SBI Debt Fund Series B - 27 - Regular Plan	32	15	32
26	UTI Fixed Term Income Fund- Series XXII - Plan X - (1098 days)	21	1	19
27	UTI Fixed Term Income Fund- Series XXII - Plan VI - (1098 days)	15	2	20
28	UTI Fixed Term Income Fund- Series XXII - Plan XIV- (1100 days)	23	8	25
29	UTI Fixed Term Income Fund- Series XXIII - Plan III- (1098 days)	26	10	28
30	UTI Fixed Term Income Fund- Series XXII - Plan IX - (1098 days)	17	25	7
31	Reliance Fixed Horizon Fund 30 - Series 4	14	6	24
32	Reliance Fixed Horizon Fund 29 - Series 8	19	24	15
33	Reliance Fixed Horizon Fund 29 - Series 9	20	23	14
34	Reliance Fixed Horizon Fund 30 - Series 17	11	21	3
35	Reliance Fixed Horizon Fund 29 - Series 16	12	3	22

Interpretation: Sharpe and Jensen ratios have highest correlation .636 describing similarity in ranking the funds. Jensen and Treynor have highest negative correlation -.66 describing dissimilarity in ranking the funds

VI. FINDINGS

- HDFC FMP 1190D March 2016-17 (1) (35) rank 1st and ICICI Prudential FMP - Series 77 - 1129 Days Plan W rank 35th by Sharpe ratio.
- UTI Fixed Term Income Fund- Series XXII - Plan X has highest positive Treynor ratio resulted rank 1st where as HDFC FMP 1190D March 2016-17 has highest negative Treynor resulted rank 35th
- Kotak FMP Series 172 - (1126D) rank 1st and Kotak FMP Series 183 - (1204D) rank 35th by Jensen ratio.
- Sharpe and Jensen ratios have similarity in ranking the funds
- Treynor and Jensen ratios have dissimilarity in ranking the funds.

VII. CONCLUSION

Mutual fund has emerged as one of the important class of financial intermediaries which cater to the needs of the potential investors. From this research it is quite clear that the income close ended mutual fund schemes have potential to give the high returns but the investor should be aware about schemes those are really operating and give high returns. Overall mutual fund companies have average returns during 2015-16 to 2018-19. 17 schemes out of 35 outperformed in all aspect.

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PRIVACY PRESERVATION OF COVID-19: A REVIEW

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ABSTRACT

With the growing speed of technology, data is also growing at a rapid speed. Big data indicates data in an enormous amount and sometimes it becomes difficult to handle by traditional systems. With this increased growth, different challenges are also increasing. And a big challenge is data privacy in big data. Data is generating from different sources such as social media, health care records, government, and weblogs etc. Efficient techniques are required to protect the sensitive information of patients in healthcare. A new pandemic has been affecting the patients very badly known as COVID-19. Data of COVID-19 patients requires privacy and different techniques can be used to preserve the privacy of COVID-19 patients. Preserving the privacy of this data is also important as personal information of patients is often misused by any third party for their own benefits. The goal of this paper focused on the study of some of the techniques for privacy preservation of sensitive information in big data and also presented the security and privacy challenges in big data. The purpose of paper is to review and analyze various techniques to preserve privacy of COVID-19 data.

Key words-Big data, Privacy, Privacy preservation, Anonymization, COVID-19

I INTRODUCTION

With the growing speed of technology, data is also growing at a rapid speed. Big data indicates data in an enormous amount and sometimes it becomes difficult to handle by traditional systems. Data is generating from different sources such as social media, health care records, government, and weblogs etc. And this data can be in the form of structured, semi-structured and un-structured data. Data can be of different types such as image, text, audio or video [1]. With this increased growth of data, different challenges are also increasing. And a big challenge is data privacy in big data. Efficient techniques are required to protect the sensitive information of patients in healthcare [2]. A new pandemic has been affecting the patients very badly known as COVID-19 [3]. Data of COVID-19 patients requires privacy and different techniques can be used to preserve the privacy of COVID-19 patients. These techniques are analyzed with their merits and demerits to get the effective results.

RELATED WORK:

W. Fang et al. [1], introduced various techniques for privacy preservation and how privacy can be preserved by using these techniques. Anonymization, access control, encryption, data auditing, and differential privacy are various important aspects of privacy preservation discussed by the author in detail. H. Taneja et al. [2], presented an approach to reduce the identification risk in electronic health care records. P. Goswami et al. [4], provided a study on big data, challenges, privacy and security and also distinguishes the privacy and security requirements in big data. U. Saranya et al. [5], described the comparative review of different anonymization techniques with the slicing of high dimensional database. A. Gosain et al. [6], discussed various privacy preservation methods and it shows how differential privacy is a better solution for big data privacy rather than other techniques. J. Vasa et al. [7], main goal of this paper is to analyze several algorithms to preserve privacy in big data. B. Sreevidya et al. [8], Proposed the work focuses on analyzing different techniques for privacy preservation of sensitive data. T. Karle et al. [9], concentrated on generalization and suppression methods of anonymization techniques for maintaining data privacy and describes Data-fly and Mondrian algorithm with their comparison. N. Victor et al. [10], provided a study on big data, the challenges associated with big data and the data sharing and publishing scenario in privacy preservation. S. Athiramol et al. [11], discussed different anonymization techniques with their disadvantages. B. Mehta et al. [12], presented general architecture and various stages of big data analytics. N. Maheshwarkar et al. [13], explained the anonymization technique to preserve privacy in big data. S. Murthy et al. [14], compared the different anonymization techniques on a dataset. A. Pawar et al. [15], described data anonymizing and differential privacy approaches. J. Vinothkumar et al. [16], described confidentiality enhancing approaches of big data such as anonymization, encryption, confidentiality preserving, and access control methods, transparency and accountability. Jain et al. [17], Defined the different anonymization methods of privacy preservation of personal information and its implementation in business.

II METHODOLOGY

In the big data environment, the preservation of information privacy is most required. So, there are many techniques for preserving privacy and most of the techniques in Privacy Preservation in Data Publishing are based on anonymizing the data. Data anonymization is an approach that is used to prevent the re-identification of users. It is also known as the de-identification of data [4]. Anonymization can be used for preserving the privacy of patients also by anonymizing the personal information. Before releasing of data, anonymization can be used to protect the sensitive information in data sets [5]. Data anonymization is used to anonymize the information to protect the original information of users as shown in Figure 1.

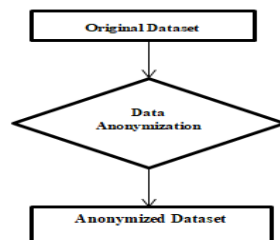


Figure 1: Data Anonymization

Data anonymization is used to change the data into anonymous data so that it will not possible for an attacker to disclose personal information of the user which he does not want to share. Data anonymization is the most beneficial technique when we require the privacy preservation of individual's information. We can use anonymization to hide the personal information of the user by hiding attributes that can uniquely identify any user such as aadhar number, name, etc. [6]. Some of the techniques are followed for preserving privacy in sensitive information [7].

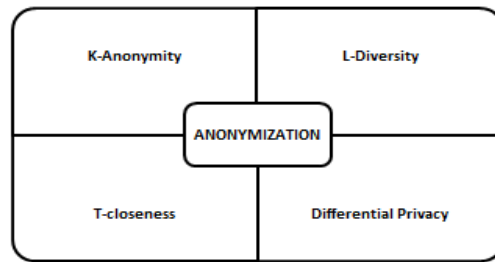


Figure 2: Anonymization Techniques

A. K-ANONYMITY

The simplest method for privacy preservation of sensitive data is k-anonymity. If the record is distinct from at least (k-1) other records on its quasi identifier attribute, then that record will be published otherwise it will not publish [8]. If the information for each individual cannot be distinguished from at least (k-1) individuals then k-anonymity is in a released data [7]. For the anonymization of microdata k-anonymity was the first model and after this other extensions are developing [9].

By removing explicit identifiers from dataset personal data can be published. As stated by, Sweeney (2002), privacy preservation of only published data may not be sufficient. By linking two databases, we can also separately identify the information of the user [10]. L. Sweeney proposes a method where the data which is published for analysis can be anonymized so that there will be at least k- individuals with the same data values, this method is called k-anonymity method for preserving the privacy of individuals. So that particular user will not get identified easily by any third party [11]. To remove personal identification of a person or hiding sensitive data Samarati and Sweeney introduced a privacy-preserving model called k-anonymity [12].

K-anonymity has some drawbacks also:

- Homogeneity attack: Homogeneity occurs when a sensitive attribute in the dataset lack diversity [13].
- Background attack: Background attack, it introduced when an attacker has some background information about the individual. Attribute disclosure is the issue that cannot be solved by using k-anonymity.

Attributes of the dataset can be divided into the following categories:

- Personal Identifiable Information (PII): Attribute that can uniquely and directly identify a person or individual. For e.g. name, id number, etc. [12]. They also called explicit identifiers [10].
- Quasi Identifiers (QI): Attribute that can combine with external data to re-identify a person's specific information for e.g. gender, age, zip code, marital status [10]
- Sensitive Attribute (SA): Sensitive attribute is the attribute that any individual or person do not want to disclose. Such as the salary of an individual, information disease of the individual. This is always released and researchers need this data [10].

- **Non-Sensitive Attribute:** Attributes that are not PII, QI, and SA are known as non-sensitive attributes. The information that can be disclosed [7].

We can anonymize the quasi-identifiers (QI) by using two approaches generalization and suppression.

- **Generalization and Suppression:** Generalization is a popular approach of k-anonymity in which record value is replaced with ‘*’ or with any other less specific and more general value. For e.g. pin code 136038 will be generalized as 1360** so it will show any value from 136000 to 136099. We cannot apply generalization on all attributes as shown in Table 1; there are different attributes such as name, pin code and age. Only age attribute can be generalized by using range approach as shown in Table 2.

We can also generalize the age attribute by replacing it with ‘*’, using range or using other forms. For e.g. 35 can be replaced by 3* or <40, [30-39]. Mostly categorical data is used under the generalization approach [12].

Another, approach used for k-anonymization is suppression. Suppression is introduced for the reduction of the generalization amount needed to satisfy the k-anonymity constraint [13]. Some constant values are used to replace quasi-identifiers for suppression approach such as 0, *, etc. [4]. Suppression method replaces some of the actual data with some special value such as ‘*’ and it indicates that the suppressed data will not revealed at all [9].

Table 1: Actual Data

Name	Pin Code	Age	Sex	Disease
Rian	136038	35	Female	Asthma
Dev	136038	35	Female	Lung Cancer
Arjun	136038	35	Male	Cardiac Arrest
Alisa	123102	42	Female	Asthma
Diya	123102	42	Male	Lung Cancer
Joy	123102	42	Male	Cardiac Arrest
Vini	138118	22	Female	Asthma
Jai	138118	22	Female	Lung Cancer
Shiv	138118	22	Female	Cardiac Arrest

Another method, generalization method to converting any record value to more general forms such as ‘female’ and ‘male’ are gender values and we can generalize them to ‘person’. Numerical data is used under the suppression approach [12]. Table 2 shows how suppression is applied on the name attribute. The advantage of both generalization and suppression approach is that they are feasible. Whereas, there is disadvantage also that replacing and deleting the record value can lead to a high possibility of information loss [14].

Table 2: Actual Data after Generalization and Suppression

Name	Pin Code	Age	Sex	Disease
***	1360**	30-40	Person	Asthma
***	1360**	30-40	Person	Lung Cancer
***	1360**	30-40	Person	Lung Infection
***	1231**	40-50	Person	Cardiac Arrest
***	1231**	40-50	Person	High Blood Pressure
***	1231**	40-50	Person	Arrhythmia
***	1381**	20-30	Person	Arthritis
***	1381**	20-30	Person	Fracture
***	1381**	20-30	Person	Low Back Pain

B. L-DIVERSITY

L-diversity is a modification to the k-anonymity proposed by Ashwin Machanavajjhala, Johannes Gehrke. It ensures that within anonymity groups, the sensitive attribute takes diverse values. Using the l-diversity method can remove homogeneity attacks [11]. K-anonymity provides protection against identity disclosure but when it comes to attribute disclosure k-anonymity does not provide sufficient protection to the sensitive attribute information of an individual. It may be very difficult to achieve l-diversity and sometimes it may be proved as irrelevant. It is insufficient to prevent attribute disclosure and skewness attack privacy for multiple sensitive attribute does not provide by l-diversity [13]. L-diversity model holds the monotonicity property. Table 3 shows the 3-diverse dataset of actual data covered in Table 1. When there are at least “l” well-represented values for the sensitive attributes, then equivalence class has l-diversity [4].

L-diversity has some drawback also-

- Similarity attack: Similarity attack occurs when the value of sensitive attribute is analogous in meaning but seems to be dissimilar.
- Skewness attack: When every block of equivalence class or quasi-identifiers has the same possibility for positive and negative values of sensitive attributes.

Table 3: 3-Diverse Dataset

Age	Sex	Disease
3*	Person	Asthma
3*	Person	Lung Cancer
3*	Person	Lung Infection
<50	Person	Cardiac Arrest
<50	Person	High Blood Pressure
<50	Person	Arrhythmia
<20	Person	Arthritis
<20	Person	Fracture
<20	Person	Low Back Pain

C. T-CLOSENESS

Another approach is t-closeness approach assimilates both k-anonymity and l-diversity approaches. T-closeness can be used to prevent attribute disclosure. If any dataset has t-closeness, then that dataset also confirms k-anonymity and l-diversity [4]. This approach has a

drawback of degrading the data utility because of the distribution of sensitive attributes, to be the same in all QID groups [12]. When we distribute sensitive attribute to any equivalence class and there should be less distribution than threshold t of attributes in the whole dataset than that equivalence class is called the class having t -closeness. [7]. As the t -closeness approach is used to overcome the drawback of the l -diversity approach. In t -closeness, sensitive values are distributed in equivalence classes, usually the same as that of actual data and it can be difficult to achieve t -closeness [15]. In the t -closeness approach, a method called EMD function is used. EMD is earth mover distance used when two sensitive values are distributed and the proximity of these values required [8].

Information gain is the main idea behind t -closeness. Before publishing and after publishing the sensitive attribute of a table, the difference between prior and posterior beliefs of an adversary can be collected easily about that sensitive attributes. The distribution of sensitive attribute cardiac arrest, high blood pressure in each quasi-identifier block and the entire dataset has a similar distribution. If there will be need to publish more values of sensitive attributes, then privacy can be questioned in the t -closeness approach. After we performed anonymization approaches such as generalization and suppression the issue arises is data quality [10].

D. DIFFERENTIAL PRIVACY

Differential privacy was introduced by Cynthia Dwork in 2006 [7]. The presence of users in the dataset does not disclose by using differential privacy. Query results are making differentially private by adding a random noise. Differential privacy can knob a variation of data and adding random distortion to the resulting query as it does not depends on attributes. Less noise will be required to add if data is large. Differential privacy can be a good approach for big data if the given data is in static form [12]. Differential privacy hides the individual identities of user data [15]. In the differential privacy approach, big data analysts must know the query to use the differential privacy method [6]. As, differential privacy is used for confidentiality that sanitizes queries results of a tuple set, rather than sanitizing that tuple set [16].

In differential privacy, the analyst cannot directly access the database that contains personal sensitive information. Intermediate software is used between the analyst and database for the protection of personal data. This intermediate software is also known as privacy guard in big data. How much distortion is needed to add is depend on privacy risk. If the risk of privacy for information is low, then a limited amount of noise will be needed to add. If the risk of privacy for information is high then a large amount of distortion will be added [17].

Table 4: Merits and Demerits

Sr. no.	Technique	Merits	Demerits
1	K-anonymity	K-anonymity technique is easy, when value of k is high there is less chances of reidentification	Does not protect against homogeneity attack and background knowledge.
2	L-diversity	Background knowledge attack is handled	Does not prevent homogeneity attack. Skewness and similarity attack occur
3	T-closeness	Can handle skewness attack	Increase in size of data develops more chances of reidentification
4	Differential privacy	Prevent identity identification of individuals	Reduces data utility

The following Table 4 shows merits and demerits of different techniques for privacy preservation of personal information in big data and these techniques can be used to preserve COVID-19 patient's privacy also.

III CONCLUSION

A new pandemic has been affecting the patients very badly known as COVID-19. Data of COVID-19 patients requires privacy and different techniques can be used to preserve the privacy of COVID-19 patients. We have analyzed that the anonymization techniques can be used to preserve the privacy of COVID-19 patient's personal information. Different anonymization techniques can preserve the privacy of patients such as k-anonymity, l-diversity, t-closeness and differential privacy. Preserving the privacy of this data is also important as personal information of patients is often misused by any third party for their own benefits. Privacy of COVID-19 patients can be preserved using different privacy preservation techniques in big data.

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ABSTRACT

This paper aims to examine a drift of the spread of fatal disease coronavirus (COVID 19) Pandemic in India and its outbreak into the Union Territory which was already locked-down since 5th of August (Lockdown 2019 - 2020) has destructive socio-economic impact and created hazardous health issue in the Union Territory which wasn't in condition to face any such calamity. Lack of communication (Journal, 2020) kept away people of said territory from informative campaigns which international communities, civil societies and governments have collaboratively started to mitigate the impact of COVID 19 pandemic by acknowledging people about possible treatments through preventions and detections. The economy of the Union Territory suffers 270 crore loss every day (Akmali, 2020) - trade sector, transporters, tourism and hospitality sector, education sector and the back bone of J & K economy handicrafts all downturned which pushed people on the road and created chaos – decrease in income, fear of job loss, arrangements of daily required essentialities compelled people take the risks of not following the SOPs which leads to community spread of COVID 19 and lead the corona cases up to 78,228. Health care professions put their best to fight against this frightful disease in absence of full library resources (Saleem, 2020) restricted internet (2G) seems agent of corona virus. Students are forced to join community classes which isn't feasible right now and it is due to restricted 4G internet services in J & K. The observation of this study implies that the restoration of 4G internet will reduce the separation of COVID 19 as people can get online guidance about minor health issue, online jobs, online classes, online safety measures and so many informative aspects. The results of this study further shows that government agencies lay their supportive hands to mitigate the consequence of the pandemic, by short – term and long – term economical policies for economical development of Jammu and Kashmir must be revitalized.

I INTRODUCTION

On 6 December 2019, Wuhan city of central Hubei Province of China became the first city where deadly Virus COVID – 19 emerged which was first titled as an outbreak of respiratory illness and reported to WHO (World Health Organization) on December, 31, 2019. The deadly virus befalls the China and thousands of people got infected including a one-day addition of nearly 15,000 infections. COVID – 19 outbreak was declared as a global health emergency on January 30, 2020 and a global pandemic on March 11, 2020 by WHO (World Health Organization) (WHO, 2020). The genome of the virus was discussed by a team of scientists in Shanghai and publish it on virological.org, an online discussion forum for epidemiologists on January 11. Researchers got access to identify the infected patients and experts confirmed that the virus is spread among the humans. (Nanshan, 2020) The virus quickly outbreak outside China – in January Thailand and Japan confirmed their first infected cases of COVID -19. After few months the deadly virus wave starts to sweep the powerful countries like Italy, America, Spain and many other countries of the world along with Asian countries.

In India, the student from Kerala, who was studying in Wuhan University and had travelled back to India was reported first positive case of the novel coronavirus on January, 30. (Perappadan, 2020) In march when more cases were confirmed and being very close to China, the government took strict safety measures against the outbreak of COVID – 19 pandemic; The persons with travel history went through thermal screening and were quarantined for 14 days or more. The Government of India found it insufficient to control the growth rate of positive cases and when 500 cases were confirmed positive of COVID -19 virus, lockdowns were placed which seemed to be the only way to slow the growth rate of the outbreak of COVID – 19 pandemic. (abc, March 2020) One after another lockdown the growth rate of COVID – 19 pandemic by April, 6 to a rate of doubling every six days and to a rate of double every eight day by April, 18. (Gupta, 2020) Even after extension of lockdowns, the growth rate of the positive cases increased and engulfed Maharashtra, Delhi, Punjab etc. Till now India became 2nd highest COVID – 19 affected country and almost every state has plenty of COVID – 19 cases. In India COVID – 19 outbreaks in many states and various union territories including union territory Jammu and Kashmir at then entire union territory was seized on August 5, 2019 by Indian Government as the statehood and political autonomy was stripped by revoking Article 370 of the Constitution. 8 million people of Jammu and Kashmir union territory were cut off to the rest of the world as they were under the consistent lockdown with restricted communications. Meanwhile two suspected cases of coronavirus with travelling history to Iran were detected on March, 4 and were guaranteed in Government Medical College Jammu where one of them reported first coronavirus positive of union territory Jammu and Kashmir. First confirmed case of COVID - 19 paralyzed the stricken people of Jammu and Kashmir and raised bundles of rumors and queries among the frustrated people of Jammu and Kashmir. In absence of internet facility in union territory people were not fully advanced about the outbreak of COVID – 19 or about the safety measures prescribed by WHO (World Health Organization) in collaboration with different governments, International communities and civil societies. Lockdowns and restrictions have bended down the people of Jammu and Kashmir as much that they have lost their faith in government for any kind of assistance during the double restrictions imposed by nature and government. When supreme court of India affirm to avail internet services to Jammu and Kashmir which is the fundamental right of the people but somehow administration couldn't allow full internet operations with 4G speed. The informative campaigns about the COVID -19 on social media were like the sun closed moon at 2G capacity of internet. The student aren't capable to get online classes with 2G speed of internet and it takes lot of time to them even download videos of 5MB. Thus internet restrictions in COVID - 19 pandemic add the fuel to the fire.

The union territory of Jammu and Kashmir was not in stand to face even single lockdown but due to the double lockdowns, the COVID -19 emerged 10 times more destructive to the Jammu and Kashmir than rest of the world. The small business sectors were forced to wind up which produce 23% economy to union territory in which 44 lakh labours earn their livelihood. Handicrafts the backbone of Union territory which provide an income to more than 4 lakhs different craftsmen which is 7% of workforce help 1.7 crore to the export economy annually which is under a threat to loss its existence. Transport sectors were in huge loss due to restrictions laid by government one after another due to internal problems of Union territory and the said sector forced to sell their vehicles at low prices to support their livelihood. Private

education sector, Fruit sector, Industrial sector and every sector is about to collapse. Employer and employees of union territory are listed in defaulter list in various banks of union territory. People fail to avail livelihood to their families. Those who are lifelong devotees of medicines can't buy their life supporting drugs and to get proper hygienic food and other medicines is to touch the stars of sky. In the same regard union territory can be the next pandemic centre of COVID – 19.

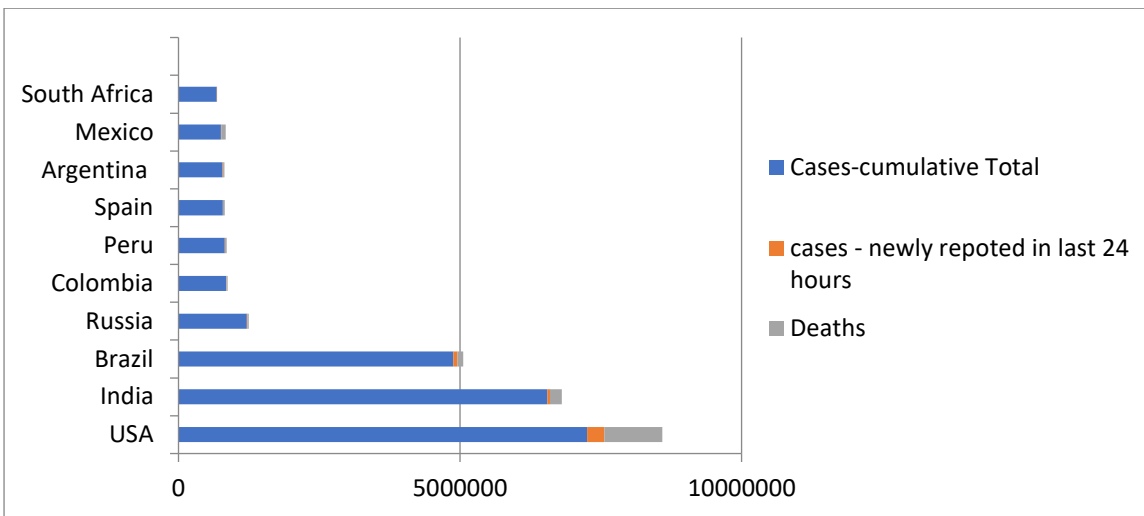
II METHODOLOGY

The study was conducted in Union territory of Jammu and Kashmir which is suited in the northern part of India. Jammu and Kashmir is home to several valleys such as the Kashmir Valley, Tawi Valley, Chenab Valley, Poonch Valley, Sind Valley and Lidder Valley. The Kashmir valley is 100 km (62 mi) wide and 15,520.3 km² (5,992.4 sq mi) in area. The Himalayas divide the Kashmir valley from the Tibetan plateau while the Pir Panjal range, which encloses the valley from the west and the south, separates it from the Great Plains of northern India. The union territory is of two region Jammu and Kashmir. Jammu which is called the city of temples. Vaishnu Devi Temple, Raghunath Temple, Peer Kho Cave, Bahu Fort etc are best tourist attractions. While as Kashmir is called the paradise on earth. It is surrounded by lot of mountains and every bit of Kashmir is tourist attraction. (Khan, 2018) Tourism, agriculture, Handicrafts etc is the main source of income for the people of union territory and these sectors are highly vulnerable to both natural hazards and anthropogenic activities. The GDP of Jammu and Kashmir remained ₹1.56 lakh crore (US\$22 billion) in 2018 – 2019 (2018). There are so many other sources of income which are at risk to despair due to disturbances which remain in the region almost every time.

This study collected cross – sectional data using an online survey method. The online articles, papers are examined and reviewed closely to collect the relevant theories and evidences to prepare and support the study. Wikipedia, the encyclopedia is mostly consulted to compile the study materials. In addition to this, the google document link was sent through social media and other possible sites to the contacts of the authors and other associated participants who were requested to upload or sent different questionnaires to collect data for the study. The primary data on which this study is based have been collected through an online survey related socioeconomic impacts and health challenges due to COVID -19 and mitigation measure against COVID – 19 pandemic in Union territory Jammu and Kashmir.

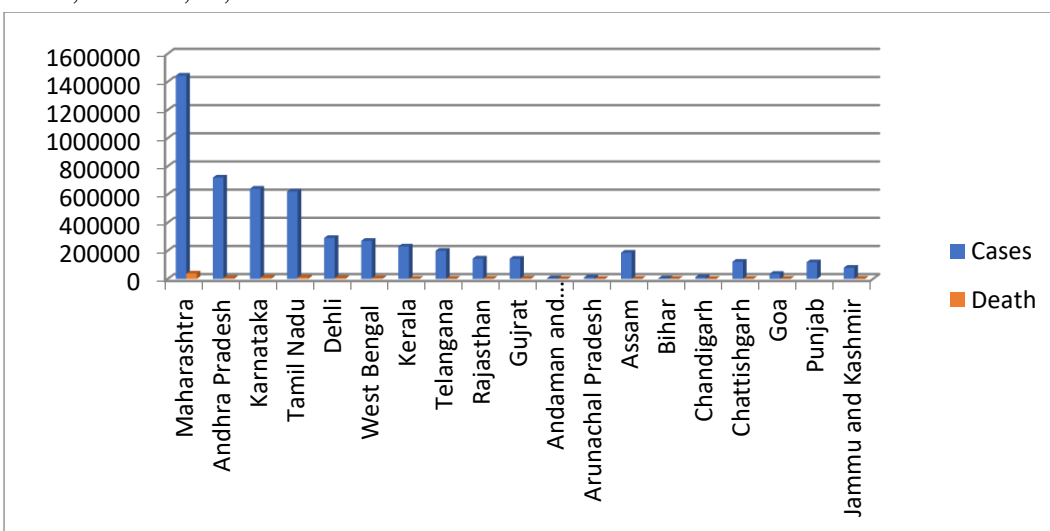
III RESULT AND DISCUSSIONS

Wuhan city of central Hubei Province of China which became the first pandemic centre of COVID -19 pandemic. China adopted such strategy that virus couldn't outbreak into any other state of China as it has earlier spread in Wuhan the entire China should be affected but the graph – 1 is evident of this that China found control over the Covid – 19 pandemic as it is not list in the list of top ten COVID -19 affected countries of the world. After China United States Of America faced the challenging outbreak of deadly virus COVID – 19 and New York became the next pandemic centre of COVID – 19 but the super power of the world couldn't get control over the versus as China had. All the strategic measures taken by USA seemed incapable against COVID -19 and USA has recorded 35,900 cases in a single day which is the highest single – day spike in coronavirus cases since its outbreak and USA topped the list with 7,471,688 positive cases and 1,056,186 deaths.



Graph – 1 (Top 10 Covid -19 affected countries of the world)

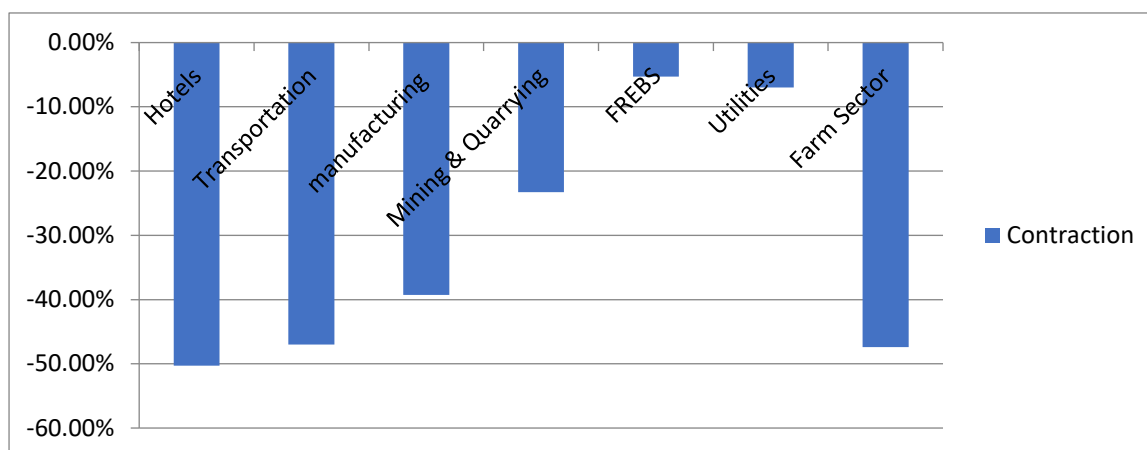
India is at 2nd position in the top ten COVID-19 affected countries’ list. After the first COVID – 19 affected case found in Kerala, new cases rapidly reported and Tablegi Jamat procession held responsible for outbreak of COVID – 19 in India (2020). When 500 cases were reported the government of India started a series of lockdowns to slow down the growth rate of COVID -1 9 affected cases. Abrupt announcement of lockdowns created chaos among the migrant laborers and employees of India. Somehow the government of India restored all the strained laborer and other people but failed to control over the growth rate of COVID -19 positive cases. All economy booster sectors of India where shut down due to lockdowns and caused rapid drop in GDP up to 23.1% which can witness further drop. Millions of people lost their jobs, rented rooms, houses and faced starvation and lack of medical facilities. The COVID -19 pandemic engulfed every state and union territory of India. Maharashtra reported most of the positive cases of COVID -19 pandemic and recorded 14,43,409 active cases and it is followed by Andhra Pradesh with 7,19,256 cases, Karnataka with 6,40,661 cases, Tamil Nadu with 6,19,996 cases, Delhi 2,90,613 cases and like wise.



Graph – 2 (State-wise COVID-19 affected sates of India)

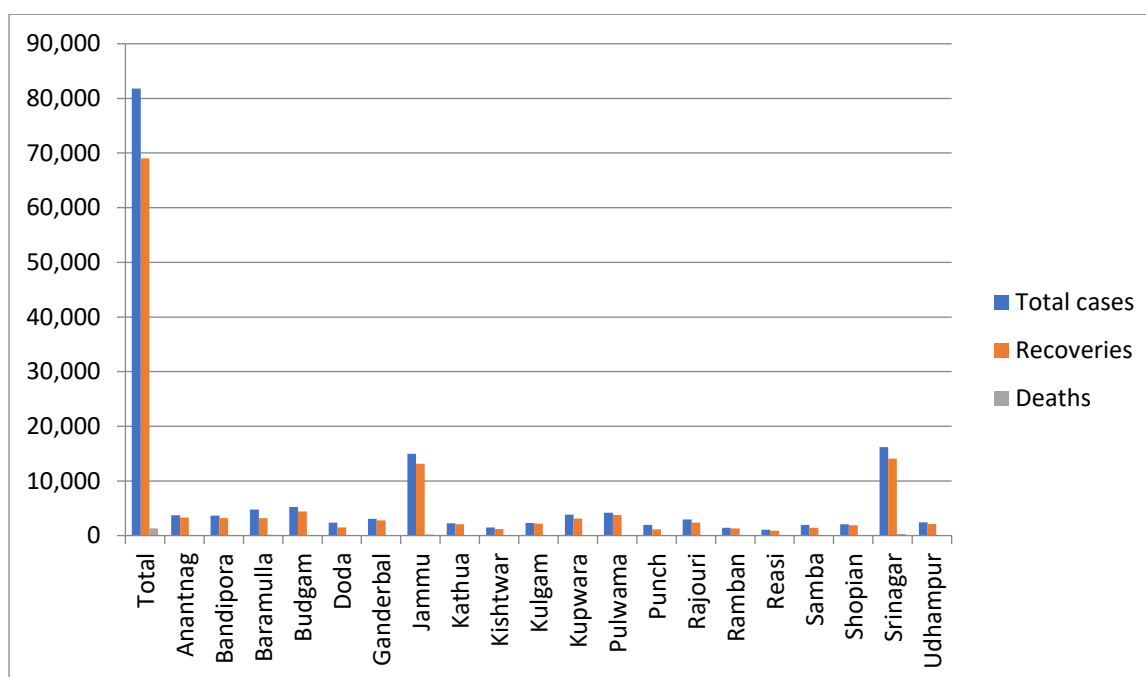
The economy of the entire world is affected due to lockdowns in the COVID -19 pandemic. The economy of India dropped down to 23.1% in the fourth quarter of the financial year 2020 and it

is assumed that India’s growth for financial year 2021 will be in the lowest figures that has ever seen in three decades since India's economic liberalization in the 1990s. (Wikipedia, 2020) Massive fall is recorded in India Business Resumption Index economic activity which is from 84.9 to 44.7 (22March to 26 April) (2020) and 23.9% fall in Indian economy is the biggest contraction on record. Contraction in hotels, transportation, manufacturing etc shown in graph - During this period millions of people lost their jobs while salaries were cut down to many other.



Graph – 3 (Contraction in various sectors of India)

COVID-19 Pandemic has exposed the backwardness of Jammu and Kashmir in terms of Socio-Economic and Health scenarios (2020) . The Government Medical infrastructure is far from fulfilling the requirement of the people, due to which high political leaders went to Private Hospitals and institutions for their treatment after getting Corona positive. Virtual Health Care is far from reality in case of Jammu and Kashmir, as the internet connectivity is not ensured with high speed data. The complete revolution has come in the World, due to COVID-19. Throughout the world, People are working from Home, attending online classes, virtual trading is taking place. Unfortunately, the root cause of more suffering of the respective Union Territory is due to obstruction in accessing 4G internet speed. Because of being unable to access Digital world as per the necessity, Jammu and Kashmir is partially isolated from the rest of the world. As, the Union Territory is facing an obstacle for virtual sale-purchase, obstruction in online classes, virtual medical facility is inaccessible. People are locked-down in their homes due to which handicraft business, tourism, transportation and many other socio-economic activities have come to halt. Including, this COVID – 19 affected cases are reported rapidly and every district reports cases every day and more than 7000 cases are confirmed as show below in graph.



Graph – 4 (District wise Covid affected districts of Union Territory of Jammu and Kashmir)

IV CONCLUSION

The COVID – 19 is deadly virus which has affected almost every country included some powerful countries of the world. It is at alarming position which can create worse consequences throughout the world as the vaccine for the said virus is yet to be prepared. The said virus has to be addressed immediately and at first priority the action in regards of safety measures must be taken by the government and other agencies and people must follow every precautionary measure laid by government at anyhow. India right now is facing challenging economical crises which directly have impact on every state and union territories including union territory Jammu and Kashmir. Due to outbreak of COVID – 19 Jammu and Kashmir is facing unavoidable challenges in the forms of limited livelihood options, Shortage medical facilities and the upcoming winter season will be a big challenge under such circumstance for the people of Jammu and Kashmir. This study addresses the centre government and local administration of union territory of Jammu and Kashmir to avail the basic facilities to the people Jammu and Kashmir to fight against the COCID – 19 and upcoming challenges.

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ADOPTION OF ONLINE LEARNING BY STUDENTS- A CASE STUDY

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ABSTRACT

Creating an environment conducive for Teaching and Learning is very important. Traditional Educational Institutions provided required facilities for teachers as well as students. The whole world went in to lockdown due to COVID 19 pandemic, and Educational Institutions were no exception to it. To continue Teaching – Learning process every one turned to online teaching without proper knowledge or data about the infrastructure requirement for teachers and students. This survey conducted two months apart was basically to know about the facilities, like devices, internet facility, mobile data availability to students, to attend online classes. Sarojini Naidu Vanita Maha Vidyalaya established in 1962 is a premier educational Institute located in the heart of Hyderabad, Telangana State, India, is one of the few colleges which offers Intermediate (+2), Under Graduate and Post Graduate Education under one roof. The college provides Hostel facility to 400 girl students. With the advantage of having students from Intermediate to PG level and age group from 14 to 21 years. The composition of the students makes this survey more relevant. The results of this survey will provide valuable insight about the infrastructure available to students and the shortfalls for online learning. The variation in the first and second survey results indicates the difficulties faced by the students in procuring the required devices and data for attending online classes. The results and analysis is presented in graphical form for easy comprehension.

Keywords: Online Class, Traditional Class, SWAYAM

I INTRODUCTION

The Lockdown enforced to contain SARS2 proliferation has thrown up unforeseen challenges to every nation across the world, especially to the Education sector. Central & State Governments have enforced indefinite closure of all Educational institutions. This pandemic has caused enormous damage to both, Students and Teachers and has curtailed their activities. Students are bewildered with several unanswered questions about their future. Indefinite hold on educational

activities like examinations, research, internships and campus placements will cause irreversible damage to their higher education and career prospects.

To minimise the damage, institutions resumed teaching by conducting online classes without the consent of students and parents. Many technical and non-technical issues were reported by students and students. Authorities were able to redress few but many remained unsolved. The main reason is lack of experience in conducting online classes. Before the Pandemic students and faculty were exploring online courses offered by Coursera, Swayam etc. But converting entire college into an online platform was a Herculean task.

To find the solution to any problem lies in understanding the origin of the problem. Precisely, to find the real hurdles in conducting online classes, two surveys were conducted among the Intermediate, U.G and P.G. students of SN Vanita Maha Vidyalaya in the month of May and July 2020. The results of the surveys have highlighted actual problems faced by the students. They have also shown the efforts by students and parents to overcome initial hurdles in attending the online classes. After six months experience of online teaching learning, students and teachers are now more comfortable and have started accepting virtual college as reality.

II METHODOLOGY

The Online survey method was chosen for collecting of the data. The discussion about suitability of online vs offline survey is irrelevant in the prevailing situation due to COVID19. Restricted movement of people and social distancing norms makes it impossible to conduct any survey by personally meeting people. The survey has been possible because of the availability of online survey tools like SoGoSurvey, Survey Monkey, Typeform, Google Forms, Client Heartbeat, Zoho Survey, Survey, Gizmo, Survey Planet. Online surveys are cost effective and tools are user friendly. The accessibility of online survey data remotely to all the team members made it very convenient for analysis. Most of the survey tools provided data analysis to a certain extent. The disadvantages of online survey like dishonest answers, unanswered questions, differences in understanding and interpretation, poorly chosen distribution channels which may lead to biased data were avoided by specifically framing the questions that could be answered in one-word, compulsory marking of all answers, using simple language and sending questioner to target group directly.

The data collection from primary data source i.e. Students, was by using the google forms. Google forms were used because students are familiar with it. The questions posted were simple and straight forward. The sample size was large enough to make valid conclusions. The data was collected from the students belonging to our institution; hence the data is authentic and was collected only from target group.

Circulated Among	600 students (approx)	600 students (approx)
Sample - Responses received	175	508
Date	20-05-2020	14-07-2020

Table 1: Survey Details

A. Questionnaire

The Minimum requirement for attending regular classes at college are the availability of transport and a residence, preferably near to the college which are totally different for attending online classes. Students need devises like Laptop/ Desk top computer with internet connection or a smart phone with Wi-Fi /Mobile data. The objective of the survey was to find how well-

equipped students are to attend the online classes. The survey was also intended to find acceptability of online classes by students.

The World took a serious note of the Pandemic in month of March 2020. In the absence of proper drugs and vaccine, the only solution available was social distancing. Government announced complete Lockdown. This affected the education sector severely with the future of 2020 batch students near destroyed. To continue Teaching Learning activity, institutions started online classes from the first week of April 2020. Initially teachers and students found it difficult to conduct classes online. But they got used to it slowly. A survey was conducted in the month of May 2020 to know the facilities available to students for attending online classes and student's opinion on online learning. Motivation, Counselling and Awareness among the students and Parents helped to procure required gadgets to attend online classes. Significant increase in attendance was observed. But many questions like, student's acceptability, urban rural divide, and financial burden remained unanswered. The surveys were conducted basically to find difficulties faced by Vanita College students. As the problems faced by students all over are almost similar, the results of the survey are useful to all Institutions and Teachers. The two surveys were conducted in a span of two months difference in order to know the improvement in availability of resources and facilities for the students. To minimise the ambiguity of results, same questions were given in both the surveys.

The first part of the questionnaire collected the basic information like Name, Roll No, Class, Group, Location, Parents profession. The questions in the second part included

1. Total Strength of different streams of students observed during Online Classes
2. Which of the following devices you use to attend online classes
3. According to you, which mode of learning is better
4. Is internet data enough to attend online classes
5. According to you, online classes should be continued even after lock-down

The same questions were posted to the students in both surveys to get the accurate data.

The google form was sent to students to their registered mobile numbers through SMS and WhatsApp. Three days' time was given for submitting the form. Answers were verified by randomly calling few students directly. Care has been taken to include all groups in the survey.

IV RESULTS AND ANALYSIS

The answers were obtained in the form of Excel sheet with Simple statistical calculations used to get meaning full inferences. The reports were generated in the form of percentages, average and graphs for better understanding. The results and inferences are presented below:

a) Approximately 80% of Post Graduate students have started attending online classes, whereas Under Graduate strength was only 50% which is less when compared to PG classes strength. This may be because for UG students, classes were scheduled immediately after Lockdown. The lack of previous experience in learning online and minimal guidance from the teachers might have contributed.

UG Students were less worried about the future because of their age. For them both higher education and job options are open, whereas PG students were keen to complete course on time and settle.

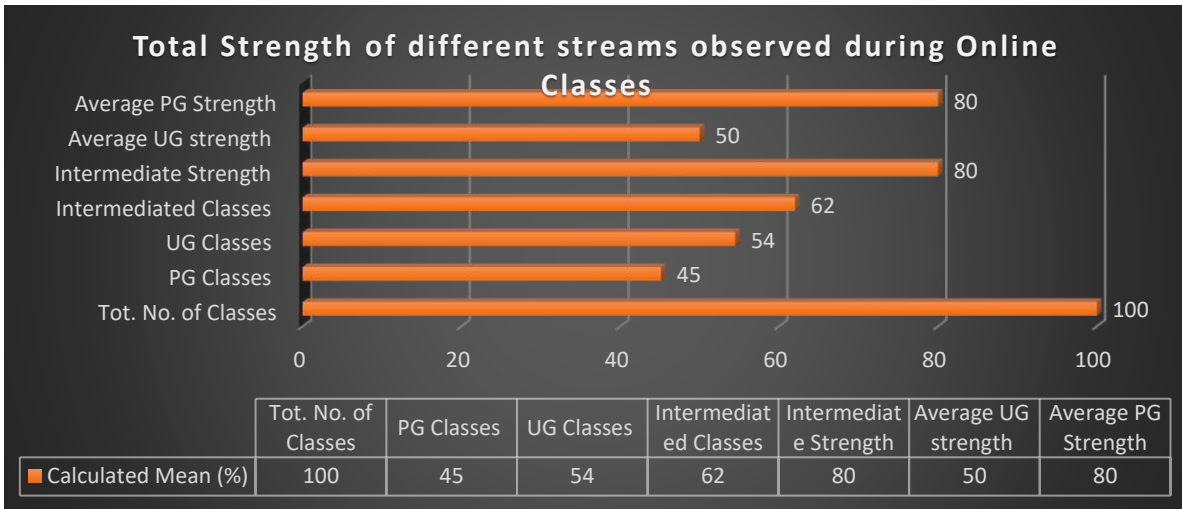


Fig 1: Total strength observed in different streams during online classes.

b) Moving on to results of second question which is based on availability of Devices and Bandwidth connection. It is observed that bandwidth connection, speed and electronic gadgets were major hurdles in attending online classes.

The first survey indicates that 41% of respondents are not having devices to attend online classes and by the time second survey was conducted only 2 % students responded negative to it. The number of respondents also increased. If we consider, the non-respondents were those, who were not having any device to attend online classes, the percentage of students who procured devices by the time second survey was conducted increased exponentially. This indicates that students and parents realised the importance of online classes and got required devices and also Internet facility.

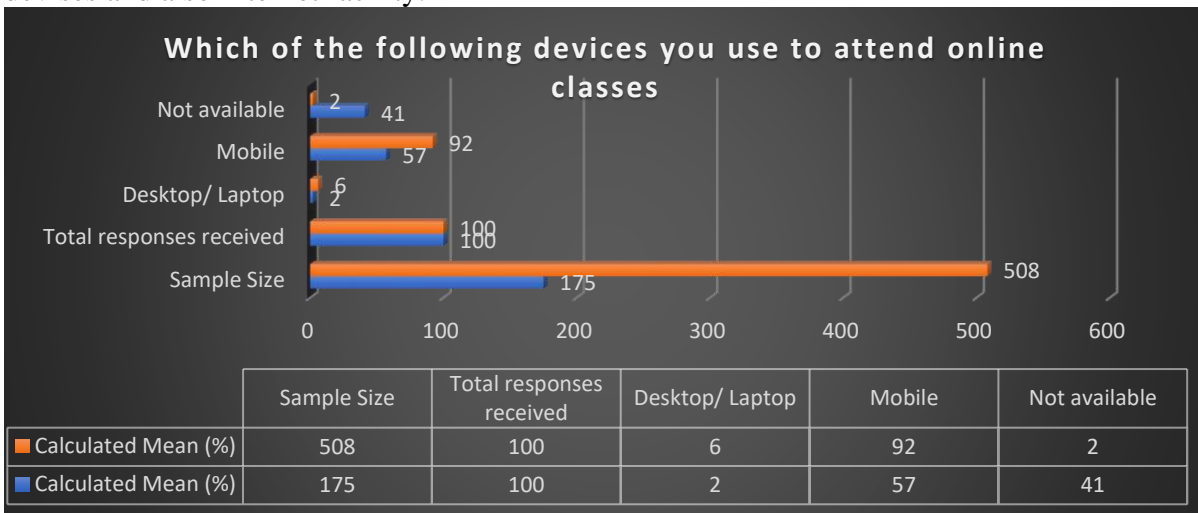


Fig 2: Devices used for Online classes.

c) The data suggests that, Classroom teaching was the preferred method in the beginning of the lockdown period. This method was rated highest with 67% of responses for it. Later it decreased to 30% and there was gradual increase in online learning method from 11% to 45% whereas there were very few who showed interest in both online -offline method.

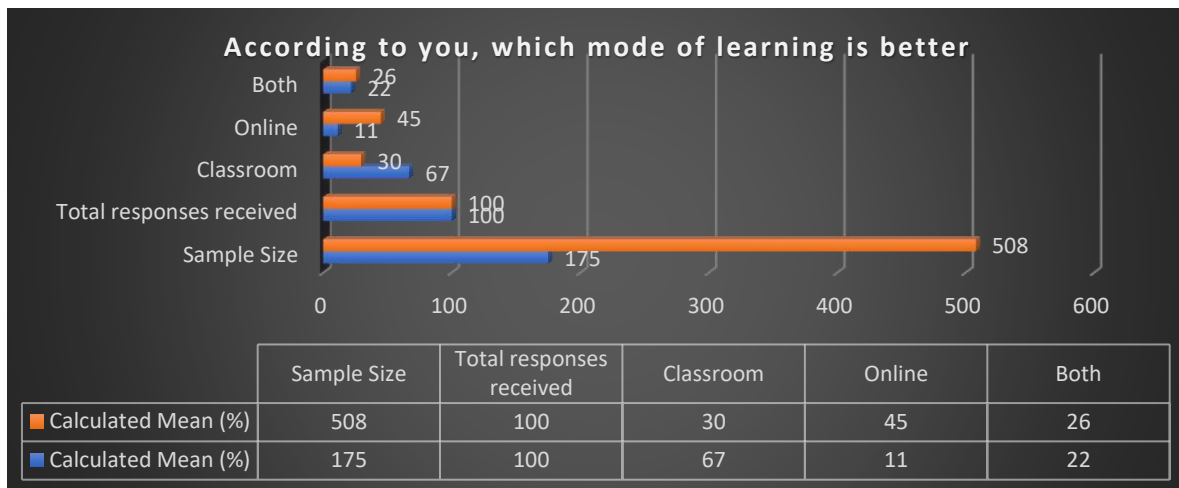


Fig 3: Better mode in teaching and learning

Students found Online Classes interesting and advantageous because of few reasons like, they can have flexible schedule. Students are given freedom to complete the assignments and class lessons leisurely. Students had lot of free time because only four hours of online classes were conducted as per Government guidelines. Students attended classes comfortably from their homes and could save travelling expenses and time.

d) Surprisingly the availability of Internet data for students to attend online classes decreased from 69% to 40%. The reason may be, at the beginning of the lockdown period only few institutions announced for online classes, gradually everyone started online classes. The decrease in responses may be due to increase in data usage or simultaneous use. All siblings belonging to different institutions and age groups had to attend the classes at the same time. In some cases, they may be sharing the same device.

Due to increase in COVID cases and extended Lockdown, students moved to their native rural areas. The internet is not available in some rural areas. This may be another reason for non-availability of internet facility to few students.

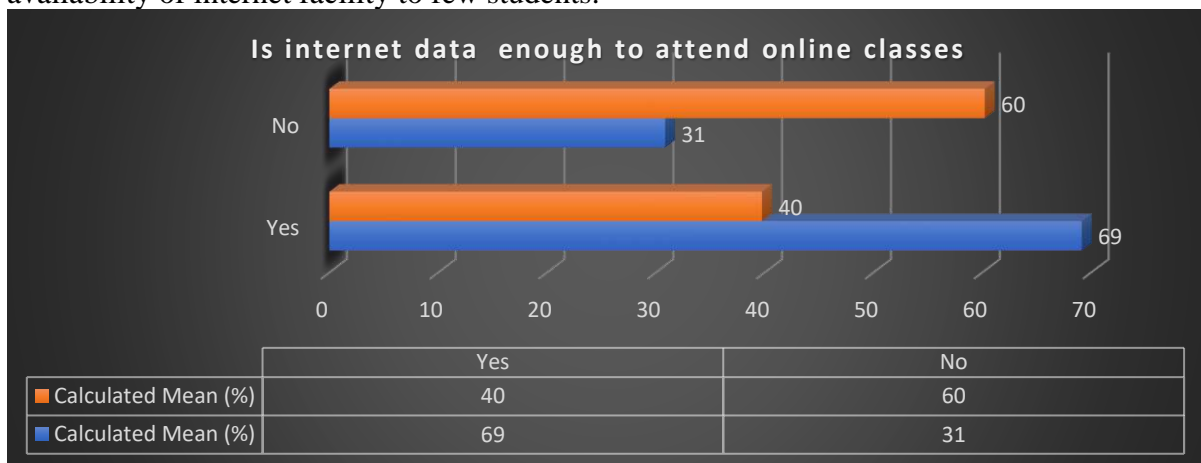


Fig: 4 Is internet data enough to attend online classes

e) The number of students who are for online class has increased from 37% to 71%. The reason may be because of consistent increase in COVID cases and extension of Lockdown. The apprehension about reopening of colleges in near future also contributed to this. Students might have realised that the only way to save the academic year is through online classes. Staying at home, saved transportation cost, traveling time. The savings were used to purchase mobiles and laptops.

Acclimatization to technology, user friendly software and mobile APPs are also the reasons for the students to go for online classes. Accessibility to wider online resources helped students to learn different skills outside the curriculum.

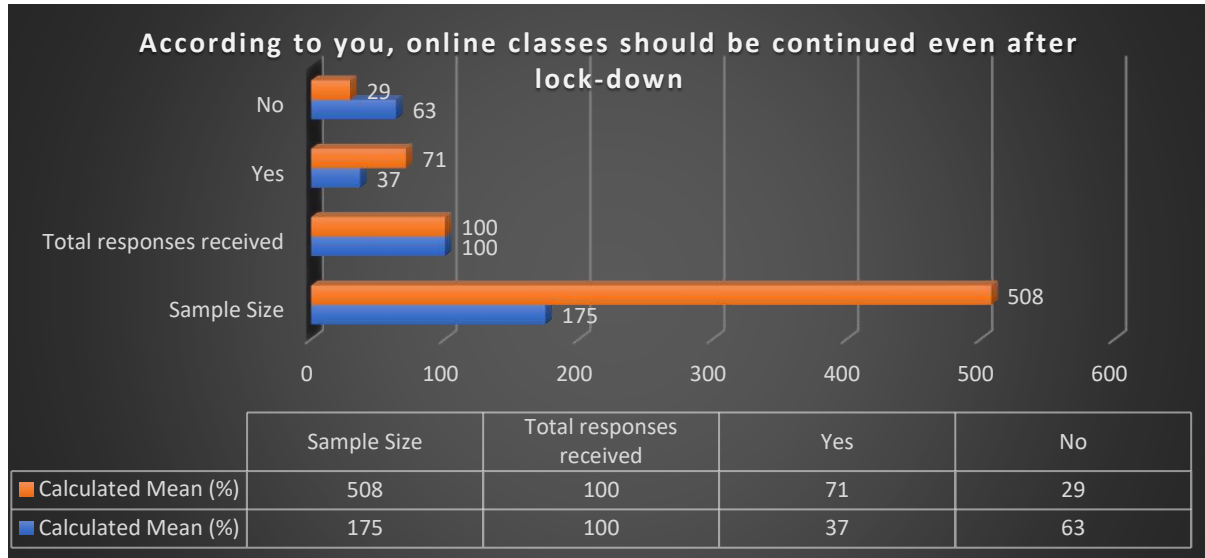


Fig: 5 According to you, online classes should be continued even after lock-down

V CONCLUSION

Online classes have been started by colleges and Universities across the country as a knee jerk reaction to continue Teaching –Learning activity. The survey concludes that students are slowly adjusting to Learning through online classes. The sample consists only of college students. The results may be different for school students. The results show that problems like internet connectivity, availability of gadgets are far from over. To overcome challenges faced by students and for continuing education in these difficult times, more investment from all the stake holders will be required so as to make education more constructive and within the reach of all students.

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X-RAY RADIOGRAPHY FOR BASED COVID-19 INFECTION DETECTION: A REVIEW ON POSSIBILITIES AND LIMITATIONS

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ABSTRACT

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) creating COVID-19 pandemic has infected the people of more than 200 countries worldwide. Till Oct, 2020, around 40.5 million reported cases and over 1.12 million deaths had been reported. As there are neither any medicine nor any vaccines available till now, isolation of infected patients by quarantining them from the social contacts are frequently recommended to control the spread of infections. Therefore, quicker detection of any infection assures the lesser spreading or minimum transmission of the disease into the healthy part of the society. As a result, a reliable, low cost and quicker detection procedure of the COVID-19 infection is required. The COVID-19 infection is being detected by the blood test in which the blood or swab samples using pathological test called reverse transcription polymerase chain reaction (RT-PCR). The RT-PCR is time consuming and depends on the availability of the testing kits. Also the false positive results may force a healthy subject under the long quarantine process and the false negative results would increase the possibility of the transmission of the disease. In this paper the possibility of the image analysis based COVID-19 diagnosis has been reviewed. The summary of the research works conducted on the machine learning based X-Ray chest radiograph analysis for COVID-19 detection has been presented along with the advantages and limitations.

Key-Words: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), Coronavirus disease 2019 (COVID-19), COVID-19 diagnosis, reverse transcription polymerase chain reaction (RT-PCR), X-Ray radiographs, machine learning (ML).

I INTRODUCTION

The outbreak of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1] has created Coronavirus disease 2019 (COVID-19) infections as a pandemic [2] worldwide. COVID-19 disease has infected more than 200 countries worldwide. Though in the mid of June, 2020, more than 7 million people were infected with more than 400000 deaths had been reported [3], in the mid of October, 2020 the infection and death cases reached up to 40.5 million reported cases and over 1.12 million deaths had been reported [4]. It is reported that, the older individuals (aged ≥ 70 years) and individuals with some chronic diseases such as diabetes, renal and cardiopulmonary disease are most prone to severe COVID-19 infection or SARS-CoV-2 disease with a large life-risk conditions [5]. It is also reported that the efficient viral transmissions via droplets and fomites are potentially supplemented by other transmission routes such as aerosol and faecal contamination [6-7]. Recent studies and the accumulating evidence suggest that pre-symptomatic or asymptomatic carriers can transmit the COVID-19 viruses [8-10]. Till now, there are neither any medicines nor any vaccines available in the society and hence the isolation of infected patients by keeping them quarantined in a suitable place which is medically safe for both the infected subject and the healthy part of the society. Quarantine processes [11] of infected subjects isolated from the

social contacts are always recommended to control the spread of the COVID-19 infections. Therefore, to assure the lesser spreading or minimum transmission of the disease into the healthy part of the society, quicker detection of any infection is required. In this situation, a reliable, efficient, low cost and quicker detection procedure of the COVID-19 infection is sought which can help in reducing the disease transmission. Generally, the COVID-19 infection is being detected by the testing blood samples [12] or the swab samples [13] collected from the suspected subject using pathological testing procedure called reverse transcription polymerase chain reaction (RT-PCR) [14]. The RT-PCR is not only the time consuming process but also it depends on the availability of the testing kits. Moreover, the false positive detection may force the healthy subjects to go under the long-quarantine process and on the other hand, if the false negative results are come out form the test, there would be an increased chance of the disease. In this direction, the possibilities of the image analysis based COVID-19 diagnosis have been reviewed. The summary of the research works conducted on the machine learning based X-Ray chest radiograph analysis for COVID-19 detection has been presented in this paper along with the advantages and limitations of the technique.

II METHODOLOGY

2.1. Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) is a virus which has never been identified before in humans. SARS-CoV-2 creates the coronavirus disease (COVID-19) disease which is an infectious respiratory disease produces symptoms such as cough, fever and, in severe cases, pneumonia. As the name suggests, the SARS-CoV-2 majorly causes respiratory illness ranging from mild disease to severe disease and death. But, the severity of the infection depends on person to person and their different level of immunity and other physiological factors. The infection becomes severe when the subjects are already suffering from other critical health problems such as high blood pressure, blood sugar, coronary artery disease, renal disease. The virus infection becomes asymptomatic for some people who are infected with the virus but their infection never develops symptoms. The asymptomatic infection is not dangerous for the infected person but it appears dangerous for the others who come in contact with the infected one. The SARS-CoV-2 can spread over human to human contact, saliva droplets, airborne viruses, fomite, fecal-oral, bloodborne, mother-to-child, animal-to-human transmission, and object to human. The structure of the is presented in the Fig. 1 [15]. The genome of SARS-CoV-2 is similar to that of the other coronaviruses (Fig. 1). The SARS-CoV-2 viruses have four genes that encode four structural proteins such as the S (spike), E (envelope), M (membrane), and N (nucleocapsid) proteins [15].

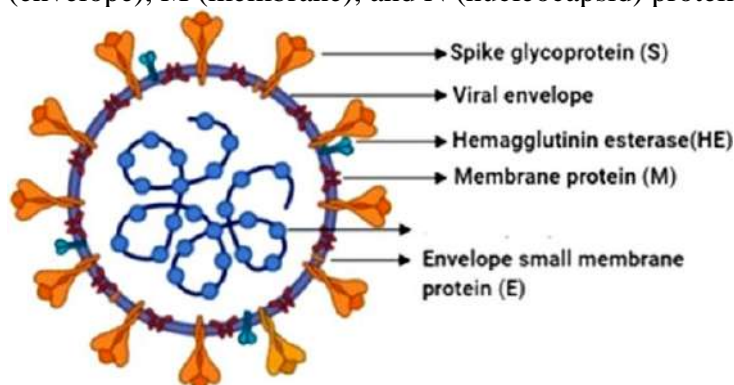


Fig. 1: A close look at the biology of SARS-CoV-2 [15].

2.2. COVID-19 Diagnoses

Two major types of testing procedures which are used for the COVID-19 detection are molecular tests (swab test) [16] or serological tests (blood sample test) [16]. The molecular test is used for detection of COVID-19 during an active infection [16]. This test procedure takes the saliva sample from the back of the throat with a cotton swab (Fig. 2a) and that is why it is also known as the swab test for COVID-19 detection. The saliva sample collected by swab is sent to the pathological laboratory and the virus infection is detected there. In the pathological laboratory, the saliva sample absorbed in the cotton swab is examined by reverse transcription polymerase chain reaction (RT-PCR) test (Fig. 2b) through to study the genetic material of the virus. In RT-PCR test, the COVID-19 infection diagnosed as positive (i.e. infection is there) if two specific SARS-CoV-2 genes are identified where as if now gene of SARS-CoV-2 virus is detected then the subject is diagnosis is called negative i.e. the subject is not infected. If one of the SARS-CoV-2 genes is found in RT-PCR test the result is called as inconclusive. The molecular tests are able to diagnose the patients with active infection only and it fails to identify if a subject had the COVID-19 earlier and presently recovered from the infection. On the contrary, the serological test for COVID-19 detection is able to detect the infection in the subjects with mild or no symptoms. Even, the serological tests can detect the antibodies that have already been produced by the body during the fight with the SARS-CoV-2 viruses to recover from the COVID-19 infection. Therefore, the serological tests need a blood sample from the subject to be examined as the antibodies are present in the blood [17].

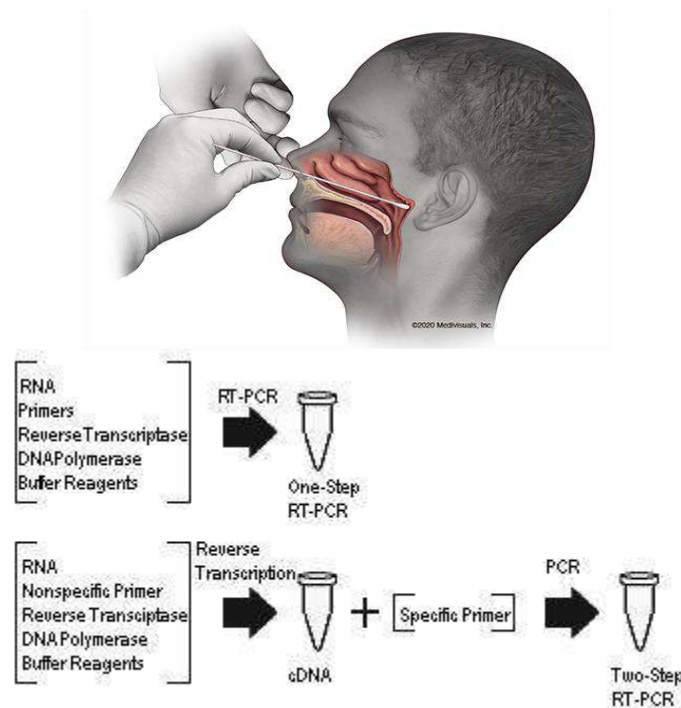


Fig. 2: Detection procedure COVID-19 infection (a) sample collection, (b) laboratory analysis of the sample collected.

III RESULTS

3.1. Present Status of the COVID-19 Detection

Molecular test for COVID-19 detection inserts a long swab into the mouth/throat (cavity between the nose and mouth called the nasopharyngeal swab) for few seconds and rotating it several times to collect enough saliva sample [18]. The swab is then kept into a air tight container and sent to the lab for pathological testing [18]. The people who have come closer

(within 6 feet) to an infected subject for a considerable time (at least 15 minutes) may have the infection [19] if the non-infected person does not have proper personal protection kits.

Reverse transcription polymerase chain reaction (RT-PCR) is a laboratory technique which combines the reverse transcription of RNA into DNA (called complementary DNA or cDNA) with the amplification of specific DNA targets using polymerase chain reaction (PCR) [20]. The RT-PCR is used to measure the amount of a specific RNA by monitoring the amplification reaction using fluorescence, a technique called real-time PCR or quantitative PCR (qPCR). To identify a viral RNA, the RT-PCR and qPCR are routinely used for analyzing the gene expression.

The close association between RT-PCR and qPCR has led to metonymic use of the term qPCR to mean RT-PCR. Such use may be confusing [2] as RT-PCR can be used without qPCR, for example to enable molecular cloning, sequencing or simple detection of RNA. Conversely, qPCR may be used without RT-PCR, for example to quantify the copy number of a specific piece of DNA.

Due to the rapidly increase in the number of infected people worldwide, the limited availability of the COVID-19 test kits is found a major problem in disease detection in hospitals and clinics. As the quicker diagnosis ensures the proper quarantine of the infected subject and hence the spreading of the infection will be minimized. With the limited availability of the testing kits, it is necessary to implement an alternative and automatic COVID-19 detection system to prevent the spreading of infection among the healthy community.

3.2. X-Ray Radiograph based COVID-19 Detection

Narin *et al.*, 2020 [21] studied the possibilities for the detection of COVID-19 disease by analyzing the chest X-ray images. The authors proposed five pre-trained convolutional neural network based models to detect the coronavirus pneumonia infections in patients using chest X-ray radiographs. They used ResNet50, ResNet101, ResNet152, InceptionV3 and Inception-ResNetV2 as the five pre-trained convolutional neural network based models. Authors implemented three different binary classifications with four classes (COVID-19, normal (healthy), viral pneumonia and bacterial pneumonia) by using 5-fold cross validation. Results demonstrated that the pre-trained ResNet50 model provides the 96.1% accuracy for Dataset-1, 99.5% accuracy for Dataset2 and 99.7% accuracy for Dataset-3 which are the highest accuracies among other models used.

Ozturk *et al.*, 2020 [22] presented a new model for automatic detection of the COVID-19 disease using the raw chest X-ray images. The authors tried to provide accurate diagnostic tool for binary classification (COVID vs. No-Findings) and multi-class classification (COVID vs. No-Findings vs. Pneumonia). The authors used 17 convolutional layers and introduced different filtering on each layer and the results demonstrated that the proposed model produced a classification accuracy of 98.08% for binary classes and 87.02% for multi-class cases. The authors claimed that the model proposed by them can not only be used to assist the radiologists in validating their initial screening but also it can be employed via cloud.

Toraman *et al.*, 2020 [23] proposed a novel artificial neural network, Convolutional CapsNet to detect the COVID-19 disease by analyzing the chest X-ray images with capsule networks. Using the binary classification (COVID-19, and No-Findings), and multi-class classification (COVID-19, and No-Findings, and Pneumonia) the proposed approach is designed for providing a fast and accurate diagnostics for COVID-19 diseases. The results obtained from the proposed method demonstrated an accuracy of 97.24%, and 84.22% for binary class, and

multi-class, respectively. Author concluded that the proposed method may help physicians to diagnose COVID-19 disease and increase the diagnostic performance.

IV CONCLUSIONS

The novel coronavirus disease 2019 (COVID-2019) spread rapidly around the world and became a pandemic causing a devastating effect on daily lives, public health, and the global economy. It is extremely essential to detect the positive cases as early as possible not only to quickly treat affected patients but also to prevent the further spread of this infection. As the infection is spreading very rapidly and the availability of the diagnostic kits is not sufficient in many clinics and hospitals, the need for auxiliary diagnostic tools has increased. Recent studies showed that using radiology imaging techniques salient information about the COVID-19 virus can be extracted and the disease can be diagnosed. Applying the image processing and analyzing technique such as advanced artificial intelligence (AI) techniques on the Chest X-Ray radiographs COVID-19 disease can be detected which may be a great help in the diagnosis without diagnostic kits. Moreover, the technique can also be helpful in remote villages to overcome the problem of a lack of specialized physicians. In this directions various computer-aided (such as CNN, DNN, etc.) deep learning models have been proposed and studied on the radiology images to extract the COVID-19 infection information to diagnose the disease. Recent studies show that, radiological images contain important information in the detection of coronavirus and the information can be extracted and analysed to detect the COVID-19 disease.

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ULTRAVIOLET (UV) LIGHT BASED SANITATION SYSTEMS FOR DISINFECTING THE COVID-19 VIRUS: POSSIBILITIES, LIMITATIONS AND CHALLENGES

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ABSTRACT

The recent outbreak of the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has created COVID-19 pandemic which has affected more than 200 countries worldwide. As of second week of Oct, 2020, around 37.6 million reported cases and over 1.08 million deaths had been reported. Isolation of cases and quarantine of their close contacts at home are frequently recommended as a disease control measure in countries with COVID-19 outbreaks, but such restrictions are likely to have little or no effect on transmission within households. As neither the vaccine and nor the medicine has been still available to all the people, coming in contact with the community are prone to the infection. As the essential commodities like food and drinks are always required to be procured regularly, people must bring these items inside their home to survive. Therefore, we all need to be sanitized our household commodities brought from outside before we use them. In this paper UV-light based sanitizing instruments are reviewed and the possibilities, limitations and challenges have been discussed. Ultraviolet (UV) light based sanitizing instruments are found effective for dry type sanitizing of items in hospitals, clinics. The papers represent the

basic principle of UV-light based sanitization process, its application and the effectiveness in sanitizing the COVID-19 viruses.

Key words: Ultraviolet (UV) light, UV-Radiation, UV-C, COVID-19, Disinfection, Sanitization, UV-Light base Sanitization

I INTRODUCTION

The recent outbreak of the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1] has created COVID-19 pandemic [2] which has affected 188 countries worldwide. As of second week of June, 2020, more than 7 million reported cases and over 400000 deaths had been reported [3]. As of second week of Oct, 2020, around 37.6 million reported cases and over 1.08 million deaths had been reported [4]. Older individuals (aged ≥ 70 years) and individuals with chronic conditions such as diabetes, renal and cardiopulmonary disease are most susceptible to severe disease and life risk conditions [5]. Efficient viral transmission via droplets and fomites is potentially supplemented by other transmission routes such as aerosol and faecal contamination [6-7]. Accumulating evidence suggests that presymptomatic or asymptomatic carriers can transmit the virus [8-10]. Isolation of cases and quarantine of their close contacts at home are frequently recommended as a disease control measure in countries with COVID-19 outbreaks, but such restrictions are likely to have little or no effect on transmission within households. As the essential commodities like food and drinks are always required to be procured regularly, people must bring these items inside their home to survive. Moreover storing of foods may not be a permanent solution for certain types of food and drinks during a prolong lockdown severely affect the social and economic life in the country, the people are supposed to work outside in the pandemic condition. As neither the vaccine and nor the medicine has been still available to all the people, coming in contact with the community are prone to the infection. Moreover the doctors, clinicians, and other health staffs working in the hospital or quarantine centers are also subject to the infection possibilities. Therefore, we all need to be sanitized our household commodities brought from outside before we use them. Ultraviolet (UV) light based sanitizing instruments are found effective for dry type sanitizing of items [11]. In this paper UV-light based sanitizing instruments are reviewed and the possibilities, limitations and challenges have been discussed.

II METHODOLOGY

2.1. Ultraviolet Light

Ultraviolet (UV) light [12] is a form of electromagnetic radiation with wavelength from 10 nm - 400 nm which is shorter than that of visible light and hence it is not considered as the visible light. The frequency of the UV ranges from 30 PHz to 750 THz. UV radiation is present in sunlight, electric arcs and specialized lights, such as mercury-vapor lamps, tanning lamps, and black lights etc. Due to the insufficient energy (compared to X-Rays [13]) in its light photons, the UV light can't not ionize the atoms and hence it is not considered as the ionizing radiation. But, the energy of UV light is sufficient to cause the chemical and biological reactions which could be utilized for many practical applications such as disinfection, sanitizations and chemical reactions causing fluoresce. Short-wave UV light damages the DNA of the biological cells and hence sterilizes surfaces of the objects by destroying the cell structure of the microbes. Upon the exposure of UV light the human-skin can go through the suntan or sunburn and even can have an increased risk of skin cancer if the skin got exposed for long time. Based on the wavelength, the UV radiation is mainly

classified into three types: Ultraviolet-A (UV-A), Ultraviolet-B (UVB), and Ultraviolet C (UV-C) [14-15]. Each type of these UV-lights each type of ray has a different wavelength as shown in the figure below (Fig. 1) and can hence have different frequencies. UV-lights with different frequencies penetrate the surfaces to a certain extent depending on their wave lengths and frequencies. UV-A light has a wave length ranges from 400-320 nm and hence UV-C rays penetrate deep into the human-skin and work as a factor in premature aging. The wavelength of the UV-B light ranges from 290-320 nm and generally creates sunburns and skin cancer for extended exposure. The UV-C light has the shortest wavelength (200-290 nm) among these three types and is capable of destroy the DNA of microbes to either kill the germs or make them inactive to function and reproduce. As a non-chemical germicidal light, UV-C light can even neutralize the microbes which have developed a resistance to the antibiotics.

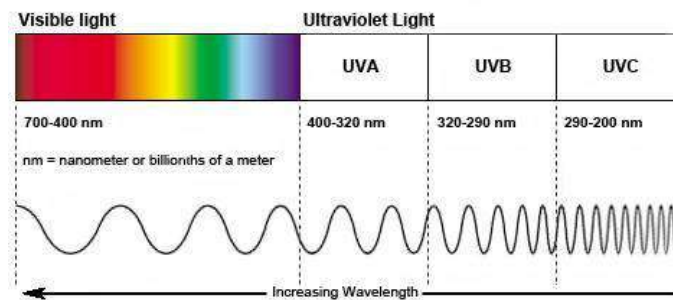


Fig. 1: Wavelength chart of the Ultraviolet (UV) light showing the Ultraviolet-A (UV-A), Ultraviolet-B (UVB), and Ultraviolet C (UV-C)

2.2. UV-Based Disinfection and Sanitization

UV light is highly effective at killing microorganism such as virus, bacteria and fungi. UV-light also can damage the cells by destroying their DNA structure. Depending upon the wavelength the UV-lights will have their germ killing ability. UV light is an electromagnetic radiation which has photon energy larger than visible light (wavelengths shorter than visible light) and lesser than X-Rays (wavelengths longer than visible X-Rays). The application of UV-C light for disinfection and sanitization process has been found since the mid of the 20th century. As an electromagnetic signal, the UV-light radiation will have its energy (E) given by the equation 1:

$$E = hf$$

(1)

Where h is the Plank's constant = 6.626×10^{-34} Joule-second and f is the frequency of the electromagnetic signal.

Now as the speed of the light ($c = 2.998 \times 10^8$ m/s) is given by

$$c = \lambda f \tag{2}$$

Where λ the wavelength (λ)

Therefore,

$$f = \frac{c}{\lambda}$$

(3)

Now replacing f in the Eq. 1 we get,

$$E = h \frac{c}{\lambda}$$

(4)

Hence, the equation 4 states that, like any other electromagnetic waves, for ultraviolet radiation when wavelength decreases the energy of the wave increases. Therefore, as the UVC rays have the shortest wavelength, it will have highest energy. Consequently, UV-C lights will be more stronger and able to kill the pathogens like bacteria and viruses. UV-C light has a wavelength of between 200 and 400 nanometers (nm). Taking an average of the of this, if the UV-C is obtained of 300 nm wavelength, the photon energy level of the UV-C radiation will be found as:

$$E = 6.626 \times 10^{-34} \times \frac{2.998 \times 10^8}{300 \times 10^{-9}} \text{ Joules} = 6.62 \times 10^{-19} \text{ Joules} = 6.62 \times 10^{-19} \times 6.242 \times 10^{18} \text{ eV} = 4.13 \text{ eV}$$

(5)

UV light is not visible light and not safe for human health as UV-light from certain wavelength can create changes in the biological cells. UV-C light is present in the sunlight but it becomes weak at the surface of the Earth's as the UV lights are blocked by the ozone layer of the atmosphere blocks it. UV-C light based sanitization or disinfection is found as a reliable, well-studied antimicrobial technology which destroying the DNA inside the microbes such as bacteria, viruses and fungi.

Ultraviolet Germicidal Irradiation (UVGI)

A UVGI device [16] can be developed with the circuit similar to the circuit required for a fluorescent lamp (Fig. 2). The UV-C Lamp is available which is required to be connected with a ballast coil or inductive coil and a starter to make and break the circuit to develop a high voltage for producing the discharge inside the lamp. The UVGI device can produce a UV-C light which is strong enough to use as the disinfection device to kill the microorganisms such as bacteria, viruses, fungi, and other pathogens.

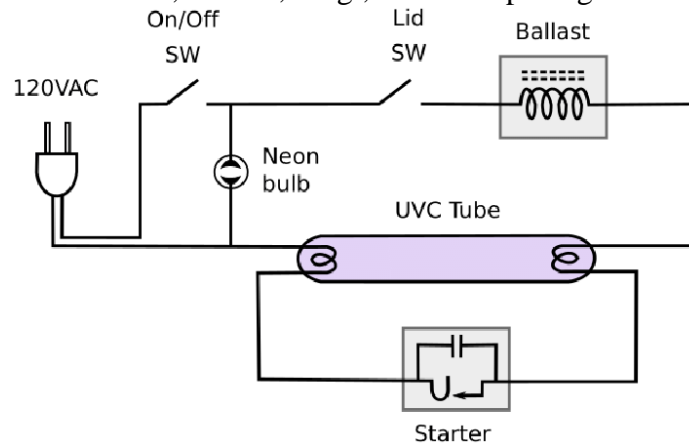


Fig. 2: Schematic of a UVGI device producing UV-C light for disinfection [16].

The mercury-based UV-lamps operate at low vapor pressure and can emit UV-light at the 253.7 nm wavelength [17]. The UV-lights can also be generated with ultraviolet light emitting diodes (UV-LEDs). As for example, an ultraviolet light-emitting diode (UV-C LED) lamps can emit UV-C light at selectable wavelengths between 255 and 280 nm [18]. A pulsed-xenon lamp emits UV light across the entire UV spectrum with a peak emission at 230 nm [19]. As shown in the Fig. 3 the germicidal effectiveness of the UV-C light depends on the wavelength of the radiation [20] as well as on the type of germs to be disinfected. Fig. 3 shows a germicidal effectiveness curve (relative intensity versus the wavelength) for E.coli [19].

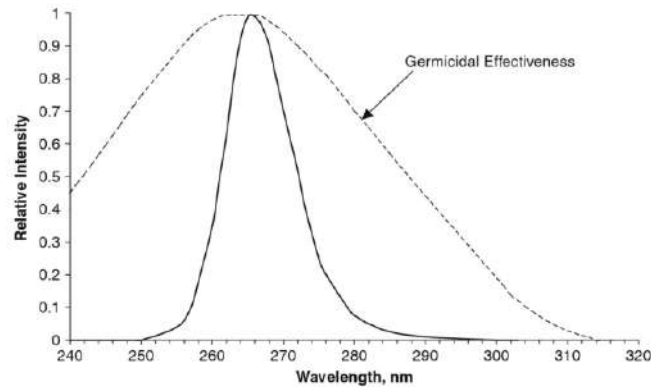


Fig. 3: UVC LED emitting 265 nm compared to E.coli germicidal effectiveness curve. [19].

III RESULTS

The UV light based disinfection, which is called as ultraviolet germicidal irradiation (UVGI) [16, 19-21], is a method of disinfection that uses high frequency (short-wavelength ultraviolet) UV-C light to kill or damage the microorganisms by destroying their DNA and make them unable or inactive to cause cellular functions [19-21]. Wavelengths between about 200 nm and 300 nm are strongly absorbed by nucleic acids of the microbes (Fig. 4a). The absorbed energy can result in defects in the DNA (Fig. 4b) including pyrimidine dimers [22-23] which are actually the results of some the photochemical reactions in which the molecular lesions are formed with the thymine bases or cytosine bases in DNA [22-23]. These pyrimidine dimers either can prevent the replication of the DNA or can prevent the expression of necessary proteins which can cause the death or inactivation of the organism (Fig. 4b).

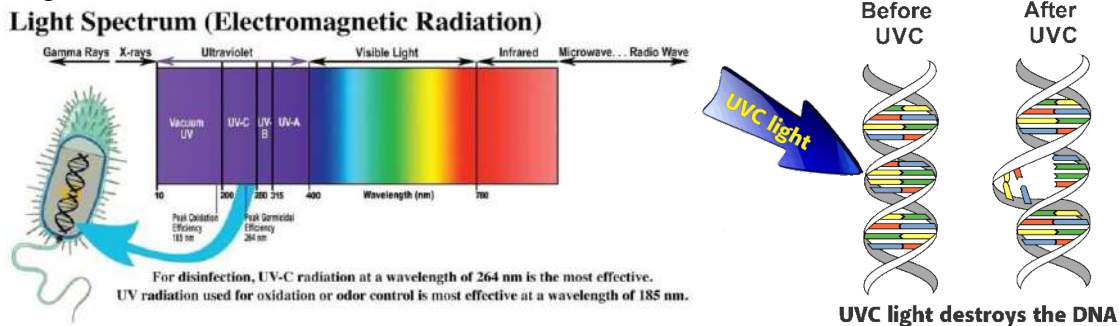


Fig. 43: Effect of UV-C light on the germs and their DNAs.

The UV-C light based sanitization or disinfection processes have been studied for a number of practical applications. The UV-C light can cause the pathophysiology of premature skin [24], mutations [15] and carcinogenesis [25]. The UV-C light has also been found suitable for disinfection of food industries [26], sanitizing the hospital objects [27-28], drinking water purification [29-30], waste water treatment [31-32], sewage and waste management [32-33], air purification [17, 34] and aerosol disinfection [35]. The application of UV-C based disinfection is found advantageous especially in hospitals environment because the UV-C can destroy the DNA of the spore-forming bacterium *Clostridium difficile* [36], which is found as the major source of hospital-acquired infections [16, 37]. Under UV-lights, the microorganisms cannot survive prolonged exposure to it and for humans the UV-lights produces sunburn and even can cause severe skin damage (Fig. 5) or cancer for longer exposure.

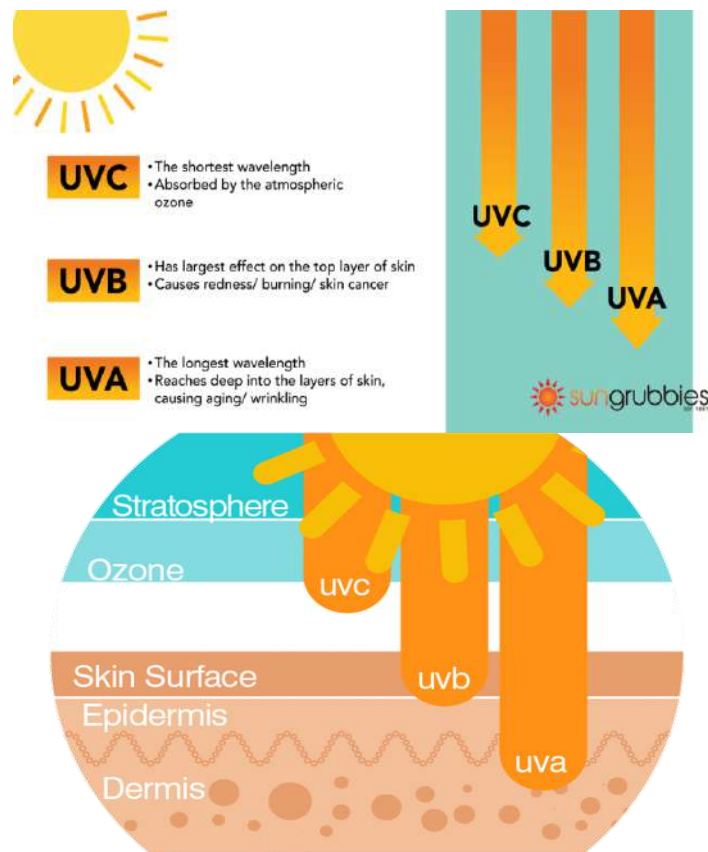


Fig. 5: Effect of UV lights on human skin

COVID-19 disease is created by the infection of SARS-CoV-2. The SARS-CoV-2 is found extremely infectious and can spread through contacts between human-to-human, human-to-object and object-to-object. The COVID-19 can spread through saliva droplets, droplets coming out through cough and sneezing and through blood, body fluids. The virus can stay alive for several hours to several days on inert objects such as soil, dust, dust beans, metals, woods, papers, plastics, shoes, mobiles, currencies, coins and other house hold commodities [38-39]. The UV-C light based sanitization or disinfection has been found very effective for COVID-19 infections [40-45] as the virus can stay alive and spread through most of the living and non-living objects we interact with during our daily life. Therefore, as all the materials are not possible for chemical or wet sanitization UV-C based dry type sanitization id also found very effective [40-45].

IV CONCLUSIONS

UV light based disinfection and sanitizing method has long been applied for killing the viruses, bacteria and other microbes. The UV based disinfecting devices called UVGI systems uses UV-C lamps capable of producing the UV-lights of specified wavelength suitable for killing the germs. The UV-C light based sanitizing systems are extremely useful for disinfecting the COVID-19 viruses as the virus can stay alive for long time on the most of the live and nonliving objects. As the chemical and wet sanitization are not possible to applied in many cases, dry type sanitization using UV-C light becomes promising and useful. A number of studies are being conducted in designing and developing UV-C based UVGI systems for disinfecting COVID-19 viruses. The UVGI devises are developed with a sealed environment so that the radiation from the lamps is confined within a desired space without creating any unexpected exposures. As the exposure to the UV-light is unhealthy and

dangerous, the instruments are kept and used with proper supervision and safety protocols to avoid the UV-light exposure. The exposure to the germicidal wavelengths of UV-light can produce sunburn, and even skin cancer. The exposure of UV-light radiation to the human eyes is extremely dangerous which can damage the cornea followed by a temporary or permanent vision impairment, and even blindness. As a full-spectrum UV-lamp releases all UV wavelengths and hence it can produce ozone (O₃) because when UV-C with some wavelength interacts with oxygen (O₂) molecules. Therefore, in designing a UV-C based sanitizing system, the care must be taken to ensure that the ozone production is either nil or is kept within the safe limit. Therefore for an effective and efficient design procedure for the UV-C based UVGI systems, the ozone gas detection and the UV radiation measurement (wavelength) are required to be studied. The O₃ measurement will ensure the instrument safety whereas the measurement of the wavelength will ensure the production of required UV-lights to increase the efficiency and reliability of the instruments.

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ANALYSIS OF RECOMMENDATION SYSTEMS: TECHNIQUES AND METHODOLOGIES

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ABSTRACT

Recommender systems are special software programs designed to recommend items to users based on their ascertained interest. A user's interest with respect to recommended items are stored in the form of interaction, for example, numerical rating, inside a rating matrix. Therefore, users, items, and the rating matrix create a recommender systems ecosystem known as a domain. These days, recommender systems focus on item recommendation to a single domain [1]. For example, AMAZON recommends items for sale to its interested users; Netflix presents its viewers with a list of media content, whereas Last.fm recommends songs and music albums to its users. Such recommender systems are increasing rapidly and are found to focus on users having specific interests, rather than relying on the wisdom of the majority, that is, covering a broad range of users [2]. It provides automated and personalized suggestions to consumers to select variety of products. Typically, the core of similarity-based CF which greatly affect the performance of recommendation system is to finding similar users to a target user. Recommender systems solve this problem by searching through large volume of dynamically generated information to provide users with personalized content and services [3]. This paper explores the different characteristics and potentials of different prediction techniques in recommendation systems in order to serve as a compass for research and practice in the field of recommendation systems.

Keywords—component; formatting; style; styling; insert (key words)

I. INTRODUCTION

A Recommendation system (RS) is a necessity and a popular technology to handle information explosion. It serves as an information filtering tool and is commonly used to assist the target user to filter through a large pool of products and present only those products that are of user's interest. It gathers a large amount of data on the activities, inclinations, interest or taste of its client for a set of things i.e. movies, hardware item, garments and so forth and makes utilization of this gathered data to give suggestions to different clients. In day to day life, we regularly depend on the opinion of like-minded individuals, individuals with comparable taste and preference or other trusted sources about the nature and quality of assets to get the suggestions for a product or item. A RS automates this word-of-mouth phenomenon and is generally utilized by the online shopping sites like Amazon to prescribe products of interest and by sites like Netflix to prescribe films to the users by giving personalization suggestions. The significance of RS increases inconceivably with the presence of long tail phenomenon [4]. A physical retail store is characterized by shortage of resources. For instance, a fabric shop has constrained rack space and can show restricted assortment of items to a client. In the physical world it is impractical to customize a physical retail store for every individual client, as it is either represented by deals figures (most prevalent products) or it relies on upon master judgment.

Despite what might be expected, an online retail store can make everything accessible to the client that exists. This peculiarity to makes things accessible between the offline and on-line world has been termed as the long tail6 phenomenon. As per the long tail, offline retail stores just give the most popular things though on-line stores offer least popular items in addition most famous things. Henceforth19, Park and Tuzhilin19 proposed the need of a RS to prescribe things to individual clients online as it is unrealistic to present every accessible thing to the client or things that match the essence of clients.

II. METHODOLOGY

Recommender system was defined as a means of assisting and augmenting the social process of using recommendations of others to make choices when there is no sufficient personal knowledge or experience of the alternatives [5]. Recommender systems handle the problem of information overload that users normally encounter by providing them with personalized, exclusive content and service recommendations. Recently, various approaches for building recommendation systems have been developed, which can utilize either collaborative filtering, content-based filtering or hybrid filtering [6]. Collaborative filtering technique is the most mature and the most commonly implemented. Collaborative filtering recommends items by identifying other users with similar taste; it uses their opinion to recommend items to the active user. Collaborative recommender systems have been implemented in different application areas. Group Lens is a news-based architecture which employed collaborative methods in assisting users to locate articles from massive news database . Ringo is an online social information filtering system that uses collaborative filtering to build users profile based on their ratings on music albums . Amazon uses topic diversification algorithms to improve its recommendation. The system uses collaborative filtering method to overcome scalability issue by generating a table of similar items offline through the use of item-to-item matrix. The system then recommends other products which are similar online according to the users' purchase history. On the other hand, content-based techniques match content resources to user characteristics. Content-based filtering techniques normally base their predictions on user's information, and they ignore contributions from other users as with the case of collaborative techniques [7]. Fab relies heavily on the ratings of different users in order to create a training set and it is an example of content-based recommender system.

III. RECOMMENDATION PROCESS

It collects the needy information of users to generate a user profile or model for the prediction tasks including user's attribute, behaviors or content of the resources the user accesses. A recommendation agent cannot function accurately until the user profile/model has been well constructed. The system needs to know as much as possible from the user in order to provide reasonable recommendation right from the onset. Recommender systems rely on different types of input such as the most convenient high quality explicit feedback, which includes explicit input by users regarding their interest in item or implicit feedback by inferring user preferences indirectly through observing user behavior . Hybrid feedback can also be obtained through the combination of both explicit and implicit feedback. In E-learning platform, a user profile is a collection of personal information associated with a specific user. This information includes cognitive skills, intellectual abilities, learning styles, interest, preferences and interaction with the system. The user profile is normally used to retrieve the needed information to build up a model of the user. Thus, a user profile describes a simple user model. The success of any recommendation system depends largely on its ability to represent user's current interests. Accurate models are indispensable for obtaining relevant and accurate recommendations from

any prediction techniques.

A. Explicit Feedback

The system normally prompts the user through the system interface to provide ratings for items in order to construct and improve his model. The accuracy of recommendation depends on the quantity of ratings provided by the user. The only shortcoming of this method is, it requires effort from the users and also, users are not always ready to supply enough information. Despite the fact that explicit feedback requires more effort from user, it is still seen as providing more reliable data, since it does not involve extracting preferences from actions, and it also provides transparency into the recommendation process that results in a slightly higher perceived recommendation quality and more confidence in the recommendations.

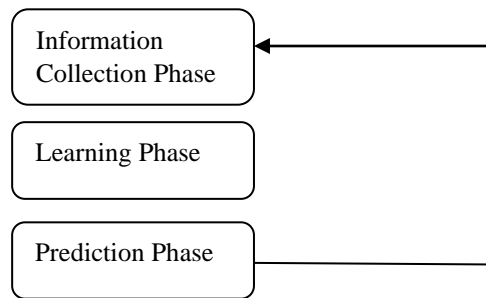


Fig-1 Feedback

This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation.

B. Implicit feedback

The system automatically infers the user’s preferences by monitoring the different actions of users such as the history of purchases, navigation history, and time spent on some web pages, links followed by the user, content of e-mail and button clicks among others. Implicit feedback reduces the burden on users by inferring their user’s preferences from their behavior with the system. The method though does not require effort from the user, but it is less accurate. Also, it has also been argued that implicit preference data might in actuality be more objective, as there is no bias arising from users responding in a socially desirable way and there are no self-image issues or any need for maintaining an image for others.

C. Hybrid feedback

The strengths of both implicit and explicit feedback can be combined in a hybrid system in order to minimize their weaknesses and get a best performing system. This can be achieved by using an implicit data as a check on explicit rating or allowing user to give explicit feedback only when he chooses to express explicit interest.

D. Learning phase

It applies a learning algorithm to filter and exploit the user’s features from the feedback gathered in information collection phase.

E. Prediction phase

It recommends or predicts what kind of items the user may prefer. This can be made either directly based on the dataset collected in information collection phase which could be memory based or model based or through the system’s observed activities of the user. Fig. 1 highlights the recommendation phases.

IV. RECOMMENDATION FILTERING TECHNIQUES

The use of efficient and accurate recommendation techniques is very important for a system that

will provide good and useful recommendation to its individual users. This explains the importance of understanding the features and potentials of different recommendation techniques

a. Content-based filtering

Content-based technique is a domain-dependent algorithm and it emphasizes more on the analysis of the attributes of items in order to generate predictions. When documents such as web pages, publications and news are to be recommended, content-based filtering technique is the most successful. In content-based filtering technique, recommendation is made based on the user profiles using features extracted from the content of the items the user has evaluated in the past [8]. Items that are mostly related to the positively rated items are recommended to the user. CBF uses different types of models to find similarity between documents in order to generate meaningful recommendations.

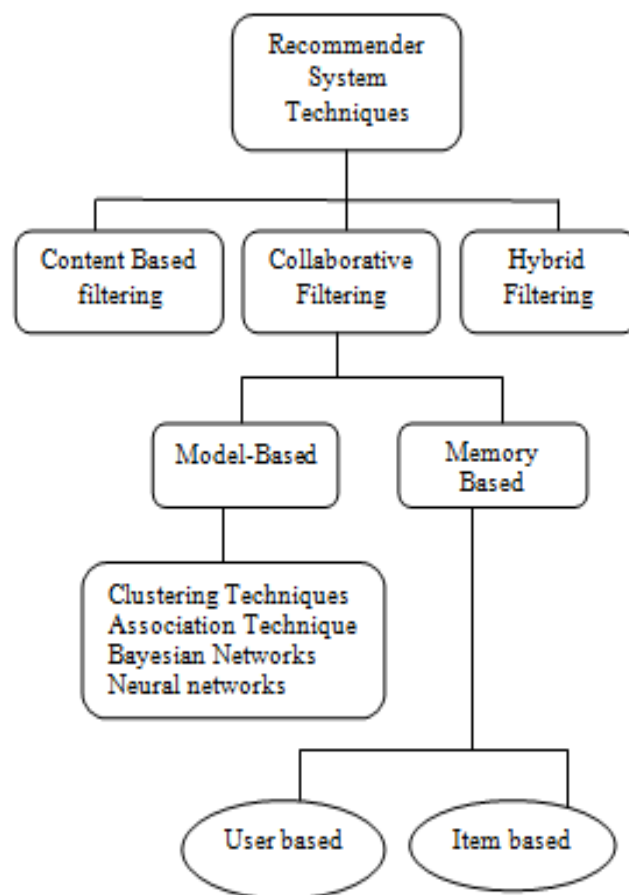


Fig-2 Recommendation Techniques

b. Collaborative filtering

Collaborative filtering is a domain-independent prediction technique for content that cannot easily and adequately be described by metadata such as movies and music. Collaborative filtering technique works by building a database (user-item matrix) of preferences for items by users. It then matches users with relevant interest and preferences by calculating similarities between their profiles to make recommendations. Such users build a group called neighborhood. An user gets recommendations to those items that he has not rated before but that were already positively rated by users in his neighborhood. Recommendations that are produced by CF can be of either prediction or recommendation. Prediction is a numerical value, expressing the

predicted score of item for the user, while Recommendation is a list of top N. The technique of collaborative filtering can be divided into two categories: memory-based and model-based.

a) *Memory based techniques*

The items that were already rated by the user before play a relevant role in searching for a neighbor that shares appreciation with him. Once a neighbor of a user is found, different algorithms can be used to combine the preferences of neighbors to generate recommendations. Due to the effectiveness of these techniques, they have achieved widespread success in real life applications. Memory-based CF can be achieved in two ways through user-based and item-based techniques. User based collaborative filtering technique calculates similarity between users by comparing their ratings on the same item, and it then computes the predicted rating for an item by the active user as a weighted average of the ratings of the item by users similar to the active user where weights are the similarities of these users with the target item. Item-based filtering techniques compute predictions using the similarity between items and not the similarity between users. It builds a model of item similarities by retrieving all items rated by an active user from the user-item matrix [9], it determines how similar the retrieved items are to the target item, then it selects the k most similar items and their corresponding similarities are also determined. Prediction is made by taking a weighted average of the active users rating on the similar items k. Several types of similarity measures are used to compute similarity between item/user. The two most popular similarity measures are correlation-based and cosine-based. Pearson correlation coefficient is used to measure the extent to which two variables linearly relate with each other and is defined as -

$$s(a, u) = \frac{\sum_{i=1}^n (r_{a,i} - \bar{r}_a)(r_{u,i} - \bar{r}_u)}{\sqrt{\sum_{i=1}^n (r_{a,i} - \bar{r}_a)^2} \sqrt{\sum_{i=1}^n (r_{u,i} - \bar{r}_u)^2}}$$

From the above equation, s(a,u) denotes the similarity between two users. Prediction for an item is made from the weighted combination of the selected neighbors' ratings, which is computed as the weighted deviation from the neighbors' mean. The general prediction formula is-

$$p(a, i) = \bar{r}_a + \frac{\sum_{i=1}^n (r_{u,i} - \bar{r}_u) \times s(a, u)}{\sum_{i=1}^n s(a, u)}$$

Cosine similarity is different from Pearson-based measure in that it is a vector-space model which is based on linear algebra rather than statistical approach. It measures the similarity between two n-dimensional vectors based on the angle between them. Cosine-based measure is widely used in the fields of information retrieval and texts mining to compare two text documents, in this case, documents are represented as vectors of terms. The similarity between two items u and v can be defined as follows:

$$s(\vec{u}, \vec{v}) = \frac{\vec{u} \cdot \vec{v}}{|\vec{u}| * |\vec{v}|} = \frac{\sum_i r_{u,i} r_{v,i}}{\sqrt{\sum_i r_{u,i}^2} \times \sqrt{\sum_i r_{v,i}^2}}$$

b) *Model-based techniques*

This technique employs the previous ratings to learn a model in order to improve the performance of Collaborative filtering Technique. The model building process can be done using machine learning or data mining techniques. These techniques can quickly recommend a set of items for the fact that they use pre-computed model and they have proved to produce

recommendation results that are similar to neighborhood-based recommender techniques. Examples of these techniques include Dimensionality Reduction technique such as Singular Value Decomposition (SVD), Matrix Completion Technique, Latent Semantic methods, and Regression and Clustering. Model-based techniques analyze the user-item matrix to identify relations between items; they use these relations to compare the list of top-N recommendations. Model based techniques resolve the sparsity problems associated with recommendation systems. The use of learning algorithms has also changed the manner of recommendations from recommending what to consume by users to recommending when to actually consume a product. It is therefore very important to examine other learning algorithms used in model-based recommender systems:

- i. **Association rule:** Association rules algorithms extract rules that predict the occurrence of an item based on the presence of other items in a transaction.
- ii. **Clustering:** Clustering techniques have been applied in different domains such as, pattern recognition, image processing, statistical data analysis and knowledge discovery. Clustering algorithm tries to partition a set of data into a set of sub-clusters in order to discover meaningful groups that exist within them. K-means and Self-Organizing Map (SOM) are the most commonly used among the different clustering methods. K-means takes an input parameter, and then partitions a set of n items into K clusters. The Self-Organizing Map (SOM) is a method for an unsupervised learning, based on artificial neurons clustering technique. Clustering techniques can be used to reduce the candidate set in collaborative based algorithms.
- iii. **Decision tree:** Decision tree is based on the methodology of tree graphs which is constructed by analyzing a set of training examples for which the class labels are known. They are then applied to classify previously unseen examples. If trained on very high quality data, they have the ability to make very accurate predictions. Decision trees are more interpretable than other classifier such as Support Vector machine and Neural Networks because they combine simple questions about data in an understandable manner.
- iv. **Artificial Neural network** ANN is a structure of many connected nodes which are arranged in layers in taxonomic relations. The connections between neurons have weights associated with them depending on the amount of influence one neuron has on another. There are some advantages in using neural networks in some special problem situations. For example, due to the fact that it contains many neurons and also assigned weight to each connection, an artificial neural network is quite robust with respect to noisy and erroneous data sets. ANN has the ability of estimating nonlinear functions and capturing complex relationships in data sets also, they can be efficient and even operate if part of the network fails. The major disadvantage is that it is hard to come up with the ideal network topology for a given problem and once the topology is decided this will act as a lower bound for the classification error. Link Analysis [10] is the process of building up networks of interconnected objects in order to explore pattern and trends. It has presented great potentials in improving the accomplishment of web search. Link analysis consists of Page Rank and HITS algorithms. Most link analysis algorithms handle a web page as a single node in the web graph.
- v. **Regression:** Regression analysis is used when two or more variables are thought to be systematically connected by a linear relationship. It is a powerful and diversity process for analyzing associative relationships between dependent variable and one or more independent variables. Uses of regression contain curve fitting, prediction, and testing systematic hypotheses about relationships between variables. The curve can be useful to identify a trend within dataset, whether it is linear, parabolic, or of some other forms.

vi. **Bayesian Classifiers:** They are probabilistic framework for solving classification problems which is based on the definition of conditional probability and Bayes theorem. Bayesian classifiers consider each attribute and class label as random variables. Given a record of N features (A1, A2, ..., AN), the goal of the classifier is to predict class Ck by finding the value of Ck that maximizes the posterior probability of the class given the data $P(C_k|A_1, A_2, \dots, A_N)$ by applying Bayes' theorem, $P(C_k|A_1, A_2, \dots, A_N) = P(A_1, A_2, \dots, A_N|C_k)P(C_k)$. The most commonly used Bayesian classifier is known as the Naive Bayes Classifier. In order to estimate the conditional probability, $P(A_1, A_2, \dots, A_N|C_k)$, a Naive Bayes Classifier assumes the probabilistic independence of the attributes that is, the presence or absence of a particular attribute is unrelated to the presence or absence of any other. This assumption leads to $P(A_1, A_2, \dots, A_N|C_k) = P(A_1|C_k)P(A_2|C_k)\dots P(A_N|C_k)$.

c. Hybrid Filtering

Recommender systems now use a hybrid approach, combining collaborative filtering, content-based filtering, and other approaches. There is no reason why several different techniques of the same type could not be hybridized. Hybrid approaches can be implemented in several ways: by making content-based and collaborative-based predictions separately and then combining them; by adding content-based capabilities to a collaborative-based approach

- **Weighted:** Combining the score of different recommendation components numerically.
- **Switching:** Choosing among recommendation components and applying the selected one.
- **Mixed:** Recommendations from different recommenders are presented together to give the recommendation.
- **Feature Combination:** Features derived from different knowledge sources are combined together and given to a single recommendation algorithm.
- **Feature Augmentation:** Computing a feature or set of features, this is then part of the input to the next technique.
- **Cascade:** Recommenders are given strict priority, with the lower priority ones breaking ties in the scoring of the higher ones.
- **Meta-level:** One recommendation technique is applied and produces some sort of model, which is then the input used by the next technique

Pros and Cons of collaborative filtering techniques

Collaborative Filtering has some major advantages over CBF in that it can perform in domains where there is not much content associated with items and where content is difficult for a computer system to analyze. Also, CF technique has the ability to provide serendipitous recommendations, which means that it can recommend items that are relevant to the user even without the content being in the user's profile. Despite the success of CF techniques, their widespread use has revealed some potential problems such as follows.. Cold-start problem. This refers to a situation where a recommender does not have adequate information about a user or an item in order to make relevant predictions. This is one of the major problems that reduce the performance of recommendation system[11]. The profile of such new user or item will be empty since he has not rated any item; hence, his taste is not known to the system data sparsity problem. This is the problem that occurs as a result of lack of enough information, that is, when only a few of the total number of items available in a database are rated by users. This always leads to a sparse user item matrix, inability to locate successful neighbors and finally, the generation of weak recommendations. Also, a data sparsity Recommendation system always leads to coverage problems, which is the percentage of items in the system that recommendations can be made for Scalability. This is another problem associated with

recommendation algorithms because computation normally grows linearly with the number of users and items . A recommendation technique that is efficient when the number of dataset is limited may be unable to generate satisfactory number of recommendations when the volume of dataset is increased. Thus, it is crucial to apply recommendation techniques which are capable of scaling up in a successful manner as the number of dataset in a database increases. Methods used for solving scalability problem and speeding up recommendation generation are based on Dimensionality reduction techniques, such as Singular Value Decomposition (SVD) method, which has the ability to produce reliable and efficient recommendations. Synonymy is the tendency of very similar items to have different names or entries. Most recommender systems find it difficult to make distinction between closely related items such as the difference between e.g. baby wear and baby cloth. Collaborative Filtering systems usually find no match between the two terms to be able to compute their similarity. Different methods, such as automatic term expansion, the construction of a thesaurus, and Singular Value Decomposition (SVD), especially Latent Semantic Indexing are capable of solving the synonymy problem. The shortcoming of these methods is that some added terms may have different meanings from what is intended, which sometimes leads to rapid degradation of recommendation performance.

Examples of collaborative systems

Ringo is a user-based CF system which makes recommendations of music albums and artists. In Ringo, when a user initially enters the system, a list of artists is given to the user to rate according to how much he likes listening to them. The list is made up of two different sections. The first session consists of the most often rated artists, and this affords the active user opportunity to rate artists which others have equally rated, so that there is a level of similarities between different users' profiles. The second session is generated upon a random selection of items from the entire user-item matrix, so that all artists and albums are eventually rated at some point in the initial rating phases.

GroupLens is a CF system that is based on client/server architecture; the system recommends Usenet news which is a high volume discussion list service on the Internet. The short lifetime of Netnews, and the underlying sparsity of the rating matrices are the two main challenges addressed by this system[12]. Users and Netnews are clustered based on the existing news groups in the system, and the implicit ratings are computed by measuring the time the users spend reading Netnews. Amazon.com is an example of e-commerce recommendation engine that uses scalable item-to-item collaborative filtering techniques to recommend online products for different users. The computational algorithm scales independently of the number of users and items within the database.

V CONCLUSION

Recommender systems provide great value in recommending relevant resources to users. It can be quite useful in finding novel and serendipitous recommendations. The effectiveness of recommender system relies on the algorithm it uses to find interesting. resources. Both of these content information and item-based. Collaborative filtering method are used together in prediction process. In the beginning, current recommendation systems and main theoretical issues behind them are generally introduced. Afterwards the related work in the related area has been covered by analyzing a variety of recommendation systems from different domains. In the most crucial part, comprehensive amount of study is done about overall system design and the prediction approach.

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SIGNIFICANCE OF GAME BASED USER INTERFACE IN SPREADING COVID-19 AWARENESS AMONG USERS

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ABSTRACT

With the ongoing surge in COVID-19 cases throughout the world, the WHO has appealed to the people to follow basic precautionary measures in order to curb the rise. Despite many social media awareness campaigns, advertisements and mobile applications, there has been no reduction in the number of COVID-19 cases. A game-based approach could help the users gain greater awareness and knowledge about COVID-19. Game-based approach is being widely used in the education industry due to its engaging yet instructive nature. Apart from the education industry, it has been used in healthcare for diseases like cancer, Alzheimer's, and diabetes where it has proved to show compelling results. This paper describes how mobile games can increase knowledge and awareness among the users, what are the parameters to consider while designing an effective awareness-based game and what are the factors resulting in the overall learning outcome of the user. This paper also presents a few user-centric game design prototypes that could possibly increase user awareness among the users.

I INTRODUCTION

The number of coronavirus cases have been increasing drastically across the world especially in countries like the USA, India and Brazil. Precautionary measures like wearing a mask, using a sanitizer, washing hands and maintaining social distance have become our necessity now in order to avoid coronavirus. People are not used to such habits and are finding it difficult to follow these practices. These precautionary practices can only be a part of the daily lifestyle if their mindset changes and if these habits become a part of their life subconsciously. Soon after the pandemic broke out, various platforms have been developed to help users gain knowledge

about coronavirus. These platforms include websites, blogs, awareness campaigns and a few others. It has been observed by the WHO that a lot of fake news and misinformation is being circulated related to COVID-19 [1] [2]. In order to avoid this, a new approach is presented in this paper namely, game-based awareness platform. Ever since 2002, the usage of game-based approach (known as serious games) in education has been widespread [3] [4]. Games, whether, video or android games are said to be one of the most representative of the current interactive media and it was observed that games can impact the players mindset and behaviour [5] [3].

Background

In order to keep the people healthy, it is important for them to be aware of the virus and follow the required precautionary measures suggested by the World Health Organization (WHO) and CDC. Many websites and apps have been developed for coronavirus tracking and self-assessment purposes. For example, the '100m app' in South Korea aims at showing the locations visited by corona infected people [6]. Also, the Arogya Sethu App in India which aims to show nearby diagnostic centres, self-assessment options and the number of coronavirus patients nearby [7]. A few COVID-19 games have been developed like the SurviveCOVID-19 which focuses on health measures required to prevent COVID-19 Pandemic. But what the game doesn't cover is the immense amount of facts and precautionary measures linked with COVID-19 which could help prevent COVID-19 like, 'The virus stays on plastic items for 2 to 3 days. Wait for 2-3 days and then touch the object.'

According to a recent study by Gartner, the mobile phone demand rate will increase by 3%, that is close to 1.5 billion units by the end of 2020 [8]. Throughout the years, kids and younger generations have been more into games. Games, whether, video or android games are said to be one of the most representative of the current interactive media and it was observed that games can impact the players mindset [9] [10]. Since the past few years, certain games have been developed in order to create awareness or enable self-monitoring for a disease. KiddyAttack, is a cancer awareness game that aims to educate kids about cancer [11]. Other games have been developed in order to create awareness for cancer patients [12]. Some of the self-monitoring games include dietcam [13] and diabetismario [14] which aim to keep weight and diabetes in control. Also, game-based learning has been useful and effective in helping high school kids learn about computer memory concepts [4]. Also, there have been prior studies that prove game-based education useful for younger people [15] [16]. Further, new games have also been developed in order to engage and help elderly people improve their cognitive abilities [17] [18]. For any serious game to provide the desired learning outcome, it must be effective enough. It has been stated in ISO 9241 that effectiveness, usability, efficiency and satisfaction are closely related [19].

Later, there have been a few studies that provide the factors and parameters to be considered while measuring the effectiveness of the game [20]. One such study was when an input-output game cycle was presented consisting of user judgments, behaviour, rules and learning outcomes. The game characteristics/goals were described using parameters like stimuli, mystery, challenge and fantasy. User judgements include the level of interactivity and immersion of the user in the game. User feedback was collected at the end of the game to measure these parameters. The learning outcomes could be skill-based or procedural. Skill-based learning outcomes include helping the user learn and develop technical skills whereas procedural learning outcomes includes knowledge to perform a particular task or procedure. Learning outcome is related to the effectiveness of the game directly. For example, if the gam provides the users with the desired learning and is able to satisfy the aim of the game then it is said to be effective.

Some of the examples of frameworks used for the evaluation of e-learning effectiveness are as follows. The CLA Framework [21] considered various factors like context along with the user's interaction, attitude and outcome. This framework used interviews, observations and surveys to analyze the impact of the game on the user. Later, another framework [22] was used to evaluate games and game-based/simulation-based education. This is a four dimensional framework which includes context, learner profile, mode of representation and learning models. Context includes where and why the game is played and also refers to the environment in which the game is played. A learner's/user's profile includes the age, demography, knowledge of games, experience with technology etc. Representation includes fidelity, ease of use, immersion and interactivity. Learning models may be associative, experiential or constructive(cognitive) based . These parameters altogether can be used to measure the effectiveness of a game. These parameters and frameworks have often been used to measure the outcomes and effectiveness of learning based games but if they are used for awareness based games, it can help create a better environment and help users gain some knowledge about COVID-19.

II METHODOLOGY

The process of design thinking is followed in order to create few user-centric game design prototypes. The design thinking process proposed by Herbert Simon(1969) which was further modified by the Hasso-Plattner Institute of Design at Stanford. The five stages of design thinking are empathizing, defining, ideating, prototyping and testing. In the empathizing stage, we analyzed the problems faced by people in following the precautions, the factors responsible for creating an interactive game design and learning outcome resulting in each parameter. After analyzing the user centered problems, the core problems are defined and different ideas and game designs are thought of which satisfy all the necessary conditions and parameters. Based on the ideas, the prototypes are designed and finally tested.

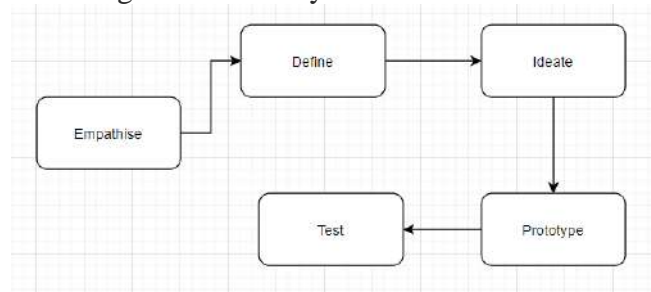


Fig. 1. Process of design thinking

Empathizing

The first phase of design thinking includes empathizing with the people or the potential consumers of the product. One of the important steps in order to develop an interactive product is to understand the user's needs and problems. After talking to a few people and analyzing the situation at a few public places like supermarkets, parks, shopping malls etc,(pertained to India) the following problems and needs are identified.

- Most of the people do not follow social distancing: In supermarkets, airports or any other public place, it was observed that people do not maintain a 6-foot distance as recommended by the WHO, instead, people stand right behind each other. This might be happening due to the fact that maybe people are of the opinion that wearing a mask would prevent the virus from attacking you no matter how close you stand to the other person. There might be a few other misconceptions that people have and require a system where they can educate themselves about the seriousness of each precaution.

- Using the same mask for days: It has been recommended by the WHO that one should dispose of a surgical mask and wash the cloth mask after a day's use. But it has been observed that most of the people use the same mask for days. Also, many people do not wash their hands after disposing of their masks. Instructions need to be provided on how to use a mask.
- Facts about the virus: Many people are not aware of the virus. For example, if the coronavirus is present on any of the cardboard/wooden surfaces, it would last until 4-5 days. Many people do not know these facts and without quarantining the courier for 4-5 days, they use it.

Defining

- In this phase, we identified the main problem that could lead to the negligence in following the required precautions. The main problems identified are that people are not able to understand the seriousness of the precautions and many people are not ready to educate themselves about the virus. So, the main aim of the game is to provide "effortless learning".
- In the ideate phase, keeping in mind the problem statement, an interactive human-centric game has to be designed that would include all the parameters mentioned in [20] [22]. These parameters include game characteristics involving fantasy, challenge, stimuli and mystery and interactive learning. The user centered game should be able to engage the user for a longer time and repeat the important information related to COVID-19 frequently so that the users understand the importance of each precaution and fact with ease. A few ideas were thought of like: (a) situation-based games where a real life scenario is shown, (b) story based game where a short paragraph is given and the user would be asked what he/she would do in such a scenario, (c) an existing casual-game with certain modifications.

Taking into account, the above mentioned type of games, the following conclusions were made:

- If a situation-based game was made that was only dedicated to providing awareness about COVID-19, most of the users would not like to play this game. If a person would want to learn more about COVID-19, he/she would go to the WHO or CDC website and gain knowledge about the virus. Our main aim is to make a game that is challenging, engaging and yet, provides effortless learning.
- In case of a story-based game, the user would be provided with a text-based scenario and would be asked what he/she would do in that scenario. This type of a game could be preferred to the previously mentioned game but this would not work for elderly people or the people who do not want to read much. This type of game would include the story to read along with the solution and facts about COVID-19
- The third type of game, i.e., modifying an existing puzzle game is preferred among all since it is challenging, engaging and would be designed in such a way that the user could learn effortlessly. Casual games are very easy to play and can be played by all age groups.

Prototype and game design

In this phase, a game prototype is created of the modified casual puzzle-game. There are many good puzzle games on android and apple stores like sudoku, two dots, 2048, Unblock me and brain it out. A level-based puzzle game was required to be implemented in order to engage and challenge the user at every level. Hence, Unblock me game was taken as a reference to design a modified version inculcating some precautions and facts about COVID-19.

The learning pattern:

When a user starts playing the game, the goal is defined. For example: "Unblock me in 30 sec time". In case, the user fails to fulfil the goal, he/she would receive an option to replay or revive.

The replay option would ask the user to play the game again and the revive option includes a fact-based COVID question which needs to be answered. If the user answers the question, a detailed answer related to that question is provided and the user is directed to the next level. The screenshots of the prototype are mentioned below. Figure 1(A-G) contains the screenshots of the game prototype. Starting from left to right row wise Fig 1 (A) represents the first level of the game (B) represents a screen where the user has failed to solve the puzzle and later is given an option to choose between replay and revive (C) represents a screen where a COVID-19 based question is displayed and the user has to choose the correct option (D) represents the detailed explanation sourced from WHO/CDC websites which explains the importance and seriousness of each precaution/fact.(E) After the user reads the information regarding the COVIDI-based question, he/she is directed to level 2 (F) If the user loses the game, on clicking the revive option, they are provided with the picture based content



Fig. 2. Screenshots of the game prototype, Starting from left to right and row wise(A)Level 1 of the game (B)Option to revive or replay the game after losing it (C)COVID-based factual questions to help users learn about the virus (D) A detailed note of the answer to the previous question cited from WHO/CDC (E) Level 2 of the game (F) Picture based information about COVID on clicking revive in Level 2

Testing

In order to test the effectiveness of the game prototype developed, we had to design a survey considering the parameters and factors mentioned in [20] [22]. Some of the main parameters that have proved to be important in measuring the effectiveness of the game are:

- Game dimensions involving rules goals, challenging and stimulating levels
- Interactivity
- Level of Immersion of the user
- Learning outcome

In order to measure the above mentioned parameters, two questionnaires were made
Pre-Game questionnaire

This questionnaire is to be filled before playing the game to test the initial knowledge of the user about COVID-19 and create a learner profile. This questionnaire asks the users their age, some basic questions on following the precautions and some questions on a few facts about the virus. These inputs are helpful in measuring the learning outcome. Learning outcomes can possibly be defined as the final knowledge gained minus the initial knowledge of the user. After this survey, the game prototype is provided to them to play.

Post-Game Questionnaire

This Questionnaire asks the user about their experience with the game in terms of challenging levels and interactivity. The inputs of this questionnaire are helpful in finding the interactivity, challenging levels, level of immersion of the user and learning outcome.

III RESULTS

Evaluation of the game was done among 20 users from varied age groups. The study comprised of 60% users of age group 20-30 age group and the remaining 40% were from the age group 45-75. The results of the two questionnaires mentioned above are as follows:

Pre-questionnaire

It is observed that about 95% of the people know the basic symptoms of COVID-19 but about 50% of the people do not follow social distancing norms as mentioned by the WHO. Also, about 30% of the users do not follow the correct procedure in wearing a mask. Out of this 30% users, 25% people use the same mask for the next day also and the remaining 5% do not wash their hands after removing the mask after one day of usage. Out of the 3 fact-based questions asked, more than 50% of them answered all of them wrong. Fig 4 represents one such fact-based question.

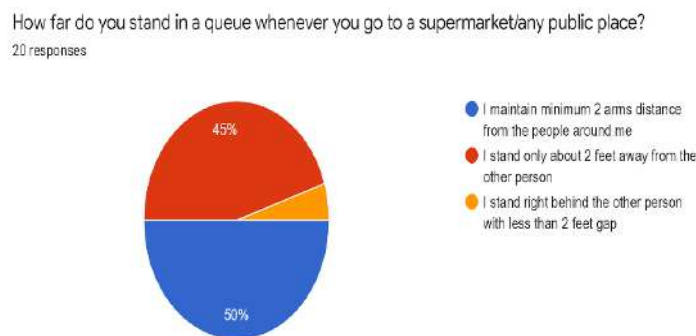


Fig. 2. Basic precaution related question of the pre-questionnaire

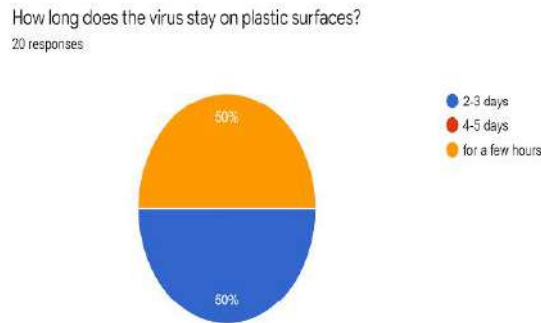


Fig. 4. Fact based question of the pre-questionnaire

Post questionnaire:

It is observed that 85% of the people found the game useful and gained some knowledge about COVID-19. In terms of interactivity, more than 50% of the people found it very interactive with an overall average being 7.4 out of 10 and the average challenging level being 7.1 out of 10. The users were asked about the maximum time that they had spent on the game and more than 50% of the people have played the game for more than 30 minutes. The average time spent by the users in playing the game was found to be 31.3 minutes. This average time spent in playing the game is an indication of the level of immersion of the user. In this case, the level of immersion is found to be good since a maximum number of people have played the game for a long time instead of logging out in a few minutes.

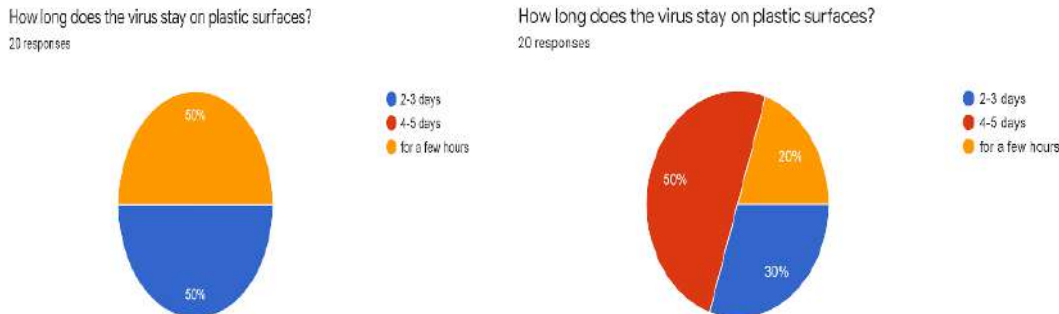


Fig. 4. Comparison of fact based question of the (A)Above: Pre questionnaire (B) Down: Post-questionnaire

Among the three fact based questions asked, more than 50% of the users were able to answer all three questions correctly after playing the game. Fig 4 shows a comparison of one such question before and after playing the game. Surely, awareness-based learning outcome is achieved and the initial aim to provide effortless learning is also achieved.

IV Conclusion

From the results provided, it can be concluded that the game prototype that has been designed is interactive, challenging, stimulating, has a good level of immersion and provides the desired learning outcome among the users. It was observed that the users who were not able to answer any of the three fact-based questions were able to answer all the three fact-based questions from the post-questionnaire correctly. Such a finding indicates that the game provides a learning outcome and spreads awareness about COVID-19 among the users. Users’ inputs need to be

recorded for a longer period of time to measure the long-term impact of the game on the user's memory. Also, in order to measure the stimuli and reactions of the user, an EEG can be used which would record the pulse of the user and all the above mentioned factors could be measured without the users filling the questionnaires.

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IMPACT ASSESSMENT OF COVID-19 PANDEMIC ON THE TOP 10 AFFECTED COUNTRIES

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Abstract— The pandemic COVID-19 is the most significant global crisis since the World War-II which has affected almost all the countries across the globe. The study mainly focuses on the trends and spread of coronavirus and its effect on top 10 affected countries. The results show that USA has the highest COVID-19 positive and death cases in the world. The average doubling rate of positive cases in the world is 29.14 days and for death is 36.04 days. It's an alarming trend for South Africa, India and Colombia where average doubling death rate found to be lower than 20 days. The severity of the coronavirus effect is more depicted by death to positive cases ratio which shows that 3.74% patients died out of 100 COVID-19 positive cases throughout the world. This ratio is very worse in Mexico (10.9%) followed by Iran (5.62%). In India, we are able to test 1.65% of the population, and the death rate is 2.05% of the COVID-19 positive based on the data up to August 07, 2020. The findings of the study are helpful for the government and administrators of the respective countries to take necessary steps and implement stringent policy to control the spread of the virus. Although rapid increase in COVID-19 positive cases is an area of concern for all the countries but more attention is required to curtail the deaths up to maximum extent by timely tracing and treatment of the affected persons.

Key words: COVID-19, Doubling effect, Positive Cases, Death Cases

I INTRODUCTION

In January 2020, the World Health Organization (WHO) in its international conference in Geneva announced an outbreak of the novel virus which belongs to the Corona virus family. The outbreak of novel coronavirus or 2019-nCoV or COVID-19 or SARS-2 (Severe Acute Respiratory Syndrome) recognized in Wuhan city of China as pneumonia in the beginning. This is the seventh virus of coronavirus family that infect humans; the first four virus are identified in the mid-1960s and caused mild symptoms whereas, fifth and sixth namely, SARS-CoV and MERS-CoV reported severe symptoms and caused to early death, identified in 2003 and 2012 respectively (Cascella, Rajnik, Cuomo, Dulebohn & Napoli, 2020). In December 2019, the seventh virus which was named SARS-CoV-2 emerged in Wuhan, China (Adhikari, Meng, Wu, Mao, Ye, Wang, et al., 2020) and it develops the COVID-19 disease, named by WHO. The virus is spreading across the globe since January 2020. On 11 March, 2020, WHO declared coronavirus disease 2019 (COVID-19) as a "global pandemic" (WHO, Speech, 2020) and soon after that United States declared COVID-19 a national emergency. COVID-19 infection which can cause fever, cough, and breathing difficulties. The novel coronavirus causes mild to severe respiratory illness, cough and death (Paules, Marston and Fauci, 2020). The structure of disease

is very dynamic and it spreads rapidly. The rapid human to human transmission cases of COVID-19 signifies that 2019-nCoV is highly infectious than other viruses of coronavirus family like SARS-CoV and MERS-CoV (N. C. P. E. R. E. Team, 2020). The pandemic COVID-19 is the most significant global crisis since the World War-II, it affected almost all the countries across the globe (Boccaletti, Ditto, Mindlin, & Atangana 2020). The pandemic has affected 215 countries, areas or territories in past months.

The statistics showed the worse condition due to coronavirus which caused for more than 3.5 crore positive cases, 1 million deaths around the world as on October 04, 2020. The present study depicts the trends and spread of coronavirus; statistics for doubling rate (seven days-window criteria) followed by cross-country comparison using various parameter. The remainder paper is structured as follows: Section 2 briefly reviews some relevant literature related to the study; Section 3 briefs about the data collected and methodology used; Section 4 discusses empirical results and its analysis and interpretation; Section 5 offers the concluding remarks.

II REVIEW OF LITERATURE

Following are the main studies which are conducted on Covid-19 across the globe.

Authors	Objectives	Methodology	Findings
Zeynep Ceylan (2020)	The study aims to forecast the epidemiological trend of COVID-19 with respect to Italy, Spain, and France, the most affected nations of Europe.	The data of COVID-19 were collected from the World Health Organization website from 21 February 2020 to 15 April 2020. The study employed Auto-Regressive Integrated Moving Average (ARIMA) models to predict the trends.	The study states that the ARIMA model is suitable for prediction of COVID-19 in the future. The results of ten days forecast, from 16 April 2020 to 25 April 2020 of Italy, Spain and France shows upward trend of total confirmed trend of COVID-19.
Tanujit Chakraborty, Indrajit Ghosh (2020)	This paper had two aims first to generate real time forecast for short term of COVID-19 cases of multiple countries and second to assess risk in terms of fatality rate of COVID-19 for some highly affected countries.	To achieve first aim of short term (ten days ahead) forecast, the study uses a hybrid approach based on Wavelet-based forecasting model and autoregressive integrated moving average model. To achieve second aim the study applied an optimal regression tree algorithm.	The study found that the hybrid model can be used as an early warning system to fight against pandemic. The risk assessment experimental results states that four out of seven control variables are highly influential.

<p>Nalini Chintalapudi, Gopi Battineni, Francesco Amenta (2020)</p>	<p>The objective of the study is to forecast the COVID-19 condition of Italy, if the lockdown continue for further 60 days.</p>	<p>The data of COVID-19 registered and recovered patient collected from the Italian health ministry website from mid-February to end March. The study applied ARIMA forecasting model of R Statistical software.</p>	<p>The study found that the accuracy of registered cases prediction was 93.75% and accuracy of recovered case model was 84.40%. The study also found that at the end of month May the registered case reach to 182,757 and 81,635 patients recovered from the COVID-19.</p>
<p>Alok Kumar Sahai, Namita Rath, Vishal Sood, Manvendra Pratap Singh (2020)</p>	<p>The paper aims to analyse top five COVID-19 affected countries time series data to forecast the spread of epidemic.</p>	<p>The time series data on daily basis of total infected cases from the top five countries viz. US, Brazil, India, Russia and Spain from 15th February to 30th June 2020 were collected. The Hannan and Rissanen algorithm used to estimate ARIMA Model, to forecast next 77 days situation of COVID-19.</p>	<p>The study states that forecast accuracy by using MAD and MAPE were acceptable. The study also found that Russia and Spain have reached to inflexion point in spread and US, Brazil and India still reflect an exponential curve.</p>
<p>Saleh I. Alzahrani, Ibrahim A. Aljamaan, Ebrahim A. Al-Fakih (2020)</p>	<p>The article aims to forecast the COVID-19 cases on daily basis for next four weeks in Saudi Arabia</p>	<p>The study employed ARIMA model to forecast the COVID-19 cases in Saudi Arabia. The Study collected daily and cumulative cases data from March 2, 2020 to April 20, 2020.</p>	<p>The results show that the new cases per day reach up to 7668 and in four weeks over 127,129 cumulative daily cases reported in Saudi Arabia.</p>
<p>Farhan Mohammad Khan, Rajiv Gupta (2020)</p>	<p>The study aims to predict the COVID-19 infected cases in India in upcoming days.</p>	<p>The study applied ARIMA model on the data collected from 31st January 2020 to 25th March 2020 from the website of MOHFW and http://covid19india.org/.</p>	<p>The results depict the increasing trend in actual as well as in forecasted cases of COVID-19 by 1500 cases per day approximately. Based on the BIC Bayesian Information Criteria, the ARIMA (1,1,0) model selected and overall highest R Squared is 0.95.</p>

<p>Hiteshi Tandon, Prabhat Ranjan, Tanmoy Chakraborty, Vandana Suhag (2020)</p>	<p>The paper aims to forecast future infected cases of COVID-19 to prevent the infection and aid in the health care service.</p>	<p>The data of recovered, confirmed and death cases of COVID-19 infection were collected for highest infected nations and the countries of South-East Asia region from the website of Johns Hopkins University from 22 January 2020 to 13 April 2020.</p>	<p>The study shows increasing trend in upcoming days. The time series analysis also shows an exponential rise in the number of cases.</p>
<p>Tania Dehesh, H.A.Mardani-Fard, Paria Dehesh (2020)</p>	<p>The first aim of the study is to find out best model to predict the daily confirmed cases and second to predict the confirmed cases with these models in order to improve healthcare system.</p>	<p>The study collected daily confirmed case data from the website of Johns Hopkins University from January 22, 2020 to March 1, 2020. The ARIMA model applied to predicting the trend of confirmed COVID-19 cases by STATA version 12.</p>	<p>The results states that Mainland China and Thailand were most stable trend and the trend of South Korea was decreasing and will become stable in future. Whereas, Iran and Italy unstable trend (increasing and decreasing).</p>
<p>Rajan Gupta and Saibal K Pal (2020)</p>	<p>The study aims to predict the expected rise in the number of cases and also discuss the situation of this diseases in India.</p>	<p>The data collected from the repository of the repository of John Hopkins University from 30th January 2020 when the first case occurred in India till the 24th March 2020. The ARIMA model applied to predict the future cases.</p>	<p>The model predicts that in next 30 days the cases reach up to 700 thousand in worst case. The average forecast by ARIMA model is around 7000 cases from 536 cases in next 30 days.</p>
<p>Fotios Petropoulos , Spyros Makridakis (2020)</p>	<p>This study aims to introduce an objective approach to predict the COVID-19.</p>	<p>The study applied simple time series approach to forecast the confirmed cases of COVID-19. The model from smoothing exponential family used to forecast the confirmed COVID-19 cases.</p>	<p>The result suggests that the increase in COVID-19 cases was uncertain and it has spread like a pandemic.</p>
<p>Matjaž Perc, Nina Gorišek Miksic', Mitja Slavinec and Andraž Stožer (2020)</p>	<p>The article aims to know the growth of confirmed cases and to understand the worrying trends of COVID-19.</p>	<p>The study used simple iteration method which need daily confirmed cases to forecast the COVID-19 cases of US, Slovenia, Iran and Germany.</p>	<p>The forecast shows that the daily growth rates should be kept at least below 5% to see the flatter curve but it is very difficult.</p>

<p>Ram Kumar Singh, Meenu Rani, Akshaya Srikanth Bhagavathula, Ranjit Sah, Alfonso J Rodriguez-Morales, Himangshu Kalita, Chintan Nanda, Shashi Sharma, Yagya Datt Sharma, Ali A Rabaan, Jamal Rahmani, Pavan Kumar (2020)</p>	<p>The study aims to identify the top 15 countries with spatial mapping of confirmed cases and forecast the COVID-19 spread for next two months.</p>	<p>The data for confirmed cases, deaths and recoveries of COVID-19 for last three months collected and compared between top 15 infected countries. Based on the time series data the advanced ARIMA model used to predict the future cases.</p>	<p>The study found that in the US, the UK, the Netherlands, Russia and Italy had slow recovery ratio. There was a high death ratio in the Italy and the United Kingdom. The study predict that confirmed cases, deaths and recoveries will double in all the observed countries except China, Switzerland and Germany. The values of ARIMA model represented with 95%, 80% and 70% confidence interval.</p>
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The present study contribute to the existing literature as it provides the trends and spread of coronavirus for top 10 affected countries; statistics for doubling rate (seven days-window criteria) followed by cross-country comparison using various parameter (population, testing and positive cases wise).

III METHODOLOGY

Sample Selection

The study is based on descriptive research design which evaluates the effect of Covid-19 on top 10 affected countries selected on the basis of highest positive cases as on August 07, 2020.

Table-1 Top 10 affected countries due to Covid-19

Name of the Country	First Case	No. of days as on 07-08-20	Cumulative Positive Covid-19 Cases as on 07-08-20	Cumulative Death due to Covid-19 as on 07-08-20
United States of America	20-01-2020	201	4781612	157357
Brazil	26-02-2020	164	2859073	97256
India	30-01-2020	191	2027074	41585
Russian Federation	31-01-2020	190	877135	14725
South Africa	05-03-2020	156	538184	9604
Mexico	28-02-2020	162	456100	49698
Peru	07-03-2020	154	447624	20228
Chile	03-03-2020	158	366671	9889
Colombia	06-03-2020	155	345714	11624
Iran	19-02-2020	171	320117	17976
World			19082952	714626

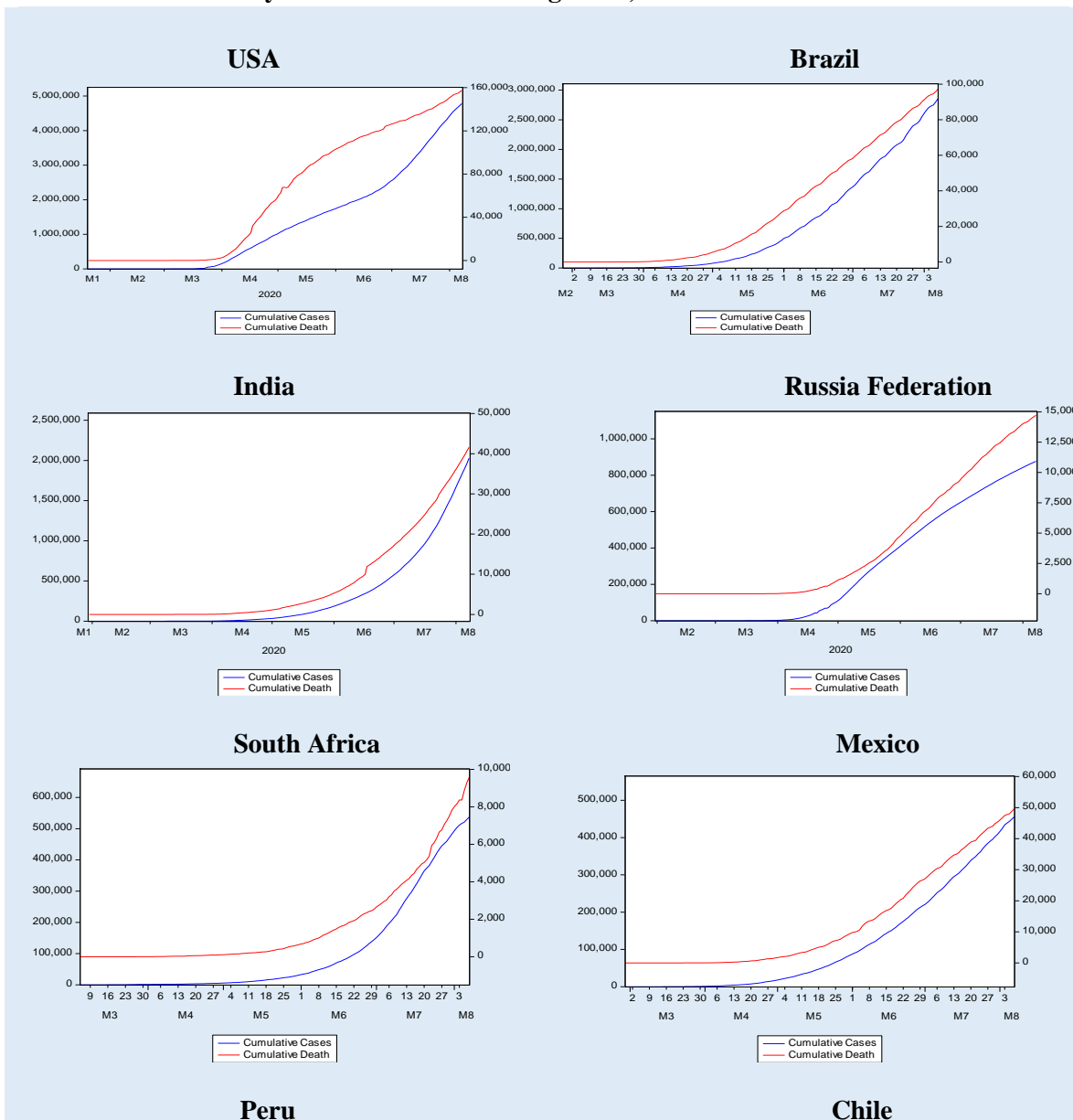
Source: Coronavirus Disease (COVID-19) Dashboard (WHO)

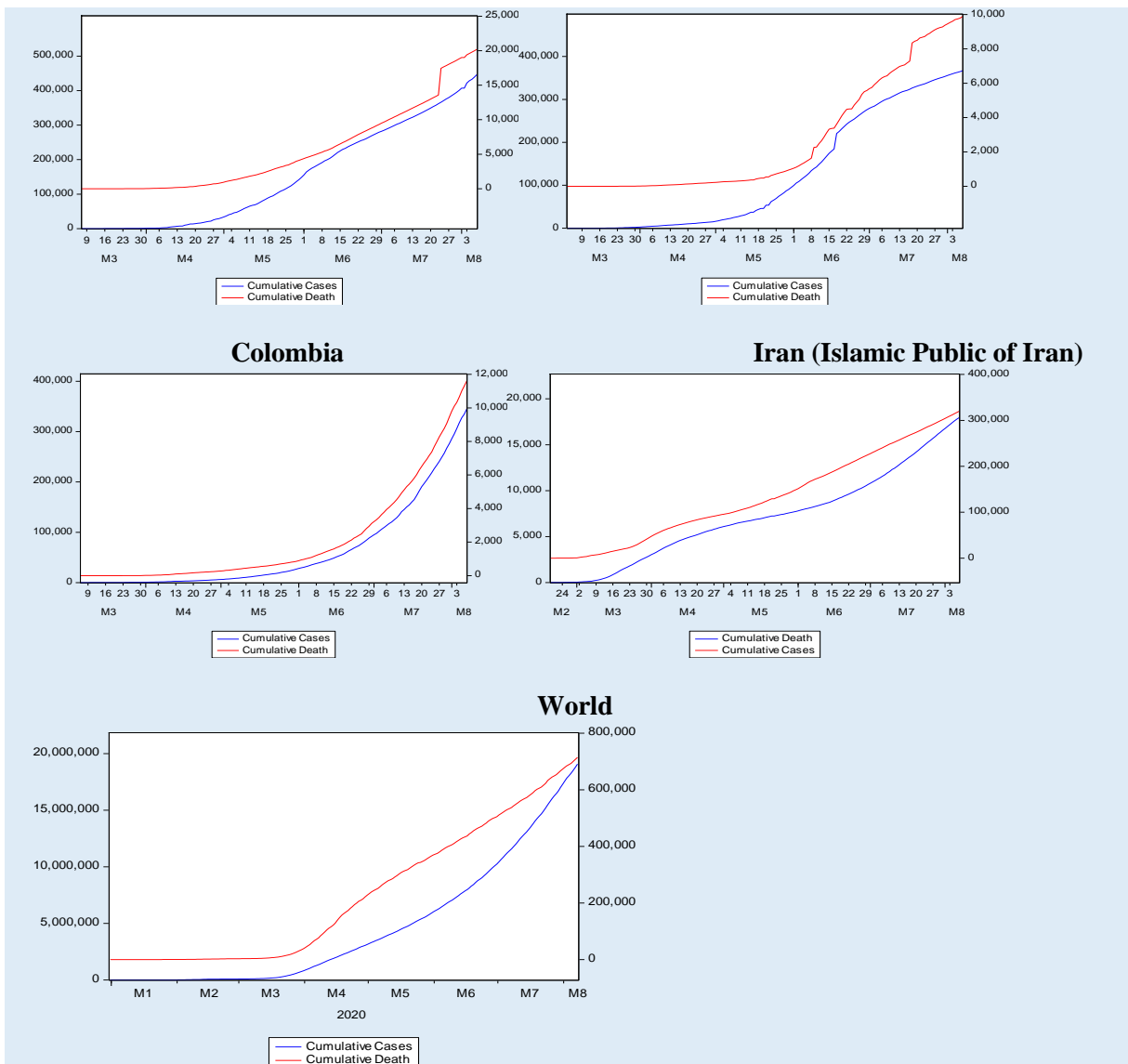
Data Sources and Study Period

The study period of the research is considered from the day of first case (country wise) to August 07, 2020. The data is collected WHO Coronavirus Disease Dashboard.

Analysis and Interpretation

Figure-1 depicts the trends of cumulative positive Covid-19 cases and death cases of top 10 affected countries from the day of their first case to August 07, 2020.





Source: Coronavirus Disease (COVID-19) Dashboard (WHO)

The United States of America (USA) is the highly affected country in the world due to Covid-19 followed by Brazil, India, Russia, South Africa, Mexico, Peru, Chile, Colombia and Iran. The positive Covid-19 cases in USA were more than 4781612 which accounted for 25.05% of total cases in world and death cases were 157357 accounted for 22% total deaths of the world. The overall Covid-19 positive cases throughout the world were 19082952 and deaths were 714626 as on August 07, 2020.

TABLE 2: SPREAD OF COVID-19 (CUMULATIVE POSITIVE CASES)

Country/ No. of cases	From 1 to 100 Cases	From 1 to 1000 Cases	From 1 to 10000 Cases	From 1 to 100000 Cases	From 1 to 1000000 Cases	From 1 to 10000000 Cases
United States of America	44	54	60	70	102	NR
Brazil	17	28	41	70	117	NR
India	46	61	76	111	170	NR

Russian Federation	48	57	70	91	NR	NR
South Africa	14	24	68	111	NR	NR
Mexico	21	34	57	99	NR	NR
P***eru	12	26	41	77	NR	NR
*Chile	15	24	49	92	NR	NR
Colombia	14	29	66	120	NR	NR
Iran	8	13	23	78	NR	NR
World	20	26	33	68	95	182

Table-2 shows the spread of coronavirus in terms of days for top 10 affected countries. As on August 07, 2020, only three countries crossed (USA, Brazil and India) the unpleasant figure of 1 million positive cases where USA touched this benchmark in 102 days, Brazil in 117 days and India in 170 days. Worldwide corona positive cases reached to 10 million cases in 182 days. Apart from top three countries, alarming trends are observed from Russia and Peru where positive cases reached from 10000 to 100000 in 21 and 36 days respectively.

Doubling Effect

The doubling effect hereby indicates the days in which the number doubles itself. On the basis of 7 days approach, the following table shows the doubling effect for cumulative positive cases and deaths due to covid-19 for top10 countries.

TABLE 3: DESCRIPTIVE STATISTICS FOR DOUBLING EFFECT

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
Doubling Effect (Cumulative Positive cases)								
USA	28.22	29.06	70.26	1.89	20.78	0.16	1.64	15.78
Brazil	16.16	11.75	45.65	1.65	12.07	0.78	2.48	17.72
India	12.70	13.13	23.32	1.71	6.53	-0.13	1.55	14.79
Russian	34.08	20.59	113.01	1.61	33.72	0.84	2.37	21.48
South Africa	14.11	13.35	47.63	1.47	7.70	1.46	7.37	172.67
Mexico	17.42	14.14	456.40	1.69	11.92	0.62	2.25	13.74
Peru	26.47	16.39	65.03	1.76	22.09	0.53	1.63	18.39
Chile	32.61	14.07	136.49	1.47	38.00	1.40	3.53	51.60
Colombia	13.91	15.19	21.94	2.07	5.61	-0.78	2.49	16.84
Iran	42.54	46.78	81.57	1.48	25.55	-0.23	1.84	10.70
World	29.14	30.87	247.45	1.75	28.08	4.70	36.09	10499.36
Doubling Effect (Cumulative Death cases)								
USA	61.17	52.60	188.90	1.85	52.74	0.39	1.85	12.32
Brazil	24.22	17.34	68.00	1.09	18.75	0.61	2.07	13.42
India	16.41	16.06	32.16	2.87	9.45	0.21	1.71	10.96
Russia	28.99	20.02	92.38	1.94	23.66	0.85	2.73	15.88
South Africa	14.13	13.28	29.24	1.89	5.90	0.03	2.36	2.15
Mexico	20.04	14.43	61.57	2.00	15.70	0.85	2.57	17.28
Peru	22.31	17.68	77.73	2.20	17.59	1.11	3.66	30.33

Chile	24.01	14.38	96.04	2.32	24.07	1.68	4.74	80.02
Colombia	15.60	16.86	24.51	2.91	5.73	-0.99	2.92	21.57
Iran	46.87	48.93	118.47	1.85	30.30	0.07	2.07	6.06
World	36.04	28.00	84.37	1.42	28.83	0.28	1.44	23.30

Table-3 shows summary statistics of doubling effect for the cumulative positive and death cases of COVID-19 for the top 10 countries in two panels. The results show the worse conditions in terms of average doubling rate in covid-19 positive cases in the countries like India (12.70); Colombia (13.91); South Africa (14.11); Brazil (16.16) and Mexico (17.42). The worldwide average doubling rate for positive cases stood at 29.14 days during the study period.

In terms of average doubling rate of death cases of covid-19, highly affected counties were South Africa (14.13); Colombia (15.6); India (16.41); Mexico (20.04) and Peru (22.31). During the study period, the same rate for worldwide positive cases was 36.04. These threatened trends were also supported by very low variability especially in case of India, South Africa and Colombia. The table also gives skewness and kurtosis along with Jarque bera indicating an abnormal distribution with a lopsided curve for both doubling rate of cumulative positive and death cases caused by this pandemic.

TABLE 4: DOUBLING RATE OF CUMULATIVE POSITIVE CASES AND DEATH CASES OF COVID-

19

Country/ Days	25		50		100		150		As on 07-08-20	
	Cases	Death	Cases	Death	Cases	Death	Cases	Death	Cases	Death
USA	18.63	NA	2.81	1.84	19.56	16.79	65.13	118.43	59.04	105.33
Brazil	2.06	NA	7.76	6.03	13.90	21.01	40.90	54.48	45.64	65.38
India	NA	NA	4.73	3.00	10.10	9.51	19.33	24.69	23.32	31.96
Russia	NA	NA	2.07	NA	10.69	11.68	60.48	41.40	113.01	89.71
South Africa	2.86	NA	12.48	13.71	13.91	12.00	32.65	22.51	47.62	22.83
Mexico	3.71	NA	7.84	4.95	18.72	14.48	37.84	45.09	45.40	53.78
Peru	5.80	5.27	9.48	6.44	29.53	23.91	44.85	66.35	44.27	67.59
Chile	3.77	3.00	14.69	10.07	18.22	7.13	111.99	85.59	136.49	93.10
Colombia	6.05	6.00	13.94	11.61	19.77	15.87	20.31	20.74	21.94	24.51
Iran	6.28	3.64	16.86	17.77	45.95	97.77	75.34	46.63	81.56	59.68
World	1.75	1.62	8.59	8.02	10.60	7.51	38.05	64.03	50.72	82.48

Table-4 exhibits the doubling rate of cumulative positive and death cases of COVID-19 in the top 10 countries since the spread of virus and as on August 7, 2020. During the initial 25 days of the spread of the SARS CoV-2 virus, when USA had the fastest doubling rate of cumulative positive cases, India and Russia were unperturbed by the virus spread. Further, within 50 days of the spread of virus, Iran rose as the country with highest doubling rate of positive COVID-19 cases, followed by Chile. Even doubling rate of death cases due to corona virus was highest in Iran. After a span of 150 days of the virus spread, USA had the highest death cases amongst the top 10 affected countries, though the cumulative positive cases were lower than before. Chile overtook Iran with the highest doubling rate of positive COVID-19 cases within 150 days of the virus spread and also highest death rate after USA.

As on August 7, 2020 Chile continues to have the highest doubling rate of cumulative positive and death cases due to COVID-19. The doubling rate of Cumulative positive cases reduced drastically in USA, but the highest number of death cases in the world. Columbia and India have the lowest doubling rate of the positive cases amongst the most affected countries, and South Africa has the least doubling rate of death cases amongst these countries.

TABLE 5: CROSS-COUNTRY COMPARISON: POPULATION, TESTING AND POSITIVE CASES WISE

Country	Tested	Positive	Death	Positive	Death	Death
	<i>(out of 1lakh of population)</i>			<i>(out of 10000 testing)</i>		<i>(out of 100 positive cases)</i>
USA	19865.79	1444.58	47.539	727.17	23.93	3.29
Brazil	6292.02	1345.07	45.755	2137.74	72.72	3.40
India	1651.33	146.89	3.013	889.52	18.25	2.05
Russia	20791.08	601.05	10.090	289.09	4.85	1.68
South Africa	5367.95	907.43	16.193	1690.46	30.17	1.78
Mexico	831.21	353.75	38.546	4255.83	463.73	10.90
Peru	7651.96	1357.59	61.349	1774.18	80.17	4.52
Chile	9342.11	1918.12	51.731	2053.19	55.37	2.70
Colombia	3620.65	679.43	22.845	1876.54	63.10	3.36
Iran	3140.23	381.12	21.402	1213.68	68.15	5.62
World		244	9			3.74

Table-5 compares the top 10 affected countries in terms of population, COVID-19 antigen tests conducted and the tests delivering positive result. Out of one lakh population in each of the 10 countries, Russia is found to have conducted the highest number of antigen test amongst its population (20%), followed by USA (19.86). Rest of the countries among top 10 affected countries was not able to test 10% of their population as on August 07, 2020. India which is second populous country in world has tested merely 1.65% of the population. In the positive covid-19 cases to population ratio, the maximum rate is observed in Chile (1.91%) while minimum rate is observed in India (0.14%). The death case to population ratio was worse for Peru which stood at 61.349 per 1 lakh of population and for India it was 3.013.

If we see testing wise comparison, the result of Mexico is showing very terrible situation where 42% of tested persons were found corona positive followed by Brazil (21.37%). The lowest covid positive to test ratio was observed in Russia (2.89%) followed by India (8.89%). Almost same picture is depicted in covid death to test ratio.

Finally we computed covid death cases to positive cases ratio which shows that 3.74% patients died out of 100 covid positive cases throughout the world. This ratio is very worse in Mexico (10.9%) followed by Iran (5.62%). The same ratio for India is 2.05%. The lowest ratio is observed in Russia where the figure stood at 1.68%.*

III CONCLUSION

The pandemic Covid-19 is the most significant global crisis since the World War-II which has affected almost all the countries across the globe. Increasing positive cases numbers are the

concern for the nations but increasing deaths are more severe situation. Although positive cases are over 1 million in USA, India and Brazil but the situation is very harsh in the countries like Mexico, Peru, Iran and Brazil where death to positive cases ratio found very high. Based on strategy given by Delhi CM Arvind Kejriwal, the study suggests 5T plan- Testing, Tracing, Treatment, Team Work and Tracking and monitoring to tackle Covid-19. The findings of the study are helpful for the government and policy makers of the respective countries to take necessary steps to reduce the deaths due to Coronavirus. For this the equally contribution is required from national citizens also to work with social distancing and take preventive measures to escape from the outbreak of disease.

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IMPACT OF COVID-19 ON INDIAN EDUCATION SYSTEM: A CRITICAL STUDY

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ABSTRACT

Due to the corona virus, almost every person in India is being affected either directly or indirectly. The education system of our nation has been destroyed in a scattered manner in this pandemic. The government and educational institutes have developed some online resources as a mode of study for schools and higher education. Such online education is time-saving with which learners can access knowledge from various authentic sites. However, online education has not only replaced classroom education but also affected the relation between learned tutors and their pupils which resulted in problems endured by the concerned stakeholders.

Key words: Corona Virus, Education, Pandemic, Problem, Government, Loss, Cyber Crimes, Legal Provisions.

I INTRODUCTION

Malcolm X once said that education is the passport to the future, for tomorrow belongs to those who prepare for it today and the education institutes provides us this education on which the future depends. We all know the importance of education but without schools or higher education institutes it seems impossible because schools not only provide education but also teach discipline, co-ordination, being social etc.

Almost all the countries of the world are affected from corona virus. Due to this pandemic the Government of India announced lockdown in entire country or even imposed curfew. In such areas where the more number of cases were more, the appropriate government declared these areas as containment zones in every state to break the chain of the disease. With such restrictions the Government announced closure of all educational institutions to reduce the spread of COVID-19 among students and other staff. Due to this outbreak of Covid-19 schools and other higher institutes remain shut for quite a long time and the students can't go to schools so that education has suffered a lot. The education sector which was considered that it will never hit be recession, has not be spared by current crisis. Not only school students but college and university education like research work has also suffered a lot because it is necessary for researchers to go in field or in libraries to do their research work. With the lockdown they can't access both.

II METHODOLOGY

The motive of the research paper is to point out the impact and effects of COVID-19 on the Indian education system. This research work is to be justified by the primary and secondary data with the help of qualitative methodology. The reference of new initiatives and strategies taken by the government to handle this prime department of education in this critical situation of COVID-19 would be employed in the study.

III RESULTS

Role of technology

Technology plays a significant role during the pandemic because everyone get latest updates of surroundings and satisfy their daily needs from home only with the use of internet. E-commerce was used by most of the public and shopkeepers also encouraged the customers for online transactions instead of cash payments. The social distancing was only possible with the use of digital technology. After closure the education system also changed drastically and all the schools and higher education institutes adopt digital technology for the continuance of study. Therefore the teachers and students uses online modes like Microsoft teams, Google classroom, Youtube, zoom etc. for study. Several academies provides online lectures and other study material for the learners. Here the technology i.e. smartphones, laptops, 4G network etc. plays an important role to continue the study in this pandemic situation.

For access to education during the post-COVID-19 period, technology plays a significant role which connects almost all the learners with the tutors, educational institutions, or other modes of learning. Prior to COVID-19 online lectures of almost every topic was available on internet but everyone can't access it and most of the students would be preferred face to face study. Therefore the use of digital technology among students before pandemic was rare and their parents were also warned them not to use mobile or laptops during study. But after closure due to COVID-19 the application of technology in the field of education grows very rapidly. All the schools and higher institutes had started online classes and also conduct online exams. So it is compulsory for each and every student to use smartphone or laptop with high speed internet connectivity. Therefore the digital technology is the most effective tool of education during pandemic.

Time saving –

The online education enables us to teach and study from any portion of the world where the internet facility is available. The online study is not place bound and the learners can keep studying from any place. The travelling time of the instructors and learners are also saved and they can conduct or attend classes without any wastage of time. Therefore the learners can spend more time with their families also.

Flexible

The online mode of learning is time flexibility where you can listen to your classes anytime you find it convenient. Recorded lectures can be listened again and again for revision and the other plus point is that you don't have to travel for long time. So it is safe for both teachers and students. Online learning can be accessed 24*7 even if your teachers are not available, you can listen to the lecture anytime or anywhere.

Disadvantages:

Lack of digital facilities

When students physically not able to attend the schools then help of technology would be taken. So that education can be delivered at home through smartphones or laptops using internet. To some extent it is a good idea when you can't step out from yours homes. Some school students

faced difficulties to access homework in time because they have no mobile phone to their own and their parents gave their mobile number to teachers for study purpose. But at the time of class or homework the parents are sometimes moves out of home and their children can't access classwork in time. Lot of students can't access online education because they belong to very poor families and doesn't have capacity or sufficient sources to buy costly Smart phones or laptops to continue their study and they feel helpless and inferior to other students. The high speed network is also not available in every areas especially in rural areas. Some used to visit their friends house who have internet in their phones for asking home work. Problem of data pack also arised because video lectures consumes lot of data and not only this expenditure increased some has to took loan for buying a mobile phone or laptop so that study of their child do not suffer. But even having access to mobile phone, laptops and internet doesn't mean that the goal of education is fulfilled.

Students lost interest in study

Due to long break some students even loose interest in education and they were used mobile for playing video games, watching videos etc. rather than to study. Some of them are not actively taken part in online classes. They login to class and turn off their video and mic during class and remains busy in playing games on their mobiles or doing other activities at home rather than study. It also developed a bad habit of social media addiction. So for lot of students this time of Covid-19 pandemic became misleading.

The government and UGC issued several guidelines regarding examinations. They fix the date of exams and after some days the exams had been postponed by them for some another date. Sometimes the authorities issued guidelines that no exams should be held and all the students will promote to next class on the basis of their internal assessment and previous year marks. But after few days they issued fresh guidelines to conduct examinations of re-appear and final year students. It took several times by which the students lost interest in their study. Atlast the colleges and universities conducted online examinations for final year students and promote other students on the basis of previous marks or internal based marks. When the result comes out and it will caused mental stress to many students because they feel that the result is differ from their expectations.

Uncomfortable for Teachers

Covid-19 started a new type of learning i.e. online learning. Schools and colleges opted for various apps that helped in education such as Zoom, Diksha, Youtube, Microsoft teams etc. But on the other hand some disadvantages of online learning are also there. Interaction is less with the students. For some teachers it is also uncomfortable to make video lectures as they are used to deliver lectures physically in classes. It is challenging for some school teachers to deliver online lectures because prior to Covid-19 they doesn't know how to use the specific apps for online study. It is difficult for teachers as well as students to learn mathematics and practical based subjects via online medium.

A large number of students attend their online classes in inappropriate manner. Some naughty students annoying the classmates and even teachers during lecture by doing funny acts. Sometimes the outsiders who are not a part of class can login to the class and harasses the teachers and other students. So it is tough task for teachers to maintain class discipline during online lectures.

Technical Problems exists

The problem of technical faults is also there. There are some regions where there are some technical glitches like internet down or system errors. You need a technician to fix it. If teacher

get faults they will not be able to start class if there is fault at student side then they will not be able to attend or join the class. However regular classes help students in better understanding and it creates more interest among students while attending offline/regular classes.

Financial loss to Faculty

The private colleges and universities relieved maximum number of teaching and non-teaching staff without any justifiable cause. The relieved staff faced mental harassment because during the pandemic they are unable to try somewhere else for jobs. Lots of teaching and non teaching staff lost their jobs in this pandemic and the ones who still remained in jobs didn't get proper salary. Their salary was cut off. So for private teachers and other workers this pandemic remains heavy on their pockets and families to survive and they can't do their best efforts to deliver online education.

Cyber Crimes

While using social media or other internet we are under potential risk sites to be a victim of cybercrimes. When the learners surfing internet for study some fake sites are shown automatically on mobile or laptop screen. If anyone has open any of these fake site then the cyber criminals can enter in your system and stolen sensitive information. The victim of cyber crime doesn't even know about it. Some apps used for online study by schools and higher education institutes are not safe. Most of the institutes used Zoom video conference app for online study during pandemic but after some time the Ministry of Home Affairs of India issued an advisory that Zoom is insecure platform and cyber criminals can access information through this app. They gave advise to discontinue it.

On alert, special care, precautions, and measurements should be taken by Government agencies to check the implementations of the policies.

IV CONCLUSION

Most of the students become social media addicted and they are wasting their study time in using social sites. So it is the primary responsibility of their parents and tutors to closely monitor their study on daily basis.

Government claims that every village is connected with regular power supply but as per the survey conducted by Ministry of Rural Development in 2017-18, there are still many villages of the country where the power supply is given by less than 8 hours per day. Most of the people has lack of digital facilities. So it is tough for people to continue online study having no such facilities. So it is responsibility of the government to consider it and make adequate infrastructure in which every person can easily access online education.

The private colleges and universities relieved and cut the salaries of most of their staff in this pandemic. The appropriate government has to provide remedies and make effective legislative measures for the people whosoever connected with the education system and who suffered loss during the post-pandemic period.

The government and educational institutes should provide safe platforms for online mode of study which are safe from cyber attacks and consumes lesser data and also help the needy ones who are not able to access online education due to lack of facilities etc. The Legal provisions should be implemented on the persons who are engaged in cybercrimes and strict punishment should be imposed on culprits and offenders.

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SOCIO-ECONOMIC IMPACT OF COVID 19 PANDEMIC IN KASHMIR

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ABSTRACT

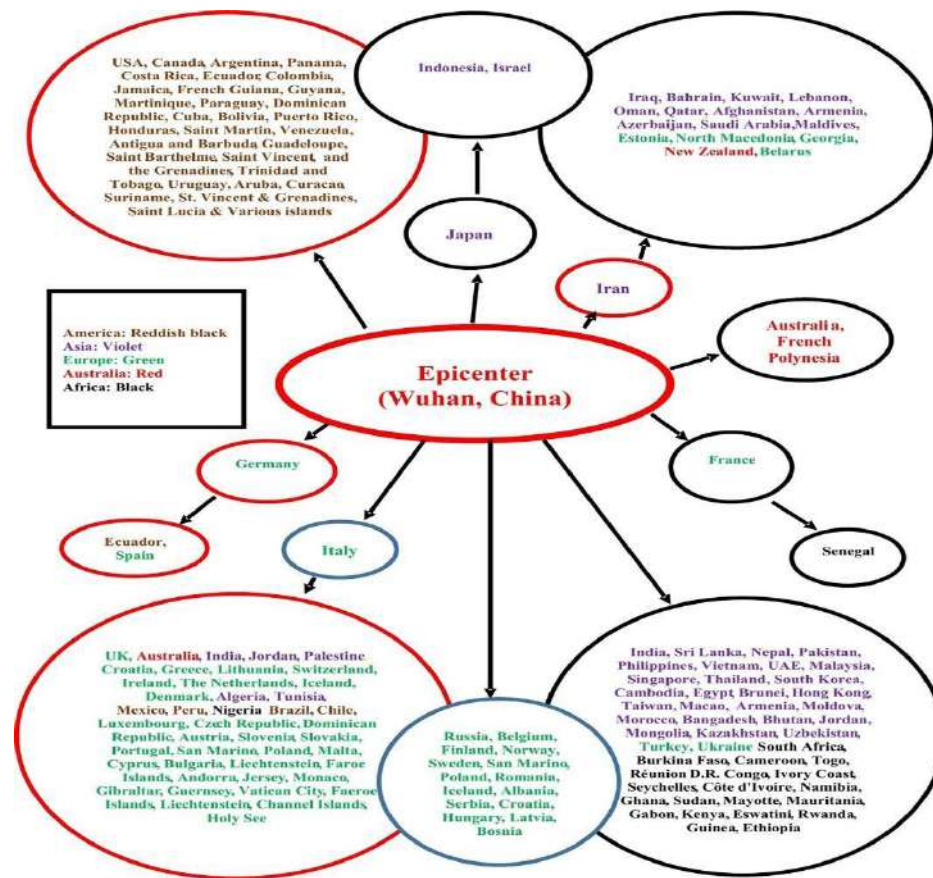
This study examines the trend of the spread of coronavirus disease (Covid-19) pandemic and to explore the community perception of the socioeconomic impact of the Covid-19 pandemic in Kashmir. The 2019 corona virus is a public health emergency of international concern and poses a challenge to the economy and social life of people. World Health Organization (WHO) announced the coronavirus which is also referred to as Covid-19 as a disease on 11th February 2020. The Covid-19 was originated from Wuhan city of Hubei province in China in December 2019. It is a viral disease due to the severe acute Respiratory Syndrome Coronavirus 2 (SARS-COV-2) virus. The symptoms of the virus include, fever, cough, sore throat, and difficulty in breathing. The results of the study show that Covid-19 cases spiked amid ease of lockdown in the country and the spread of a novel coronavirus pandemic has a significant socioeconomic impact. It is a respiratory disease that affects the health of the individual as a whole. Financial uncertainty, a decrease in income, fear of job loss, and food insecurity are some major challenges that Kashmiri communities face due to the outbreak of coronavirus. The results further show that lack of community cooperation with government agencies, lack of awareness about the severity of coronavirus, and insufficient Covid-19 testing kits are the major factors that caused the spread of coronavirus cases. Social connections, interactions, and relations have become an important part of our life, and the absence of such connections lead to anxiety, depression, mental disorder, health problems which affect the life of the individual and collective society as a whole. Finally, it was suggested that to cope with Covid-19 lockout

stress, keep ourselves busy in physical activities, religious activities, and social work. The Central and State governments are taking several measures and formulating several wartime protocols to achieve this goal. This paper aims to study the economic downfall of disturbing the social life of people.

Keywords: Covid-19, Socio-economic factors, Impact on Kashmir, Economic downfall.

I INTRODUCTION

In March 2020, the World Health Organization (WHO) referred to the corona virus as a pandemic disease which means the deadly virus is spreading outside containment measures in most of the countries around the world. The corona virus belongs to the coronaviridae family and appears just like spiked rings when observed through an electronic microscope. The surface looks with various spikes, which are helpful to attack and blind living cells. Corona. These are the viruses causing the simple common cold disease to severe illness like the Middle east the source of this virus is from animals including bats. The word coronavirus is a derivative of the Latin corona, which means crown or halo, that states to the typical look indicative of a crown or a solar corona around the virions. These viruses are having a positive-sense single-stranded RNA genome (27 to 34 kilobases) and helical symmetry nucleocapsid ([Su et al., 2016](#); [Sexton et al., 2016](#)). Typically, the coronaviruses are of ~20 nm size draped with a large petal or club-shaped surface appearance. The first coronavirus was discovered in 1937 in the birds and later on in the 1960s in humans ([Coronavirus: Common Symptoms, Preventive Measures, and how to Diagnose it. Caringly Yours, 2020](#)). The various types of viruses, capable to infect human beings are 229E, OC43, HCoV-NL63, SARS-CoV, MERS-CoV, HKU1, and SARS-CoV-2. There are several outbreaks from time to time due to these viruses. The most notorious outbreaks were in 2003, 2012, 2015, and 2018 with 774, 400, 36, and 42 deaths, respectively. It is important to mention that the 2019–2020 outbreak is started in Wuhan, Hubei Province, China in December 2019 ([The Editorial Board, 2020](#)) when a new strain of coronavirus was detected on 31st December 2019 ([WHO, 2020](#)). World Health Organization (WHO) has given name to this virus as 2019-nCoV ([Novel Coronavirus 2019, 2020](#)) which was later renamed as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses. The diseases caused by this virus is called as coronavirus disease 2019 and abbreviated as COVID-19 [CO: corona, VI: virus, D: disease and 19: 2019 year]. This virus was found to have 86.9% resemblance to a bat coronavirus, and, hence, is suspected to develop from bats ([Lu et al., 2020](#); [Wan et al., 2020](#); [Zhu et al., 2020](#)). This virus is out broken in pneumonia type of disease with respiratory problems, leading to death due to respiratory failure. About 210 countries and territories have been reported to be infected with major outbreaks in the USA, China, South Korea, Italy, Iran, Japan, etc. tolling about 2.2 million patients with more than 0.15 million deaths globally. The United States of America is the most affected country with the highest patients of about 0.7 million and about 35,000 deaths.



Source: <https://www.sciencedirect.com/science/article/pii/S0048969720323780>

These viruses infect the upper gastrointestinal and respiratory tract of the mammals (including humans) and the birds. These viruses cause many diseases in animals and human beings. The common signs of infection are fatigue, muscle pain, sneezing, sore throat, dry cough, high fever, respiratory problems, etc. with some severe cases having pneumonia, serious respiratory syndrome, kidney failure, and even death (Huang et al., 2020; Hui et al., 2020; Ren et al., 2020). During the last few decades, it was observed that coronaviruses can infect rats, mice, cats, dogs, horses, cattle, and pigs. Occasionally, these animals may communicate coronaviruses to humans the coronavirus is spread by sneezing, cough droplets, and contact. Normally this enters the body through the mouth, nose, and eyes. Prevention and management are very important issues to control COVID-19. Therefore, there is a great need for the collective efforts of the public and the government. The regular and proper care of the homes and hospitals is very important to control this calamity. The regular recommendations to minimize the infection are cleaning of your area. The most important to avoid sneezing and cough at the public place. The hand cleaning with soap and sanitizer, mouth and nose coverage with a mask during sneezing and coughing are essential. Regular cleaning of the surface by the disinfectants may control the virus outbreak. Therefore, it is urgently advised and requested that all the persons should follow the preventive measures, management, and quarantine strictly without any religious discrepancy otherwise the situation may be the worst. The first confirmed case of the Corona Virus infection in India was reported on 30 January 2020 in the state of Kerala. The affected had a travel history from Wuhan, China. The government of India also issued an advisory for voluntary home quarantine (self-isolation). They are asked to self-segregate in the home-settings to evade contact with others to avert the spread of the virus at the initial stage of infection. As per the

Ministry of Health and Family Welfare Government of India, there is a total of 114 confirmed cases of COVID-19 till March 16-2020. Protective self-separation is recommended for a person who is at high-risk for severe illness from COVID-19 which includes old- persons, sick people, and children. Voluntary avoidance of crowded places is recommended for a person who is asymptomatic and who is considered to have less risk of exposure to the virus that causes COVID-19. Masks should be used by the asymptomatic individual, if available, to provide a physical barrier that may help to prevent the spread of the virus.

In the present scenario, COVID -19 has affected all the sectors of society. There is a big loss globally and it cannot be estimated exactly. Now-a-days, the whole world is just like a family where everyone has to contribute to run the family. The whole world is affected economically very badly due to a decrease in industrial production. Social distancing involves staying away from people to avoid spreading and catching the virus. It is a new emerging terminology which means to avoid the crowd. This has forced people to work from home and avoid social gatherings and contacting even their near ones. Man is a social animal and social relations and the social interactions are integral to human civilization, and the absence of such meaningful connections leads to stressful states of anxiety both in mind and in the body. Loneliness, Anxiety drives, depression, panic states, mental disorders, health hazards, and many other issues impact the life of the individual and society as a whole. The researchers based on online survey and media reports that emerging studies into COVID -9 together with lessons from past outbreaks suggest that the pandemic could have profound and potentially long-term impacts on psychological, health, economic, social, and religious life. The corona virus is impacting the lives of individuals as a whole. It creates a sense of fear and also stress, anxiety, and other mental disorders. According to the Center for Disease Control and Prevention (CDC) “The outbreak of Corona Virus disease 2019 (COVID-19) may be stressful for people. Fear and anxiety about a disease can be overwhelming and cause strong emotions in adults and children. Coping with stress will make you, the people you care about, and your community stronger. There is a big shift in the world economic market and the share market has witnessed crashes day by day. Factories, Restaurants, Markets, Flights, Super Markets, Malls, Universities, and Colleges, etc. were shut down. The fear of coronavirus has limited the movement of individuals. People were not even going to buy the daily essentials and these all were somewhere impacting the economy of the world as a whole. The Organization for Economic Cooperation and Development (OECD) also revealed that they cut their expectation for global growth to 2.4% from 2.9%, and warned that it could fall as low as 1.5%. According to Economic Times, India faces a huge decline in government revenues and growth of the income for at least two quarters as the Corona Virus hits the economic activity of the country as a whole. A fall in investor and other persons which also impacts privatization plans, government, and industry. industry. The researchers based on online survey and media reports that emerging studies into Covid-19 together with lessons from past outbreaks suggest that the pandemic could have profound and potentially long-term impacts on psychological health, economic, social, and religious life. Rapid and rigorous research accessing the impact of Covid-19 on the psychological health of people is needed to limit the impact of the pandemic. The present pandemic is having a major social and psychological impact on the whole population, increasing unemployment, separating families, and various other changes which are generally considered as major psychological risk factors for anxiety, depression, and self-harm.

Table 1: District-wise cases of COVID-19 in Jammu and Kashmir

COVID-19 pandemic in Jammu and Kashmir by district				
District	Total cases	Recoveries	Deaths	Active cases

Total	81,793	69,020	1,291	11,482
Anantnag	3707	3325	69	313
Bandipora	3646	3207	41	398
Baramulla	4761	3187	126	1448
Budgam	5263	4408	89	766
Doda	2371	1504	38	829
Ganderbal	3075	2780	30	265
Jammu	14950	13128	212	1610
Kathua	2218	2051	28	139
Kishtwar	1471	1200	11	260
Kulgam	2317	2188	43	86
Kupwara	3827	3114	70	643
Pulwama	4169	3745	72	352
Punch	1957	1113	18	826
Rajouri	2921	2355	39	527
Ramban	1430	1303	11	116
Reasi	1098	898	6	194
Samba	1926	1431	24	471
Shopian	2079	1896	32	151
Srinagar	16164	14078	310	1776
Udhampur	2443	2109	22	312
As of 08-10-2020				

Source: https://en.wikipedia.org/wiki/COVID-19_pandemic_in_Jammu_and_Kashmir

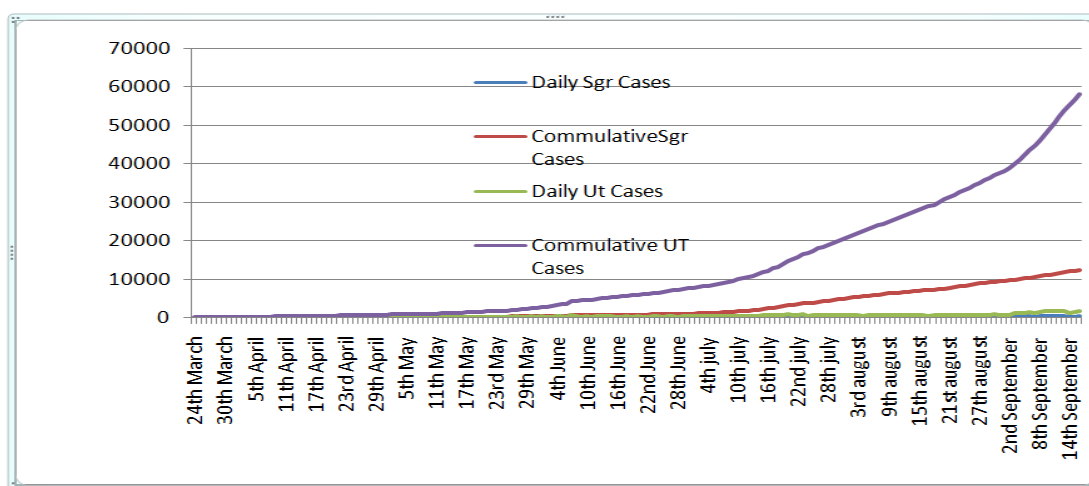


Fig.2: Confirmed cases of COVID-19 reported from the union territory of Jammu & Kashmir

Source: <https://thekashmirimages.com/2020/10/07/the-statistical-analysis-of-corona-in-jk/>

II OBJECTIVES OF THE STUDY

1. To study the socio-economic impact of CO-VID 19 in Kashmir valley.
2. To provide awareness among people of Kashmir related to CO-VID 19.
3. To assess the knowledge about COVID 19.

III MATERIALS AND METHODS

A literature search was conducted by using Pub-med and Google scholar. Besides, existing guidelines including those by the Ministry of Health and Family Welfare, Government, and

articles from non-academic sources (e.g. news websites, etc.) were accessed. This research uses a qualitative case study approach. The review drew on a wide range of data sources, including books, journal articles, government documents, policy reports, and conference papers.

IV FUTURE PERSPECTIVES

As expected, SARS-CoV is zootomic and originated from the bats. It is observed that many people are consuming bats. It is observed that many people are consuming various animals like food-setups. Some animals like bats, snakes, cats, mice, rats, dogs, pigs, etc. should not be consumed as they may have dangerous microbes while the only safe animals should be consumed. Moreover, it is also advisable that we should consume vegetables and fruits as maximum as possible in our food. There is an urgent need to educate our new generation for science and technology

V DISCUSSIONS

The threat of influenza pandemic has drastically increased during the last century with the emergence of highly contagious influenza viruses such as H5N1, H1N1, and the most recent one, COVID-19. Evidence suggests that the likelihood of pandemics has increased because of increased global travel and integration, urbanization, changes in land use, and greater exploitation of the natural environment (Jones et al., 2008; Morse, 1995). These trends seem to intensify in the case of COVID-19 which requires significant policy attention on the need to identify and limit emerging outbreaks. Despite the efforts and progress toward preparing for and mitigating the impact of pandemics, COVID-19 has challenged the global health system and has impacted millions of lives around the world.

Evidence suggests that epidemics and pandemics can have significant social consequences causing mobility restrictions, travel bans, closure of borders, and, in extreme cases, area quarantines (Espinoza, Castillo-Chavez, & Perring's, 2019). Our findings support the evidence that the current crisis has changed the way people have managed their lives by restricting mobility and social distancing. The consequence of the pandemic is not only limited to social life but also affect financial constraints at the household. The findings of the research reveal that individuals perceive the persistence of pandemic may lead to financial uncertainty and reduction in income due to longer lockdown periods. Our findings are in line with the results of Blake, Blendon, and Viswanath (2010) that reveal job insecurity as a real consideration for many working adults in the United States during the influenza outbreak. In the absence of well-implemented social safety nets and unemployment benefits, financial problems may weigh heavily on the minds of workers during a pandemic, and these problems may result in comprise on compliance consideration. The global health impact of the COVID-19 pandemic has affected workforces, transportation systems, and supply chains around the world. But this kind of emergency has threatened geographically isolated communities at another level by creating a food crisis even before the virus causes severe health problems in the community. This is mainly because it is hard to get food supplies locally, and economic activities are disrupted as a result of lockdown. The most at-risk populations during a severe pandemic are those that are already struggling with hunger, health, and poverty. Studies provide substantive literature to support the evidence that food insecurity is significantly higher in the mountain areas of Kashmir. Our findings are, similar perceived risk of food insecurity is significantly high among the Kashmiri community and food support is considered as the foremost and first priority of households during the lockdown. As the mountain communities are already dealing with the epidemics of poverty, geographic isolation, and subsistence farming, the food crisis in the long term is

inevitable for communities and may result in lesser compliance with strategies of lockdown and social distancing. Besides, many households are vulnerable because of the way the pandemic has affected economic and social systems. Policy-makers must take necessary actions to prepare for food security and ensure food supply during a severe pandemic to cope with the impacts of spreading disease.

VI CONCLUSION

Covid-19 disease is originated from Wuhan city of Hubei Province in China in December 2019 and has become pandemic as per WHO. The pandemic of the corona virus is severely impacting the lives of the individuals on the whole. Everyone in the world is directly or indirectly facing the severe consequences of this disease. Many countries have declared unprecedented lockdowns and emergencies. The schools, colleges, universities, market, mall, shopping complex, etc. are shut down by the Governments. It has created an environment of fear, anxiety, and stress among the developed and developing societies. WHO and all the member nations have issued advisories related to the impact of the Novel Corona Virus. But this disease due to its extreme isolation and lockdown measures creates several other issues including social anxiety, panic states due to uncertainty, economic recessions, and extreme mental stress. To contain this virus, coordinated efforts are required and people need to make uncomfortable yet necessary changes in their daily routine under the advisories and suggestions by the Government and WHO. This will provide for more opportunities for the medical staff to intervene effectively with the limited resources at their disposal and buy significant time to place additional resources for controlled management of this novel Pandemic.

LIMITATIONS OF THE RESEARCH

The purpose of this research is to analyze the impact of the Covid- 19 in the life of an individual as a whole. The data is based on secondary information which is available on the internet.

SUGGESTIONS

The Covid-19 pandemic is spreading day by day and now has become a part of our lives so we have to be prepared for it. Here are some of the suggestions below to prevent Covid-19 until we invent vaccines or medicine to cure this disease.

1. Physical Distancing.
2. Wearing a Mask.
3. Keeping rooms well ventilated.
4. Avoiding crowds.
5. Use sanitizer.
6. Cleaning your hands.
7. Coughing into a bent elbow or tissue.
8. Maintain at least a 1-meter distance between yourself and others to reduce your risk of infection when they cough sneeze or speak.
9. Avoid the spaces 3Cs space that is closed, crowded, or involve close contact.
10. If you have a fever, cough, and difficulty breathing, seek medical attention immediately.
11. Stay home and self-isolate even if you have minor symptoms such as cough, headache, mild fever until you recover.
12. Daily use of warm water, garlic, ginger, turmeric powder will make our immunity strong and we can fight from this pandemic.
13. Keep up to the date on the latest information from trusted sources, such as WHO or your local and national health authorities.

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IMPACT OF COVID-19 PANDEMIC ON MSME SECTOR OF INDIAN ECONOMY

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I INTRODUCTION

The outburst of the COVID-19 pandemic is one of the greatest calamities in the history of mankind. It affected every country, every sector and every individual in the world. UNCTAD (2020) rightly points out that “COVID-19 has affected mankind physically, economically and psychologically”. To contain the spread of the corona virus outbreak, the Government of India announced the national wide lockdown on 24th March 2020 and extended up to 31th May 2020. The lockdown is further extended in containment zones. This biggest lockdown devastated the economic activities and put a hold on growth of the economy. IMF, Managing Director, Georgieva K mentioned as “World economy is in a recession and way worse than the global financial crisis of 2008. It is a crisis like no other and never in the history of the IMF; have we seen world economy coming to stand still”. According to a rough estimate a day of lockdown Indian economy is losing on an average 32000 crore . COVID-19 impacted on all the sectors in the economy but most affected sectors are MSME, Tourism and Aviation, Retail, Transportation, Automobile industries, Textiles, Construction, Entertainment, Electronics, Village and Cottage Industries, Agro based industries, E-Commerce, and all other services etc.

Micro Small Medium Enterprises (MSME)

Micro, Small and Medium Enterprises (MSME) sector is playing an important role in Indian economy. As per the 73rd round National Sample Survey (NSS), in 2015-16 there were around 633.8 lakh MSME in the country and they were providing employment to 1109.89 lakh workers. Among 633.8 lakh MSME 99.46 percent of MSMEs fall in the micro enterprises category, 0.52 percent of them fall in the small and only 0.02 percent of them fall under the category of medium enterprises. Around 51 percent of MSME situated in rural area.

Table: 1.1- New Classification of MSME – June, 2020

Classification	Micro	Small	Medium
Manufacturing & Service	Investment<Rs.1 Cr. and turnover<Rs.5 Cr.	Investment<Rs.10 Cr. and turnover<Rs.50 Cr.	Investment<Rs.20 Cr. and turnover<Rs.100 Cr.

Source: MSME.gov.in

The contribution of MSME is very crucial to Indian economy. It is considered as the growth engine of the nation. It contributes 6.11 percent to manufacturing GDP, 24.63 percent to service GDP, 33.4 percent to manufacturing output and 45 percent to India’s exports. From the above data it is evident that MSME’s are playing an important role in creating employment, increasing exports, achieving inclusive growth and Make in India etc in India.

II OBJECTIVES

The important objectives of the study are;

- 1.To analyse the impact of COVID-19 on MSME.
2. To identify the challenges facing by MSME during COVID-19.

III Review of the Literature

Informality in the MSME sector exists in both the nature of businesses and the relationships that businesses and workers share. The number of enterprises in the unorganized sector [is estimated](#) to be 99.7% of all unincorporated non-agricultural enterprises.What is also significant to note is that around 84.17% of this universe of unincorporated businesses are the owner-managed/self-employed

firms (with characteristic features of household enterprises), and the next highest share is of units that employ up to 5 workers (micro units). These two categories thus together form 97.4% of informal businesses in this country. [Various government sources state different levels of informal employment](#), what is agreed on however is that it has persistently hovered well above the 90% mark.

With respect to arrangements between businesses and workers, the conditions of employment look grim. The most recent [Periodic Labour Force Survey \(2017-18\)](#) notes that even among regular wage/salaried employees in the non-agriculture sector, 71.1% had no written job contract, 54% were not eligible for paid leave, and 49.6% were not eligible for any social security benefit. The International Labour Organization has specifically [highlighted](#) how economies with large informal sectors will need to acknowledge and act on the fact that workers in such sectors have no income replacement and are directly affected by lockdown measures – the worst affected group being the self-employed, street vendors, hawkers, construction, transport and domestic workers, to name a few.

IV- Methodology

The present study is based on a secondary source of data consisting of Government publications, namely Economic Survey, RBI reports and official website of Ministry of Statistics and Programme Implementation. Simple statistical tools namely percentage, average used to analyse the data.

V- Impact on Indian MSME Sector

This pandemic has shaken and deteriorates the global economy. In this paper we will try to overview the probable impact of Covid19 on Indian MSME. It is too early to estimate how deeply the pandemic will affect MSME. Covid-19 has moved from a health crisis to an economic crisis. This pandemic destroyed the business cycle all over the world. Around 100 countries have closed national border. During the past month global supply chain has been collapsed. Global economy could shrink by almost 1% in 2020 due to Covid19 pandemic.

India is a developing country. The position of India's Micro, Small and medium enterprises (MSME) is the largest in world after china. MSME plays a significant role to accelerate the growth of Indian economy. But the position of MSME will be very unimaginable and unpredictable after this epidemic. The state of Uttar Pradesh has the largest number of estimated MSME with share of 14.20% of total MSME's in the country. West Bengal comes as close second with a share of 14% followed by Tamil Nadu and Maharashtra at 8%. Indian economy that desperately needs immediate assistance, it is Micro, Small and Medium enterprises to survive. In India there are over 63 million MSME units in India. The Indian MSME will be impacted significantly due to the outbreak of Covid19 in near future. Visualization of future existence of Indian MSME is completely impossible and uncertain at this moment. To contain Covid19 spread India has declare 21 days complete lockdown in each state which may be extend according to the situation. Normal business activities are being completely stopped for all type of business organization. This standstill for couple of month will be a very crucial for Indian MSME. However if the pandemic proliferates and prolonged lockdown would exacerbate economic trouble. India's growth may fall below 3% in financial year 2021 under this scenario (KPMG report). Corona virus outbreak is having a stark effect on small business businesses as the situation drags on (National Federation of Independent Business).

There will be unemployment situation rises around 8000 to 10000 in the coming couple of months, since people displaced from their jobs for maintaining social distancing guidelines. But for some businesses the impact may be positive. Those businesses which deal with essential items which is

required for livelihood experiencing stronger sales due to Sharpe rise in demand for product. Consumers are buying essential commodity more than necessary which ultimately leads to exponential growth in sales. The stutter buying in huge quantity of essential commodity leads to increase the price of commodity due to lower supply and high demand. For packaged food business this critical situation has some opportunity to expand their business.

Every family have been quarantine in their home. They are not allowed to move from one place to another. In this time business who deals with packaged food can grab the opportunity by making home delivery and create a healthy relationship with society. SMEs who deals with export, there will be slow down of export business. Service sector is also slowing down since more people opting social isolation like salon shop. MSME sector in India will face the problem like low liquidity or cash flow and lack of workforce since daily-wagers have gone to their villages. Lack of workforce will have to be a negative impact on production. Lower production means lower supply and lower supply will create the inflation environment. But government has started taking some initiative to keep the MSME segment afloat.

The RBI recently introduced long term repo operation (LTRO) worth 100000 crore, as a result bank can increase lending at cheaper interest rate. Such type of initiative will give some help to MSME sector. Those SME's which are listed in BSESME exchange there is a possibility to decline the share price. People will hesitate to invest in SMEs stock after this epidemic as a result supply will be greater than demand which leads to decline the share value. The impact of lockdown will be very discomfort for Indian MSME because in India most of the small business transactions are done in cash and payment to the workers and laborers are also made in cash. Small businesses are not very much comfortable to adopt digital practices in its business. Due to this crisis small businesses will try to adopt digital practices in its business. There are chances to arise the problem of liquidity crunch and without adequate liquidity the small business might be close down in coming future.

As a result workers will face layoff and unemployment in near future. Workers are moving towards native house from work place. There is a very fragile situation for workers during this time. 19% to 43% of the MSME may disappear if epidemic persist 4 or 8 weeks. MSMEs have gone through most difficult time in the last 3 year. They faced one setback after another. Sign of red alert are already visible. MSME will have to face huge financial burden of unpaid salaries which lead to loss of employment, unpaid EMI whose negative impact will be reflected in the balance sheet of small firm. Due to lockdown, movement of goods from one country to another country has been stopped. One of the positive thing due to this crisis is that those enterprises who deal with import and export business, they can be self reliant and will try to produce goods within India instead of import which will improve balance of payment situation to some extent.

There is a great opportunity for SME which belongs to chemical sector. They can extend its product line by making hand sanitizer product whose demand is to increase in right now. Apparel sector can also grab the opportunity by making face mask. Poultry firm is facing lots of problem due to shutdown. Demand of chickens has been decrease with falling rate 20 per kg from prevailing market price 90 per kg. To alive the poultry, the owner of firm will have to maintain fixed cost as a feed for poultry even there is no sale. Haats in some rural area are main source of revenue of rural people like Odisha, West Bengal and Chhattisgarh. Haats are being closed down. Starvation situation will arise if lockdown continue to around 8 weeks. If we go to the agriculture business, harvest season will begin

and there is a shortage of worker for harvesting wheat which could lead to rotting of crop in the fields.

As a result price of flour may be increase after this epidemic due to lower supply. This will be crucial for keeping the supply chain of food grains alive. The major concern for MSME will be liquidity crunch due to the covid-19 outbreak. Lack of liquidity will disrupt supply chain and labour availability. Many units have paid their workers' wages for March in full and are prepared for April payment while there is no revenue now. In addition there are bills like electricity bill, water bill that also have to be paid but without revenue or substantial government support, there is no way they can carry on in May and beyond. Major big concern of MSME units are delay in launch of new product, inability to meet demand from essential industries, tough social distancing. State bank of India has set a target to distribute 700 crore to MSME in Mumbai. The government is working on 1 trillion packages. There is a possibility to change the definition of MSME. The proposal is still to be approved. The Indian government will also need to increase insolvency limit for SMEs and MSME to 1 crore from 1 lakh.

VI- Impact on Indian Economy:

There will be devastating impact on Indian economy due to the pandemic of Covid-19. Every economic activity which reflects GDP of a country has been stopped. This standstill will decline the speed of growth of Indian economy. Cross border economic activity has been stopped. We can expect sluggishness in the developing country like India. The pandemic and consequent lockdown have hit various sector of Indian economy.

- ✧ **Agriculture:** The nationwide lockdown will have significant impact on agriculture sector. Farmers are worry about government procurement and their ability to sell their agricultural product. Even markets are still closed, order from the home ministry to exempt all farming activities from shutdown. Unless the government acts soon, farmers in India will face bleak future leading to bankruptcies and they will suicide.
- ✧ **Raw material and spare parts:** In India around 55% of electronic component import from China. Imports have been decreased to 40% due to the outbreak of corona virus and prolong lockdown. To tackle this problem India is considering the promotion of home production to reduce the dependency on China. In addition China is India's third largest export partner for export of raw material like organic chemical, mineral fuel, cotton etc and due to complete lockdown export has been stopped which leads to a substantial trade deficit for India.
- ✧ **Automotive:** Automotive sector was already witnessing a sluggish demand for last one year. The present situation has further aggravated the problem and compounded the situation with an acute liquidity crunch. China account for 27% of India's automotive part import. Wuhan is the major auto hub the supply chain of automotive sector has been hit significantly.
- ✧ **Hotels, restaurants and tourism:** demand has decline substantially due to complete lockdown. Owners are struggling to recover fixed cost. There will be no demand of hotels around 5 to 6 month, people will try to avoid travelling which leads to lower demand to hotels. India is a beautiful cultural and historical tourism attract domestic and foreign national throughout the year. The entire tourism value chain, which includes hotels, restaurants, and agents have been stopped. Tourism industry is likely take a massive hit and people will generally avoid movement for tourist purposes in

foreseeable future. In India the service sector account for 55% of GDP. It is estimated that the loss to tourism and hospitality industry will be \$2.1 billion for March and April alone.

- ✧ **Apparel and Textile:** This sector contributes 2% of GDP. China is the production hub of cotton. India is totally dependence on china for textile raw material includes synthetic yarn, synthetic fabric, buttons, zippers and hangers. India also exports cotton yarn to china in bulk quantity. Now due to the outbreak there is poor demand in china as result price to come down in India. Garment manufacturer can look at local sourcing opportunities. Textile and apparel sector production is expected to decline by 10-12 percent in April- June quarter. This sector is one of the largest employers in the country, employing over 45 million (direct jobs) as well as large number of daily pay workers. Temporary closures of factories and lay-off have already begun among low-wage worker.
- ✧ **commerce:** Several e-commerce players Flipcart, Amazon, Mintra etc are unable to fulfillment customer requirement due to absence of delivery man. They are not accepting new orders however companies are trying to service essential items on priority basis. But the story is not end here, consumer buying habit is going to be change after this event, consumer will avoid large gathering as in traditional shop. Most of the consumer will prefer online shopping. Hence there is lots of opportunity to expand business in near future.
- ✧ **Building and Construction:** construction work in different sites has been stopped. Estimated job loss of 30% in real estate sector. Fresh equity investments into the country's real estate sector would slow down.
- ✧ **Education and Skilling:** all the education institution is closed to avoid large gathering. In India there are 39931 colleges and 933 universities (2018-19). Schools around the country have been impacted by Covid-19, closures of schools last several weeks during the crucial period of academic year ending. Low-fee private schools especially are likely face larger impact on teaching and learning. In higher education, most higher education institute are not fully geared to implement online learning.
- ✧ **Chemicals and Petrochemicals:** India is 6th largest chemical and petrochemicals producer in world, contribute 3.5% of global chemical industry (2018-19). Raw material price for petrochemicals are falling primarily driven by crude price. Imports are expected to fall as major import sources, Middle East and China are highly impacted by Covid-19. Majority of the chemical producing units are SMEs and they do not sudden increase working capital requirement. Extension of credit to customers and suppliers alongside falling revenue in the short to medium term is expected to adversely affect cash flows.

As per the World Bank's latest assessment India is expected to grow 1.5% to 2.8%.

The IMF projected a GDP growth of 1.9% for India in 2020 because the global economy hits the worst recession since the greatest depression in 1930. 1.70 lakh crore rupee relief package announced by finance minister on 26 March. Under Pradhan Mantri Garib Kalyan Yojana around 39 crore poor people have received financial assistance of rupees 34800 crore as direct benefit transfer till 5 May 2020, 12810 crore has been distributed in two instalments to 25.62 crore account holder, 1405 crore distributed to around 2.82 crore old age persons, widows and disabled person ,2.20 crore workers received financial assistance to 3493 crore. Under Pradhan Mantri Garib Kalyan Ann Yojana 67.65

lakh tones of foodgrains lifted by 36 states and union territory, 4.82 crore free cooking gas cylinders has been delivered under Pradhan Mantri Ujjwala Yojna.

The Indian government has extended the ongoing nationwide lockdown till 3 May. It will cover various sectors of the vulnerable segment from farmer, women, and small businesses to organized worker. The Indian stock market on March 23 suffered its worst single-day rout in history. The NSE Nifty 50 index sank 12.98%, while S&P BSE Sensex fell 13.15% to 25981.24. The rupee hit low records of 76.16 against the U.S dollar. Impact of covid-19 might to prove fatal for many of India MSME unit. Standard operating procedure for MSMEs at work place will be strictly followed where premises shall be disinfected on regular basis, provision for hand wash & sanitizer, mandatory thermal scanning of everyone entering and exit the work place. Medical insurance for worker will be mandatory.

Ministry of Corporate Affair clarify that annual general meeting should be conducted through video conferencing for avoiding large gathering , which is little bit difficult for listed SMEs. MCA also clarify that contribution to PM CARE FUND will qualify as CSR expenditure. On 30.03.2020 MCA introduced a new scheme Companies Fresh Start Scheme, 2020 (CFSS 2020). Maximum interval between two board meetings shall be extended by 60 days for the next two quarters. SIDBI will provide emergency working capital up to Rs 1 crore to MSMEs. SIDBI has made arrangement for providing loans at 5% within 48 hours for MSMEs manufacturing any product to fight against corona virus like hand sanitizers, masks, bodysuits, ventilators, testing lab etc. Andhra bank is setting up short-term credit facility for small businesses.

VII- Analysis and Findings

Issues and Challenges faced by MSMEs in India during COVID-19

Table: 7.1 - MSME affected by Lockdown

Sec tor	Total workf orce(millio n)	Expecte d job loss in key industri es (%)	Sector s with low percen tage of formal emplo yees (%)
MS ME s	114	43	Manuf acturin g (machi nery) 47% and (non- machi nery)

			21%
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Source: Mahesh Kulkarni, Deccan Herald, May 3, 2020

- ✧ **Shortage of Working Capital and Credit:** In the lockdown period due to stoppage of economic activity majority of the MSME's facing shortage of working capital. They are facing difficulty in paying salaries, raw materials and it is difficult for them to start their production again. According to survey conducted by All India Manufacturers' Organisation (AIMO) 43 percent MSMEs shutdown if panic extends beyond eight weeks.
- ✧ **Decrease in demand for non-essential goods:** During the lockdown due to lack of income in the hands of people there is a decline in the demand for non-essential goods. This increased the high risk in production and mental stress to the management of MSME sector.
- ✧ **Delay in supplying raw materials from china:** Indian MSME sectors are also hugely dependent on China for their raw material. For example, Indian drug makers source almost 70 per cent of their ingredients from Chinese factories. But due to lockdown in China, partial lockdown in Indian MSME's were not able to get supply of raw material from China. This results in a shortfall in the production.
- ✧ **Problem of repaying loan:** Due to lack of working capital MSMEs were not able to repay their loans. According to Trans Union Cibil, MSME loans worth Rs. 2.3 lakh crore are at a higher risk of becoming non-performing assets (NPA).
- ✧ **Not able to pay salaries to the employees:** In the lockdown period due to the stop page of economic activity majority of the MSME's facing difficulty in paying salaries to the employees. According to a survey conducted by All India Manufacturers' Organisation (AIMO), 71 percent of the businesses are not able to pay salaries in March.
- ✧ **Migration of workers and non-availability of manpower:** Due to the lockdown, daily-wage workers especially migrant labourers left with no work and they are moving towards their native places. As per Indian Railway nearly fifty seven lakh migrant workers transported so far by Sharamik Special Trains as on 3rd June 2020. This results in scarcity of skilled workers to MSMEs especially in major production cities.
- ✧ **Not able to start production at full scale and maintain social distancing in factory:** After relaxation in lockdown, companies started preparations for restarting operations. Some companies have opened offices with the maximum permitted strength of 33 percent while others took a more cautious approach of as low as five per cent.

VIII-Government and RBI relief Package

The Government and Reserve Bank of India announced several policy measures to control the impact of the COVID-19 pandemic on economy. The following are the important among them which will also help MSMEs.

Table: 8.1 - COVID-19 Stimulus Package by Government

SI. No.	Particulars	Amount (Rs. In Crore)
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1.	Collateral Free Loan for Standard MSMEs	300000
2.	Special liquidity scheme which guarantee the instruments to be floated by NBFCs/HFCs/MFIs	30000
3.	Equity infusion into fund of fund for MSMEs	50000
4.	EPF	2500
5.	Subordinate Debt	20000
6.	Reduction of EPF burden	6750
7.	Infusion of liquidity to DISCOMs through PFC & REC	90000
8.	Partial credit guarantee for NBFCs	45000
9.	TDS reduction by 25% up to 31.03.2021	50000

The Government and RBI announced relief measures worth is Rs.12.88 lakh crore to face impact of COVID-19. Under this RBI liquidity infusion worth is Rs.5.24 lakh crore. Few important relief measures are mentioned in above table no.03.The finance Minister on 13th May 2020 announced the stimulus package to control the impact of Covide-19 on economy. The important among them which helps MSME is Collateral free loan of Rs.3 lakh crore for standard MSMEs. Under this free loans will be given for a period of 4 years with one year moratorium on repayment of installment till 31st October 2020. Government will provide 100 percent credit guarantee cover to banks and NBFCs for providing these loans. For this purpose Rs.4000 crore will be provided to credit Guarantee Fund Trust for Micro and Small Enterprises. It will benefit over 4.5 million MSMEs. The Government has planned Rs. 50000 crore equity infusion into MSMEs. For this purpose fund of funds will be established with a corpus of Rs. 10000 crore.

Government has also taken initiative to clear dues to be paid to MSMEs from both Government and Central Public Sector Enterprises (CPSE) within 45 days. Because often MSMEs face problem of delayed payments which affecting their day today cash flows. Even thought there are provisions of penalty in case of delayed payments in MSME act 2006 due to the fear of losing their customers and weak bargaining power these provisions were not effective on the grounds. This measure helps to cater the problem of delayed payments.

Government also supports MSMEs by cancelling global tender for procurement up to Rs.200 Crore and it will be reserved only for domestic MSMEs. It will increase the demand for domestic MSMEs products by curbing the global competition and help to achieve Make in India concept. Along with the above Government also announces collateral-free automatic loan which will be funded by up to Rs 3 lakh crore and it will benefit over 45 lakh micro, small and medium enterprises with a loan tenure of four years and a moratorium one year.

RBI announced many relief measures to increase the liquidity infusion in the economy. Important among them are a substantial cut in the repo rate by 75 basis points to 4.4%. This is the lowest policy rate in this century. Three months moratorium on payment of installments on the existing term loans, Reduced the liquidity coverage ratio from 100 percent to 80 percent. Government TDS reduction by 25 percent will also give temporary relief to MSMEs. Under this Government provided Rs.50000 crore liquidity through TDS reduction for the remaining period up to 31.03.2021. But interest on these delayed installments on three months moratorium is not justifiable.

To meet the short-run credit concerns emergency credit lines announced by Public Sector Banks as per the instruction given by RBI and SIDBI to help the MSME, under this scheme at 5 percent low

rate of interest loan were sanctioned within 48 hours. RBI opened Rs.50000 crore to the refinancing window for NABARD, SIDBI and NHB. Under this banks will be required to make these investments within one month from receiving funds from the RBI.

IX- Suggestion

- ✧ Due to COVID-19 migration is more from urban to rural area. This increases the labour supply in rural area and scarcity in urban area. Therefore, to enhance the skills among rural youth especially among migrated workers there is a need of mobile skill development centre at block level. This will help to MSMEs to solve the scarcity of skilled workers.
- ✧ Emphasis on rural entrepreneurship development to create self employment in rural area. Lockdown results in workers migration from urban cities to rural area. Therefore, there is a need to promote self employment and reduce unemployment in rural area. This will help to utilize the skills of migrated employees in the rural areas.
- ✧ To pay salary to employees Government should give subsidies or part of salary must reimburse to MSMEs. Due to lockdown in country MSMEs are not able to produce goods and demand for non-essentials are also reduced drastically. Therefore, MSMEs are facing shortage of funds to pay salaries to their employees. To avoid the shutting down of them and reduce increasing unemployment in the economy Government needs to support them by reimbursing part of salary to MSMEs.
- ✧ Government should purchase products from MSMEs and encouragement to make in India through MSMEs. MSMEs are facing scarcity of demand for their product especially non-essential commodities. Therefore, there is a need of creating demand for their product by Government. Government already announced to cancel global tender for procurement up to Rs.200 Crore and it will be reserved only for domestic MSMEs. But, along with this Make in India concept must be seriously pushed to reduce dependence on imports and increase the demand for domestic products.
- ✧ Quick Relief package and Programmes to cater the specific problems of MSME workers. To meet immediate credit need, a Credit protection scheme is very much needed for MSMEs. Government must also think about helping unregistered MSMEs.
- ✧ Government relief package must also reach to unregistered MSMEs. Therefore, Survey on MSME to must be conducted to understand the problems and to take proper policy measure to increase the registration of unregistered MSMEs.

X- Conclusion

MSME sector is the major contributor to Indian economy. Therefore, there is a need of helping this sector to come out of this pandemic situation. To inject the lifeblood to the MSME sector, along with the temporary relief programme the Government must plan for medium and long term requirements of MSMEs to strengthen this sector. The relief package must also quickly reach to MSMEs. Almost every country in the world is being affected from devastating outbreak of Covid-19. The most powerful economies countries have become helpless, situation has become uncontrollable. But the bounce back by taking quick and timely decision by India is really appreciable. we cannot overlook the devastating impact of covid-19 but if we compare India with some developed countries like USA or Italy whose comparison obviously is not justified but if we analyze, India is in too much better position. This is just because of quick lockdown of country, giving more attention towards social distancing. To great extent India has to contain the spread of virus till now. If India did not take quick decision, then impact of the pandemic is being more and more dangerous and visualization of its

impact will be really shocking in coming future. Every sector is being affected due to the pandemic. But whether India will tolerate the consequence of the Covid-19 pandemic in near future. How much it will take time to come back in the track of growth is unanswered. India has already suffered from unemployment and this will be further extended. From every incident of life we learn something new it may be positive or negative or both. This positive thing is that, from this pandemic India can analyze its potential. India is too much dependent on other countries for importing goods, how India has tackled this situation by home sourcing arrangement instead of import from other country. This will improve BOP situation of India to some extent. Work from home concept is going to being new culture of India. As a result use of digital practice will be increase in near future. Make in India and Digital India will be encouraging more. There will be a big shock for new entrepreneur and start up, they might be shut down. Some small businesses will be vanished.

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COVID AND A FAILING ECONOMY: A TWO-FRONT WAR FOR SYRIA

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ABSTRACT

The world has been a witness to many wars, none of which have brought anything but desperation, hardship and destruction of human life. Syria, officially known as the Syrian Arab Republic, a country with a population of over 17.5 million in Western Asia, is reeling under a civil war for the last 9 years. The onset of COVID has brought with it more challenges for the Syrians who were already struggling with the consequences of a political turmoil. There is massive pressure on the economy and healthcare infrastructure resulting from the anti-pandemic measures against COVID-19. This work is an attempt to analyze the devastating effects of COVID-19 on the Syrian economy, and healthcare infrastructure. We have realized, during the course of compiling this work, that not much information is available on the current situation in Syria. Much of what is available is in the form of news articles, personal blogs, and social media posts. We have collected and analyzed resources from the Web, such as news articles and published reports by humanitarian organizations, and tried to present a coherent and accurate state of the current economic situation in Syria.

I INTRODUCTION

A new zoonotic disease called COVID-19 [1], caused by the SARS-CoV-2 virus [2], was first reported in Wuhan City, China, in December 2019 [3]. Due to a rapid increase in the number of cases worldwide, the World Health Organization (WHO) declared it a global pandemic on March 11, 2020 [4]. As of October 9, 2020, there have been 36,237,403 confirmed cases of COVID-19, with 1,054,868 deaths, reported to WHO from around the world (Fig. 1). Out of these, in the Syrian Arab Republic, reportedly there have been 4,566 confirmed cases with 215 deaths [5] (Fig. 2). However, independent humanitarian organizations have estimated the actual number of confirmed cases to be much higher and claims that the government is not releasing the actual COVID-related data to avoid criticism. The social and economic repercussions have been profound for the citizens at large. The pandemic and the strict lockdown measures that followed resulted in a total collapse of the Syrian economy which was already in rubbles. Unemployment, a surge in food prices, a sharp devaluation of the currency, and lack of water and other basic necessities further increased the woes for the citizens. The sub-standard living conditions for the refugees and internally displaced persons (IDPs) in crowded camps and collective centers present a challenging scenario to efficiently implement effective anti-pandemic measures.

This work highlights the current socio-economic and healthcare challenges faced by Syria in the wake of the pandemic. We have tried to consolidate information about the economic state of Syria from various

disparate and distributed sources on the Web, and present a one-stop resource for stakeholders interested to learn about the current socio-economic challenges prevalent in Syria. The remainder of this paper is structured as follows. Section II presents information about the social and economic state prior to the outbreak of COVID. Section III is about the emergence of the first confirmed case of COVID and the initial reaction from the authorities. Section IV lists the repercussions of the anti-pandemic response measures on the socio-economic and health infrastructure of the nation. Section V captures the support provided by the local and international community in the relief activities ongoing in Syria. Finally, Section VI concludes the paper.

II BACKGROUND

Any discussion about the present-day situation in Syria is incomplete without first understanding the historical context which influenced it. The civil war started with the Arab Spring [6], [7], [8] which was a series of anti-government protests and demonstrations against oppressive regimes in the Middle East and North Africa (MENA). In March 2011, peaceful protests erupted in Syria which was responded violently by the Bashar al-Assad-led Syrian government causing the death of hundreds of protestors and imprisonment of many more. This resulted in the first wave of violence which marked the beginning of the civil war. Since then, the involvement of local militias and many foreign powers, such as the USA, Russia, Turkey and Iran made it effectively a global fight for military dominance.

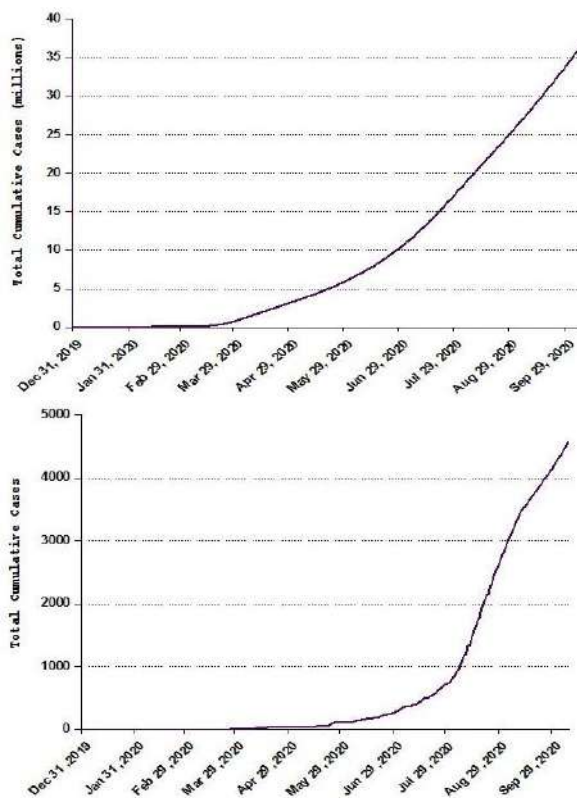


Fig. 1. Graphical representation of the trend in total number of confirmed cases (a) in the world (b) in the Syrian Arab Republic, as of October 9, 2020.

Source of data: Max Roser, Hannah Ritchie, Esteban Ortiz-Ospina and Joe Hasell (2020) - "Coronavirus Pandemic (COVID-19)". Published online at OurWorldInData.org. Retrieved from: <https://ourworldindata.org/coronavirus> [Online Resource]

The unrest had devastating effects on the socio-economic, healthcare, and political infrastructure of the country. As per a report by the World Bank [9] focusing on the period 2011 to early 2017, it is estimated that the war resulted in the death of 400,000 Syrians and displaced about half of the population, many of whom either left the country or sought accommodation in overcrowded refugee camps. As of August 2018, there were 6.2 million IDPs of whom 14% resides in temporary sites, collective centers, and refugee camps [10]. Challenging living conditions with limited access to basic amenities led to a significant deterioration in the quality of life of the Syrian civilians.

Due to the effects of the war, Syria's GDP decreased by 63% between 2010 and 2016

[11]. An annual loss of approximately 538,000 jobs was reported in the first 4 years of the conflict [9]. The unemployment rate increased from 22% to 41% for females and from 6% to 11% for males in the period from 2010 to 2017, according to the World Bank [12]. This forced the people from rural and suburban areas to move towards cities in search of better employment opportunities which further increased the burden on the existing infrastructure in those cities. Extensive damage to real estate was reported due to bombings and the use of ammunition during the conflict. Reportedly, about 27% of all housing units were destroyed or partially damaged. Around 16% of medical facilities were completely destroyed and 50% partially damaged [9]. This damage to infrastructure led to an overall deterioration in living standards across Syria.

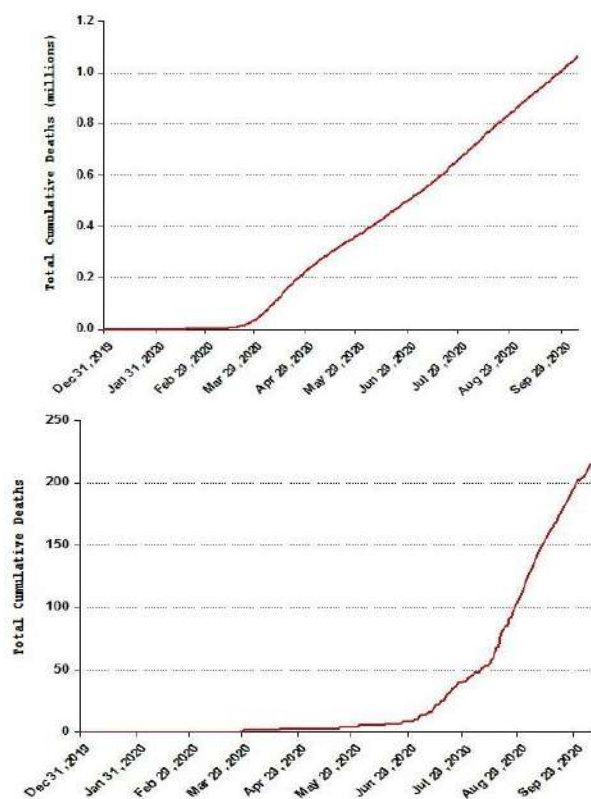


Fig. 2. Graphical representation of the trend in the total number of confirmed deaths (a) in the world (b) in the Syrian Arab Republic, as of October 9, 2020.

Source of data: Max Roser, Hannah Ritchie, Esteban Ortiz-Ospina and Joe Hasell (2020) - "Coronavirus Pandemic (COVID-19)". Published online at OurWorldInData.org. Retrieved from: <https://ourworldindata.org/coronavirus> [Online Resource]

Before the emergence of the first confirmed case of SARS-CoV-2 in Syria in early 2020, the economy was already under pressure due to the after-effects of a decade long war. The war had destroyed the healthcare infrastructure and the ordinary citizens were struggling with issues of poverty, unemployment, inflation, and dangerous living conditions.

The first confirmed case of COVID-19 was officially reported on March 22, 2020 in the city of Damascus [13]. In response, the Government of Syria (GoS) began to impose initial preventive measures all around the country to curb the spread of the virus with partial closures of borders and shrines, regulation of workforce in public and private administrations, and a complete suspension of the majority of unnecessary economic

activities. But the ground reality was far from what was depicted by the government. For weeks, the authorities themselves denied the danger of the pandemic to a wide extent. Shia pilgrims from Iran and other neighboring countries were granted access to the shrines near Damascus while military movements were allowed along and through the borders. Ruwan al-Rejoleh, an analyst based in Washington observed that “There seems to be a state of denial in Syria regarding COVID-19. In both government-held and anti-government areas, the governing bodies refused to admit that COVID even exists to deal with it in the first place. The delay in announcing that there is COVID in Syria is caused by two reasons: firstly, no testing kits were available to trace the infected cases, and secondly, the literacy surrounding COVID and social fear. People have little proper education about the virus or its symptoms.” [14]. The Ministry of Health and its directories seem lost over the current status of COVID in the nation and are poorly equipped to deal with it citing limited testing kits and ill-equipped medical facilities. There have been allegations on the government that even during this pandemic, the authorities had been trying to push their agenda against dissent to the forefront. Dr. Nizar Yaziji, the Health Minister in the al-Assad government, when asked about the steps taken and the strategy to tackle the pandemic in the future said, “I want to assure all Syrians amid this coronavirus outbreak that the Syrian Arab Army has cleansed all germs that exist on Syrian soil” referring to the rebellions and other anti-state actors in the conflict [13]. Similar situations prevailed in other rebel-held areas due to aggressive actions of the al-Assad government as it always had been a strategy of the GoS to deprive the conflict-ridden part of the country of international humanitarian aids to crush the morale of the rebellions.

Though the number of confirmed cases were on the rise, the Syrian cabinet on April 29, took a decision of relaxation in restrictions that were in place to curb the spread of the pandemic [15]. This announcement was particularly aimed at reviving the economy of the country which was receiving the direct blow of the lockdown. Markets, shops, trade facilities were among the businesses permitted to resume operations.

As the death count due to COVID-19 has crossed a million globally, Syria has its share of casualties, officially totaling 215, for a country with limited testing capacity and a fragile health infrastructure, clearly hinting at methodical underreporting of cases on a large scale by the administration citing challenges in the attribution of cause of deaths. The total officially reported cases in Syria is 4566, with the fatality rate of 4.7%; there are still 3139 active cases across the country [16], [17].

After-Effects Of Covid

The economic effects of COVID-19 have been severe in almost every country around the globe. Many developed economies have reported depressing figures for their GDP growth outlook for the coming days. While the global growth projection is estimated to be -4.6 percent for 2020 [18], a recent study estimates the contraction in Indian GDP for FY2021 to be 11 percent [19],

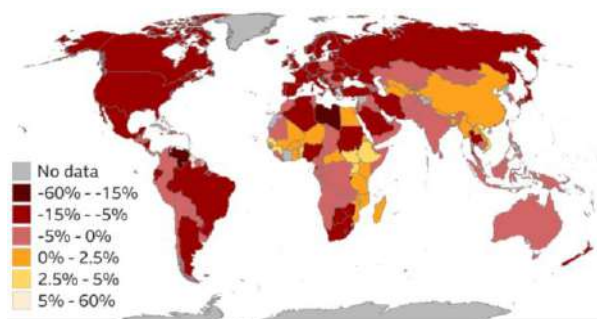


Fig. 3. Real GDP growth, Q1 2020. Lora Jones, Daniele Palumbo, and David Brown, Coronavirus: A visual guide to the economic impact, BBC News, June 30, 2020. (<https://www.bbc.com/news/business-51706225>). Copyright by BBC.

and the annual growth rate is estimated to be -3.8 percent for the US economy [20]. Fig. 3 shows the extent of economic damage COVID has done to economies around the globe. For the Syrian economy, which was already crumbling under the weights of a devastating war and poor political leadership, the effects are far more damaging.

Precautionary measures to contain the spread of the virus included the imposition of lockdown clamping down on the free movement of persons and vehicles; closure of schools, universities, shops, places of worship; prohibiting large gatherings; suspension of domestic and international flights, and closure of international land borders. Economies that were most affected by these pandemic responses included tourism, retail, transport, hospitality, construction, and small and medium scale industries. An estimate by Dr. Ali Kannan, head of the Department of Banking at Faculty of Economics, Damascus University pegged the economic loss to be around 4 trillion Syrian Pounds due to lockdown measures in the month of March and April 2020 alone [14]. The economic effect of the loss in businesses forced representatives from the business community to make a public statement highlighting the situation. “Let’s hope that the closures and movement restrictions do not force the poor to choose between dying from the Coronavirus or from famine; the situation would then spiral out of control”, said Fares Shehabi, chairman of the Federation of Syrian Chambers of Industry. Kifah Qaddour, the secretary-general of the Tartous Chamber of Commerce and Industry said that “if restrictions continue, many companies will go bankrupt.” [21].

Closure of international borders and suspension of flights stopped tourism and trade with Iran, Lebanon, and Jordan. Religious tourism from Iran was a major source of foreign currency for Syria. And, in the wake of rising international sanctions on Iran, a major trade ally, trade with Lebanon provided an opportunity for local businesses to minimize the effects of the devaluation of the local currency. The Syrian currency has experienced a sharp decline in value against the US Dollar, 632 SYP to 1 USD on October 19, 2019 to 3175 SYP to 1 USD on June 8, 2020, in the unofficial trade market [22]. To artificially deflate the price of imported goods, relaxation was extended for two public entities – Syria for Trade and the General Directorate of External Trade, to continue purchasing imported goods at a rate of 438 SYP, while a preferential conversion rate of 700 SYP to 1 USD was announced for all local transactions by the Central Bank of Syria on March 26, 2020 [23]. On June 17, 2020, the conversion rate for inbound foreign wire transfers was increased from 700 SYP per USD to 1,256 SYP per USD while the conversion rate for transfers made by humanitarian and diplomatic organizations was fixed at 1,256 SYP per USD [24].

Closure of shops and restrictions on the movement of persons and vehicles have adversely impacted the income of the masses. Where many small and medium scale industries closed operations under rising costs and lack of business during the lockdown eliminating thousands of jobs; for the 47 percent of Syria’s workforce employed by the services sector and the 18 percent working in retail [25], this increased economic hardships resulting in a decline in purchasing power amid rise in food prices.

Years of conflict, a crumbling economy, and lack of governmental support machinery have exhausted Syrians’ savings. A countrywide household assessment survey [10] shows that an estimated 6.5 million Syrians are food insecure, and another 2.5 million are on the risk of food insecurity. Prices of consumer goods have doubled, with a rise of 50 percent in the prices of meat and vegetables and those of sanitizers and face masks have increased by a

staggering 5000 percent since March 2020, according to official estimates [22]. The prime factors resulting in such a steep rise in commodity prices are the destruction of productive sectors due to war, rising costs of imports, currency devaluation, closure of local businesses, and suspension of trade across provincial and international borders due to anti-pandemic lockdown measures.

Poverty, unemployment, and inflation have also affected the purchasing power of households. A Damascus-based newspaper estimates that the average cost of living in Damascus during the first quarter of 2020 have increased to 430,000 SYP per month, where an average of 230,000 SYP is spent on food [25], reflecting the impact of the pandemic response measures. A more recent report by another newspaper has indicated that since the onset of COVID, the average monthly food cost for a family of five rose to 600,000 SYP [25]. As per another report [10], around 7 percent of the income of a Syrian household is spent on purchasing water and, out of the surveyed households, an estimated 40 percent spend more than 65 percent of their expenditure on food alone. Despite such a sharp rise in food prices, it is observed that salaries across both the public and private sectors have remained constant with local sources estimating the average minimum wage to be 60,000 SYP per month in Damascus and 46,000 SYP in other parts of Syria [26]. A media report estimated that to have an equivalent purchasing power to that of the pre-conflict era, a Syrian would need to earn 310,00 SYP per month [26].

To rationalize consumption, the al-Assad-led government introduced the much-criticized distribution of subsidized bread, among other essential food items, via a “smart card” distribution system in early February 2020, where the cost of a bag of 7 loaves of bread was 50 SYP and 100 SYP for a bag of 11 loaves – with a maximum of 4 bags for each family per day [27]. However, on July 1, 2020, as per a local media report [26], the government reduced the subsidies on sugar and rice by more than 100 percent, which drove the prices of a pack of sugar sold through the smart card from 350 SYP to 800 SYP, while in the international market, a kilogram of sugar costs less than 20 cents (200 SYP) [28], and the price of rice rose from 400 SYP to 900 SYP. Despite a large chunk of the Syrian budget, around 10 percent (373 billion SYP out of 4000 billion SYP) [29], allocated towards state contribution to price stabilization expenses in the form of food and fuel subsidies, the intense criticism by the public reflect poor implementation and execution of the policies. The government has allegedly shown favoritism in the framing and implementation of social policies, in favor of certain cities and sections of the population such as families of the ruling party, pro-government supporters, and military personnel. The risk for the poor is that they cannot expect support from vital lifelines such as the social safety net, income guarantees, and aids and remittances, which are now also in jeopardy due to underfunding, diminishing volume, and mismanagement.

Wage losses and a significant reduction in the purchasing power force families to resort to desperate measures including borrowing and child labor. As per a survey conducted in Northeast Syria [30], child labor was observed in 60% of the assessed communities. Other challenges that have a direct negative impact on the living conditions in these regions is the bad state of the public support infrastructure. Inaccessibility and unaffordability to health facilities force people to directly visit pharmacies for their medical needs instead of consulting clinics. Disruptions of water and electricity networks encourage the use of expensive alternatives such as water trucks and electric generators. 96 percent of the assessed households reported less than 12 hours per day of availability of electricity and nearly 80 percent of the households did not receive water from the public distribution network every day of the week. Since proper sanitation is the only effective strategy against the virus, inaccessibility to water poses a greater challenge in the implementation of the guidelines and leaves the poor all the more vulnerable to this deadly disease.

The state of healthcare in Syria was already in shambles long before the emergence of COVID. The ongoing political and military conflict and the heavy use of ammunitions had destroyed a large part of the infrastructure and resulted in the death and displacement of many health workers. Reported as of the end of 2019 [31], only 64% of hospitals and 52%

TABLE I
AVAILABILITY OF VENTILATORS ACROSS PROVINCES IN SYRIA

Province	Available ICU beds with ventilator
Damascus	96
Aleppo	5
Rural Damascus	11
Homs	5
Hama	29
Lattakia	77
al-Hasakah	18
Deir ez-Zor	0
Idlib	20
Tartus	30
al-Raqqqa	4
Deraa	3
al-Sweida	22
al-Quneitra	5
Across Syria	325

Source: Gharibah, Mazen and Mehchv, Zaki (2020). "COVID-19

primary healthcare facilities were fully functional. There were also reported incidents of 595 attacks on at least 350 separate health facilities in which 923 health workers were killed, of which 20 attacks took place between Jan – July 2020 in Northwest Syria [13]. This also resulted in around 70 percent of the health workers fleeing the country or becoming refugees in different parts of Syria [31]. M. Gharibah and Z. Mehchy [13] performed a study, aimed at finding the state of health facilities across the different provinces of Syria, reported a severe shortage of ventilators, a life-saving equipment in critical cases of COVID-19. Table 1 lists the number of ventilators present in each of the 14 provinces. The distribution is quite unequal with a large number of ventilators present in the capital city of Damascus and the province of Deir ez-Zor having none.

Highlighting the risks faced by the health community due to the availability of inadequate personal protective equipment (PPE), out of the total number of COVID cases confirmed by the Ministry of Health (MoH) as of the end of September 2020, 143 were healthcare professionals and, of particular concern is that 11 healthcare workers have been reported to have died, most recently on September 3 [32]. The rising number of infections detected in health workers led to a pause in the dissemination of health services, and to a reduction in the number of workers operating across camps and clinics. Though the current official figures are relatively low, one area of concern is that more than 92 percent of the cases have not been linked to any known sources pointing to widespread community transmission. Difficulties in contact tracing due to high levels of population displacement and densely crowded IDP settlements pose major challenges in implementing COVID-19 preparedness, mitigation, testing, and response measures. Moreover, international media and local health actors have reported far more number of confirmed cases than reported through official channels. Ramesh Rajasingham, Deputy Emergency Relief Coordinator from the UN, highlighted this issue in his brief to the UN Security Council – “Reports of healthcare facilities filling up, of rising numbers of death notices and burials, all seem to indicate that actual cases far exceed official figures.” [33].

The refugees living in makeshift camps and collective centers are the most vulnerable to the virus. The camps are overly crowded where the inhabitants are living under increased climatic exposure due to sub-standard shelter, and poor nutritional and health status, with no streamlined access to water, sanitation, and hygiene (WASH). Clean water is often scarce, illnesses are rife and social distancing is nearly impossible. The modalities of services and assistance provision, involving large unmanaged crowds, could worsen the situation further.

Response And Support

Governmental Support

In response to the economic downfall resulting from its fight against the virus, the Government of Syria allocated 100 billion SYP to revive the economy, and announced financial compensation for the poor and frontline workers as support in their fight against COVID. It has also launched the National Strategy for Social Emergency Response Plan under which a lumpsum payment of 100,000 SYP is given to people who lost their job during the pandemic [21]. Apart from this, policies were framed easing import restrictions and the payment of taxes were postponed to ease the economic burden on local businesses and individuals.

In cooperation with local NGOs and the WHO, the Idlib Health Directorate in the

rebel-controlled northwest region of the country launched a COVID Task Force and Emergency Plan worth USD 30 million to setup emergency medical facilities for critical patients, and isolation centers for suspected cases [14].

International Support

Various local and international humanitarian organizations and individuals have provided direct and indirect support to ongoing relief activities in Syria in the form of aids and remittances.

The Fourth Brussels Conference on “*Supporting the future of Syria and the region*”, co-chaired by the European Union and the United Nations in a virtual format between June 22-30, 2020, witnessed participation from 80 countries among other organizations. The conference succeeded in mobilizing aid through pledges totaling USD 5.5 billion for 2020, and USD 2.2 billion as multi-year pledges for the year 2021 and beyond. Mark Lowcock, the UN Under-Secretary-General for Humanitarian Affairs and Emergency Relief Coordinator, through his words, reflected the sentiments of the world community – “The high level of participation conveys a message to Syrians, wherever they are, that the world has not forgotten them and the world will stand by them. That is important in the current circumstances where the conflict is nearly 10 years old.” [34].

During the UN General Assembly on September 24, the U.S. Government announced a financial package of more than USD 720 million to support the provision of emergency food, health, livelihood, shelter, water, sanitation, and hygiene assistance for IDPs and other vulnerable populations in Syria [35]. Additionally, it announced USD 140 million specifically for regional coronavirus disease preparedness and response efforts.

Local Support

In the rebel-held northwest Syria, home to 3 million people, with only one machine to run a polymerase chain reaction (PCR) test to detect the virus, a group of volunteers including engineers and technicians, built prototypes of ventilators and testing machines, using wooden boxes and plastic hoses, to support the local community in case of a large outbreak of the virus, especially when hospitals lie in ruins after nine years of war [36].

Conclusion

Syria, which was once a booming economy of the region is now slowly drifting to a state of complete economic collapse. The humanitarian organizations which have helped the nation with aid are also facing the wrath of the current global situation. The pandemic has affected the financial capabilities of these organizations and the countries funding them. Syria desperately need urgent humanitarian assistance from other countries much more than ever before. The situation calls for active engagement from the stakeholders to draft and devise innovative and aggressive policies to alleviate the situation and to provide better living conditions for its citizens. It is an opportunity for global investors to establish trade relations with Syria which would not only help in the revival of the local economy but will eventually, bring more business to these organizations resulting in an overall improvement in the lives of the people.

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EFFECTS OF COVID 19 PANDEMIC ON CHANGES IN LIFESTYLE AND PHYSICAL ACTIVITIES OF THE FEMALE COLLEGE STUDENTS IN INDIA

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ABSTRACT

Due to COVID-19 Pandemic, the lockdown has disturbed the normal lifestyle of every individual. The impact of lockdown has much affected students' participation in physical activities leading to increase in sedentary behavior. The present study is to explore the effects of Covid 19 Pandemic on physical activities and changes in the lifestyle pattern of female college students in India. For the purpose of data collection, a Google form questionnaire was developed and sent among students' community across India. 386 Undergraduate (75.9%) and Post-Graduate (24.1%) students from 15 states and 3 union territories of India participated in the survey. The mean age, weight and height of the respondents was 20.8 ± 1.9 years; 54.1 ± 9.9 kg and 5.2 ± 0.3 ft/in. respectively. Results showed that the majority of students participated in leisure-time physical activities like home exercise, walking, stepping, dancing and yoga; while few participated sometimes. Majority of students were involved in household physical activities like dusting & cleaning, washing vessels, sweeping, mopping and washing clothes manually. Among Skill-oriented activities performed atleast 2-3 days per week, maximum students were involved in cooking activity followed by playing board games and art and craft activities. In sedentary behaviour activities majority of students were indulged in surfing and watching movies on mobile phone; listening music; working on computers/laptops/mobile phones, followed by watching TV; socialising with friends and relatives/cousins on mobile, attending webinars, playing video games and others. 88.6% of the students showed changes in sleeping pattern like sleeping more and sleeping at odd times; while 51.3 reported change in diet pattern and eating time. Overall, the results signified that irrespective of performing physical activity the students were similarly adapting incorrect lifestyle patterns which might impact their health status later. Thus, it is essential to guide the students to perform daily physical activity and to maintain a healthy lifestyle so as to minimize the unintentional increase of sedentary behavior during the lockdown.

Key words: Physical Activity, Sedentary behavior, COVID-19, lifestyle changes, Female Students

I. INTRODUCTION

The Covid 19 pandemic has restricted physical and other activities of the people. It has forced them to spend their time at home; leading a sedentary life, with little opportunity to be physically active. People are not able to go out for walking, gyming, marketing, participating in leisure time activities like jogging, cycling, going to parks, etc. Due to social distancing and closure of schools, colleges, parks, gardens, gyms and not being able to meet friends, relatives; or participate in events or physically chat with their friends. All this seems to have an impact on physical, psychological and social wellbeing of the students. It may be challenging to be more active during this lockdown period, but even though it is for a short period there is a need to have movement, rather than sitting and adopting a sedentary lifestyle.

The isolation imposed by lockdown frequently leaves people feeling that they have no control over the situation. They also feel detached from the rest of the world and unable to perform their usual duties, that can lead to poor sleep, poor cardiovascular health, lower immunity, pressive symptoms, and impaired executive

function. Majority of adolescent and young adults living under COVID-19 lockdowns, social restrictions and school closures are dealing with feelings of anxiety, with many at risk of lasting psychological distress, including depression.[1]

Most people accumulate their "active minutes" by doing various other activities such as housework, walking the dog, walking/cycling to and from work, walking between tube/train stations, etc. All these activities are part of people's daily lives and contribute to their physical activity minutes. During periods of lockdown, many of these activities are restricted or not even taking place and it is extremely difficult to build in these levels of activity when people's daily movements are restricted.[2]. Studies have shown that enforced sedentary behaviour has led to depressive feelings and low moods in healthy people within seven days [3].

Data from Garmin, a wearable technology company shows interesting pictures of the type of physical activities people engage in during these times. But this data is not cross-sectional as only those people who are using wearable technology such as smartwatches and fitness trackers are considered. Interestingly, the result showed that during the month of March 2020 there was a global reduction in the daily average amount of steps taken which is indicative of people being restricted in their movements. In other countries, such as the UK and Sweden where outdoor exercise is allowed, there was a significant increase in outdoor cycling activities compared to the same time in 2019.[4].

There is strong evidence of a link between physical activity and mental well-being, as physical activity is a key, to critically manage mental health well-being. Studies have shown that enforced sedentary behaviour has led to depressive feelings and low moods in healthy people within seven days.[3].

One of the studies found the most common physical activities during the early-COVID-19 period were free play/ unstructured activity (e.g., running around, tag) (90% of children) and going for a walk (55% of children). Children engaged in about 90 min of school-related sitting and over 8 h of leisure-related sitting a day. Parents of older children (ages 9–13) vs. younger children (ages 5–8) perceived greater decreases in physical activity and greater increases in sedentary behaviour from the pre- to early-COVID-19 periods. Children were more likely to perform PA at home indoors or on neighbourhood streets during the early- vs. pre-COVID-19 periods. About a third of children used remote/streaming services for activity classes and lessons during the early-COVID-19 period. [5]

A review article mentioned that regular PA and exercise promote cardiorespiratory fitness and longevity and recommended healthy individuals to remain physically active and exercise while socially distanced when they are well during and following the COVID-19 pandemic.[6]

Unfortunately, modern lifestyle behaviours promote physical inactivity and sedentariness.[7, 8, 9]. These poor lifestyle behaviours are intensified by social distancing and self-imposed or government mandated quarantine measures intended to reduce COVID-19 spread. These circumstances pose significant challenges for remaining physically active. During periods of isolation, all socioeconomic groups, ethnicities, and ages should maintain good health by following the WHO PA recommendations of 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity PA per week, or a combination of both. Muscle-strengthening activities involving major muscle groups are recommended on two or more days a week[9]. In children/adolescents the recommendations include at least 60 minutes per day of vigorous or moderate intensity PA.[10].

A study recommended that to become physically active and to reduce sedentary behavior, one can easily accomplish by avoiding sitting for long time periods, taking short movement or activity breaks, utilizing online exercise classes, and using mobile technologies such as telephone applications and wearable sensors to encourage movement.[6].

Physical activity has been universally recommended by researcher's time and again as a contributor to enhance the quality of life and power to fight against any infection. It helps to prevent and/or treat many physical and mental health conditions by improving the functioning of numerous physiological systems.[11].

Generally it is seen that there are some gender differences in exercise habits and motivations for exercise.[12, 13] found that females are more inclined to exercise in home-setting, practising aerobics, dancing, yoga, pilates or circuits with push-ups, squats, planks and jumping jacks. Furthermore, the lower variation in physical activity levels between before and during quarantine found in women can be possibly explained by the higher amount of housework physical activity than males.[14]. To understand this, the present study was undertaken to

explore female college students' engagement in different types of physical activities and time spent on these activities and changes in the lifestyle pattern during the lockdown period in Covid 19 Pandemic times in India.

Therefore the major objectives of the study was to explore the involvement of female college students in physical activities during lockdown, to investigate the participation in different types of sedentary activities and to find the involvement in household and skill related activities.

II. Procedure for Paper Submission

A. Participants

The participants for the study were female college students residing in different parts of India. The age of the participants ranged between 17-28 years. In all 450 students participated in the survey, out of which 356 students had filled complete data and were used for the study. The students belonged to junior college, graduates, post graduates and Ph.D scholars.

B. Data Collection Method

Online survey was conducted using google form from June 22 – July 15, 2020 to collect the data. The google form was sent via email and WhatsApp directly to the students and to faculties of colleges and universities to forward it to their students. The responses were gathered from female college students right from junior college students to Ph.D. scholars. The female college students from 15 states and 3 union territories from India participated in research.

A structured questionnaire was prepared which was incorporated in the Google form with short answers and close ended questions. It was divided into 3 sections –

Section I – General demographic Information that included name, age, gender, email ID, phone number, location, department/college name, year of studying in college/university.

Section II – Anthropometry and Lifestyle pattern in COVID-19 pandemic which included height, weight, change in weight, change in sleep pattern and duration of sleep during COVID-9 pandemic, change in dietary pattern.

Section III – Information related to Physical activities and sedentary behaviour. Involvement in specific physical activities like sports and leisure (indoor/outdoor sports, games, dancing, yoga and other), exercise (indoor exercising with/without equipment, walking, jogging, climbing stairs/stepping) and household activities (cooking, washing clothes, dusting, sweeping, mopping and other) was obtained. Also, data was on skill-oriented (art/craft) and sedentary behaviour activities (watching TV, reading books, playing games on mobile/computer/tablet, inactive sitting, attending classes online and others) in terms of duration of involvement during COVID-19 pandemic.

The data was analysed using descriptive statistics. Mean, standard deviation and percentages were computed using microsoft excel.

III. RESULTS

The present study was conducted to identify the changes in lifestyle pattern, involvement in physical activities and sedentary behaviour activities during covid 19 pandemic lockdown on the female college students from various parts of the country. In all from 15 states and 3 union territories of India, 386 female students out of which 293 students belonged to undergraduate (UG) course (75.9%) and 93 students were from Post-Graduate (PG) program (24.1%) participated in the survey.

A. Demographic Profile

Table 1 shows the descriptive analysis of the demographic characteristics of the college female students during the lockdown period. The mean age, weight and height of the respondents was 20.8 ± 1.9 years; 54.1 ± 9.9 kg and 5.2 ± 0.3 ft/in. respectively. The mean age of the UG students was 20.1yrs while for PG students 23.0yrs. The mean height of both the groups was 5.2 ft/in and mean weight was 53.8kg for UG students and 55.2kg for PG students. The mean weight gain during lockdown was 2.7kg (range-0.8-12.0kg) for UG students and 3.0kg (range-1.0-12.0kg) for PG students.

TABLE I

DEMOGRAPHIC CHARACTERISTICS OF THE FEMALE COLLEGE STUDENTS DURING LOCKDOWN

	Total (n=386)				Undergraduate (n=293)				Post Graduate (n=93)			
	\bar{x}	SD	Min	Max	\bar{x}	SD	Min	Max	\bar{x}	SD	Min	Max
Age (yrs)	20.8	1.9	17.0	28.0	20.1	1.3	17.0	24.0	23.0	1.6	19.0	28.0
Height (ft/in)	5.2	0.3	4.0	6.0	5.2	0.3	4.0	6.0	5.2	0.3	4.1	5.9
Weight (kg)	54.1	9.9	33.0	90.0	53.8	9.8	33.0	90.0	55.2	10.1	33.0	85.0
Weight gained (kg)	2.8	1.5	0.8	12.0	2.7	1.4	0.8	10.0	3.0	1.8	1.0	12.0

B. Changes in Lifestyle Pattern

Table 2 shows the changes in the lifestyle pattern with respect to sleep, food and weight gain during lockdown period by students

TABLE II

CHANGES IN SLEEP AND DIET PATTERN OF THE FEMALE STUDENTS DURING LOCKDOWN

SLEEP AND DIET PATTERN	Total (n=386)		Undergraduate (n=293)		Post Graduate (n=93)	
	Sum	%	Sum	%	Sum	%
Change in Sleep pattern	342	88.6	260	88.7	82	88.2
Sleeping more in lockdown	172	44.6	132	45.1	40	43.0
Sleeping less during lockdown	37	9.6	27	9.2	10	10.8
Sleeping at odd hours	125	32.4	94	32.1	31	33.3
Other changes in sleep pattern	8	2.1	7	2.4	1	1.1
Change in Diet pattern						
Yes	198	51.3	150	51.2	48	51.6
Somewhat	134	34.7	102	34.8	32	34.4
Effects of change in Diet pattern						
Frequency of eating increased	108	28.0	80	27.3	28	30.1
Frequency of eating decreased	29	7.5	20	6.8	9	9.7
Eating time changed	135	35.0	107	36.5	28	30.1
Frequency of eating increased & eating time changed	29	7.5	20	6.8	9	9.7
Frequency of eating decreased & eating time changed	13	3.4	12	4.1	1	1.1
Healthy eating during Covid	5	1.3	4	1.4	1	1.1

Overall, 88.6% of students reported a change in sleep pattern. 44.6% reported sleeping more; while 32.4% reported sleeping at odd hours, but almost similar patterns were observed in both the groups. 51.3% students reported change in diet/food consumption pattern; 34.7% showed somewhat change in diet/food pattern; while 15% showed no change. Overall, the change showed similar results in both groups. Further, food consumption patterns showed changes in eating timing (35%), increase in frequency of eating (28%), decrease in eating frequency (7.5%) and increase in frequency of eating and change in eating time (7.5%) respectively.

C. Involvement in Leisure Time Physical Activities

Table 3 depicts the participation in leisure-time physical activities by female college students during lockdown.

TABLE III
PARTICIPATION IN LEISURE-TIME PHYSICAL ACTIVITIES BY FEMALE COLLEGE STUDENTS DURING LOCKDOWN

LEISURE-TIME PHYSICAL ACTIVITIES	Total (n=386)		Undergraduate (n=293)		Post Graduate (n=93)	
	Sum	%	Sum	%	Sum	%
Performed leisure-time physical activity						
Yes	258	66.8	213	72.7	45	48.4
Somewhat	88	22.8	56	19.1	32	34.4
Involvement in leisure activity						
Yoga	104	26.9	81	27.6	23	24.7
Home exercise	237	61.4	197	67.2	40	43.0
Skipping rope	81	21.0	70	23.9	11	11.8
Stepping / climbing staircase	140	36.3	121	41.3	19	20.4
Walking	233	60.4	197	67.2	36	38.7
Gym	38	9.8	32	10.9	6	6.5
Jogging	74	19.2	65	22.2	9	9.7
Dancing	122	31.6	95	32.4	27	29.0
Others (Cycling, Gardening, Badminton, Zumba, Cricket, Skating, etc.)	41	10.6	31	10.6	10	10.8

Overall, 66.8% students were involved in some or the other leisure-time activity and 22.8% somewhat participated, while 10% didn't participate in any leisure-time activity. Majority of UG students (72.7%) participated in leisure-time activities, while only 48.4% from PG programs were involved in leisure-time activities. Total 61.4% and 60.4% were involved in home exercise and walking activity, followed by stepping/climbing staircases (36.3%). 31.6% were engaged in dancing; 26.9% in yoga; 21% in skipping rope; 19% in jogging and the remaining fraction of students in gym, cycling, gardening, playing badminton, cricket, skating, Zumba, etc.

The table reflected that in all leisure-time activities the participation of UG students was much more than PG students. Majority (67.2%) of UG students were involved in home exercise and walking; followed by stepping/climbing staircase (41.3%), dancing (32.4%), yoga (27.6%), skipping (23.9%), jogging (22.2%), gyming (10.9%) and others (10.6%). In case of PG student's maximum participation was seen in home exercise, walking, dancing, yoga, stepping/climbing staircases. Minimal participation was observed in skipping rope, jogging, gyming and others.

D. Involvement in Household and Skill-Oriented Physical Activities

Table 4 shows the participation of students in household activities like sweeping, dusting, mopping, washing clothes manually, washing vessels and other activities; and skill-related activities like playing games/board games, playing musical instruments, art and craft, singing, cooking and other activities.

TABLE IV
HOUSEHOLD AND SKILL-ORIENTED ACTIVITIES PERFORMED BY FEMALE COLLEGE STUDENTS DURING LOCKDOWN

HOUSEHOLD AND SKILL-ORIENTED ACTIVITIES	Total (n=386)		Undergraduate (n=293)		Post Graduate (n=93)	
	Sum	%	Sum	%	Sum	%
Household physical activity performed						
Dusting & cleaning	306	79.3	232	79.2	74	79.6
Sweeping	217	56.2	168	57.3	49	52.7
Mopping	214	55.4	162	55.3	52	55.9

Washing clothes manually	189	49.0	144	49.1	45	48.4
Washing vessels	269	69.7	203	69.3	66	71.0
Others	4	1.0	4	1.4	0	0.0
Skill-oriented activities performed at least 2-3 days/week						
Playing board/ card games/ chess/ other sitting games	212	54.9	162	55.3	50	53.8
Playing musical instrument	35	9.1	25	8.5	10	10.8
Art/craft	196	50.8	153	52.2	43	46.2
Singing	62	16.1	50	17.1	12	12.9
Cooking	329	85.2	247	84.3	82	88.2
Other	12	3.1	8	2.7	4	4.3

The results of the participation in household physical activities by the female students; showed maximum participation in dusting/cleaning (79.3%) and washing vessels (69.7%) activities; followed by sweeping (56.2%), mopping (55.4%), washing clothes manually (49%) and negligible involvement in other small odd activities. With respect to UG and PG students the participation in these activities was almost similar except UG student’s participation in sweeping was slightly more.

In skill-related activities, the participation in cooking (88.2%) and playing instrument (10.8%) activities by PG students was little more than UG students (84.3% and 8.5%). In art/craft (52.2%); singing (17.1%) and sitting games (55.3%) the participation of UG students was slightly more than PG students (46.2%; 12.9% and 53.8%).

E. Involvement in Sedentary Behaviour Activities

Table V studies the most important aspect of the study i.e., involvement in sedentary type of activities. The sedentary activities like watching TV, mobile usage for internet surfing, watching movies, playing video games, listening music, talking to friends/relatives; usage of computers/laptops/mobiles for online study purpose, attending webinars and other activities involving sedentary behaviour.

It could be observed from table V, that the participation in sedentary activity; internet surfing and watching movies on mobile phones was highest (81.6%) followed by sitting and listening to music (73.3%). The participation in other sedentary activities showed; that 67.4% worked on computers/laptops/mobile phones for online studies; 65.3% were engaged in watching TV; 63% were socialising with friends over phone; 61.1% were socialising with family members/cousins/relatives; 58.8% were engaged in attending webinars and 34.2% were involved in playing video games on laptops/ PlayStation/mobile phones/tablets.

TABLE V
SEDENTARY ACTIVITIES PERFORMED BY FEMALE COLLEGE STUDENTS DURING LOCKDOWN

SEDENTARY ACTIVITIES PERFORMED	Total (n=386)		Undergraduate (n=293)		Post Graduate (n=93)	
	Sum	%	Sum	%	Sum	%
Watching TV	252	65.3	192	65.5	60	64.5
Surfing/watching movies on mobile phone	315	81.6	236	80.5	79	84.9
Playing video games on a laptop/ PlayStation/ mobile phones/ tablets/ etc.	132	34.2	98	33.4	34	36.6
Socializing with friends over phone	243	63.0	180	61.4	63	67.7
Socializing with family members	236	61.1	183	62.5	53	57.0
Listening to music	283	73.3	213	72.7	70	75.3
Working on computers/ laptop/ mobiles for online study	260	67.4	195	66.6	65	69.9
Attending webinars	227	58.8	169	57.7	58	62.4

F. Overall Time Spent on Different Activities

Table VI shows the overall time spent by the students on different activities like sleeping hours, leisure-time activities and household physical activities.

TABLE VI

TOTAL TIME SPENT ON DIFFERENT ACTIVITIES DURING LOCKDOWN PERIOD BY FEMALE COLLEGE STUDENTS

Time spent on various activity	Total (n=386)				Undergraduate (n=293)				Post Graduate (n=93)			
	\bar{x}	SD	Min	Max	\bar{x}	SD	Min	Max	\bar{x}	SD	Min	Max
Sleeping (hours)	8.9	1.8	6.0	15.0	9.0	1.7	6.0	15.0	8.9	2.0	6.0	15.0
Leisure-time physical activities (minutes)	52.2 (n=258)	34.8	10	180	53.4	35.1	10.0	180.0	49.2	33.2	15.0	180.0
Household physical activity (minutes)	97.3	76.0	10.0	420	94.6	74.3	10	360.0	105.6	80.9	15.0	420.0

Table VI shows that with respect to sleeping hours, both the groups sleeping hours were similar 9.0 hours ranging between 6-15 hours/day. In leisure-time activities, overall UG students spend on an average 53.4 minutes/day and PG students spend 49.2 minutes/day, but the minimum time spent per day is more among PG students. Further, the average time spent/day on household physical activities by both UG and PG students showed that PG students spend little more time (105.6min/day) than UG students (94.6min/day), but maximum time spent was the same for both.

IV. DISCUSSIONS

The present study was conducted to explore the lifestyle and behaviour pattern adopted by the female college students during lockdown period in Covid 19 pandemic. The data for the study was collected from June 22 – July 15, 2020 when all students were confined to homestay. The lockdown in India started from March 22, 2020 and data was collected almost after 3 months of lockdown period. Schools, colleges, playgrounds, gym, parks, gardens, malls, playgrounds, movie theatres, etc everything was closed, imposing restrictions on physical movements, which directly impacted the physical activities of the students. 386 female college students participated in the online survey through google form from 15 states and 3 union territories of India. 75.9% of students were from undergraduate courses and 24.1% were from post-graduate programs. Mean age, weight and height of the students was 20.8 ± 1.9 years; 54.1 ± 9.9 kg and 5.2 ± 0.3 ft/in. respectively. Similar study on physiotherapy students and professionals found[15], mean (with 95% CI) age and weight of the survey participants 23.9 (23–24.8) years and 60.9 (58.9–62.9) kg respectively. Another similar study[5] on physical activities and sedentary behaviour among US school children aging between 5-13 years from 35 states and districts of Columbia, was reported. Overall, 51.6% of students reported weight gain (mean weight gain-2.8kg) during the lockdown period ranging from 0.8-12.0 kg. Total weight gain and maximum weight gain was seen higher among PG students. 88.6% students reported a change in sleeping pattern with respect to sleeping more, sleeping less and sleeping at odd hours. UG students slept slightly more than PG students; while sleeping less and sleeping at odd hours was slightly more among PG students. In another study on sleep patterns of college students reported that the female students went to bed and rose earlier and had longer sleep latency, more awakenings, and poorer sleep quality than the male.[16].

A study on sleeping patterns among university students found that the impact of lockdown was greater in students than in workers, and in females than in males[17]. With respect to bedtime and wake-up time during the lockdown, the impact of the delay in Bed Time and in Wake-Up was more distinct in students. An investigation on sleep behaviours prior to and

during Stay-at-Home orders in 139 university students (aged 22.2 ± 1.7 years old [\pm SD]) showed significant change during Stay-at-Home in three dimensions of sleep health behaviours that i) Time in bed (TIB) devoted to sleep increased on weekdays and weekends, ii) Time in bed increased every day of the week except on Saturday and iii) Sleep timing in general was later during Stay-at-Home versus baseline.[18]. In a survey on COVID-19 impact, reported that lockdown has disrupted sleep patterns among 1,500 respondents in India among which 67% respondents that worked from home had altered sleep schedules, 50% believed that their sleep pattern had disrupted, 81% felt their sleep schedule will get better after lockdown. [19].

With respect to lifestyle changes/ dietary food pattern 51.3% reported of change in diet and food pattern during lockdown. Both UG and PG students showed similar changes. This can be compared with the study where over 43.0% and nearly 52% reported of eating and snacking more, respectively, and these tendencies were more frequent in overweight and obese individuals. Almost 30% and over 18% experienced weight gain (mean \pm SD 3.0 ± 1.6 kg) and loss (-2.9 ± 1.5 kg), respectively. In present study the weight gain was average mean \pm SD 2.8 ± 1.5 kg.[20]. In the recent study on eating habits and lifestyle changes among Italian population, aged between 12 and 86 years (76.1% females) 48.6% of weight gain was observed in the population.[21].

The results of the present study on leisure time physical activities showed that 66.8% regularly participated in one or more physical activities, while 22.8 students participated irregularly and 10% didn't participate in any leisure activity. Majority of UG students were more and regularly involved in leisure-time activities; whereas PG students were irregular and less involved in leisure-time physical activities. The major activities performed by students were home exercising, walking, climbing staircases, dancing, yoga, skipping and jogging. Stairs can be found in most private homes, and stair climbing (at least 10 min per day) is considered a vigorous-intensity activity[22]. Females are more inclined to exercise in home-setting, practising aerobics, dancing, yoga, pilates or circuits with push-ups, squats, planks and jumping jacks. Furthermore, the lower variation in physical activity levels between before and during quarantine found in women is possibly explained by the higher amount of housework physical activity than males. Although the scientific community has highlighted the real benefits to stay active during the pandemic, the results showed a strong reduction of physical activity levels, especially for vigorous activity and walking. These data reflect the major difficulties to walk and perform an intense exercise at home, compared to moderate activity.[14].

A recent study insisted on home exercises as they did not require large spaces or equipment and can easily be practiced at all times of the day including chair squats, pushups, sit-ups, rope jumping, yoga, pilates, and Tai Chi. They also recommended that in the beginning exercise program should start at low intensities for short durations and progress slowly to more intense PA or exercise periods of longer durations.[6].

In a study, about 48% of physical activity and 49% energy expenditure were decreased in physiotherapy professionals and students during the lockdown period when compared to them before the lockdown period[15] (Article in press). Results from the studies [5] suggested that U.S. children performed less PA and engaged in more SB during the early-COVID-19 period as compared to before the pandemic and the most frequently reported physical activities were free play/unstructured PA (e.g., running around, tag, other active

games) and going for a walk, which shows a similar trend when compared to present study. The ICMR report [23] shows physical inactivity is very common in India and reported 54% people as inactive, it also states further that females are more inactive than males and less than 10% are engaged in recreational activities.

Involvement in household and skill-oriented physical activities showed that the majority of the students actively participated in household chores like dusting, cleaning, washing vessels, sweeping mopping, washing clothes manually among both groups. The maximum participation in skill related activity was seen in cooking activity with more than 80% involvement; followed by sitting and playing board games/video games and art and craft activities.

The involvement of female students in sedentary activities like watching TV, mobile usage for internet surfing, watching movies, playing video games, listening music, talking to friends/relatives; usage of computers/ laptops/ mobiles for online study purposes, involving sedentary behaviour was high. Similar findings were reported [24] but not during covid 19. In a study on two groups of school children, older children (9-14yrs) spent more time playing computer or video games, using the Internet/emailing/ electronic media for leisure, sitting while listening to music, and sitting talking on the phone/texting [5]. One of the studies reported that staying home for prolonged time might lead to sedentary behaviors, such as spending more time on sitting activities, playing games. Watching television, decreasing regular outdoor activity and exercises leads to an increased risk of chronic health conditions.[25].

Overall in the present study average time spent by the female college students on different activities like sleeping hours (8.9 hours/day), leisure-time activities (52.2 minutes/day) and household (97.3 minutes/day) physical activities was very much pronounced. Home exercising, walking, cooking, dusting and cleaning, sitting playing board games were the physical activities performed by students. Change in food habit pattern, sleep pattern and involvement in sedentary activities like watching television, listening to music, playing video games, surfing the internet, watching movies on mobiles/computer were reported.

V. CONCLUSION

The Covid 19 pandemic lockdown has presented many challenges to maintain a physically active lifestyle. The results of the study signified that irrespective of performing physical activity the students were adapting incorrect lifestyle patterns which might have an impact on their health status later. Thus, it is essential to guide the students to perform daily physical activity and to maintain a healthy lifestyle and minimize the sedentary behaviour during the lockdown. Physical activity and exercise can bring benefits like improving mood, sleep, and physical health should be explained.

VI. RECOMMENDATIONS

Physical activity and a healthy lifestyle pattern should be widely recommended for an active lifestyle and efforts are needed to promote it.

- Prioritize physical activity in your daily schedule to enjoy long term benefits along with immediate improvement in your well being.
- Participate in home exercises where minimal requirements are needed like walking, skipping rope, yoga, stationary activities like treadmill running, jogging, stepping/staircase climbing,

cycling in front/backyard of house

- Perform regularly disciplined leisure physical activities including light, moderate and some high intensity physical activities for at least 60 minutes per day like squats, lunges, lifting weights, push ups, pull ups, resistance exercise like pushing against wall and so on.
- Reduce time on screen based sedentary activities and increase time playing moderate indoor or outdoor physical activities for relaxing mind and body.
- Avoid sitting for longer period of time for weight management, take short breaks and do stretching
- Have goodnight sleep, avoid late night sleep, sleeping at odd hours.
- Follow healthy eating habits, avoid junk food and snacking at odd times, eat food that improves your immunity levels.
- Drink lots of water and keep yourself hydrated all the time.

LIMITATIONS OF THE STUDY

There are chances of data being over-reported and under-reported on physical activity as well as sedentary activities performed by the students. But to overcome this problem some data was verified.

The study could have been conducted using standardised physical activity questionnaires like IPAC, GPAC and others so that validity could have been assured.

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IMPACT OF COVID-19 ON ECONOMIC AND EDUCATIONAL STATUS OF SCHEDULED TRIBES

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ABSTRACT

The Covid-19 pandemic has spread across the world. Due to this pandemic, the immediate measure to control the spread of virus countries have adopted lockdown and implemented as well. In India, lockdown has had an uneven effect on healthcare system, economy and education. The multicultural with inequality Indian society characterized by vast inequalities like high population density, under prepared healthcare system and wide socio-economic disparity. This research paper focused on the impact of Covid-19 pandemic on scheduled tribal communities in India. The present research is of illustrative Research. For the purpose of study, information has been collected through secondary sources, such as research articles, reports on Covid-19 pandemic, reference books, and so on. The life style of tribal and their development is considered to be a subject of special concern and their lifeway, language, and culture, and their livelihoods are now again at stick during the COVID-19 pandemic.

The change in system drastically affects the socio-economic conditions, the environment, the cultural-political and the indigenous life style practices. Tribal migrants reportedly having problems accessing the PDS, rations should be made available at the doorsteps and PDS should be universalized. Indigenous communities are not advanced preparation for this pandemic and insufficiency cultural and logistical support. The unplanned remigration to their native place without income leads to more poverty and other allied economic and educational issues among scheduled tribes and other vulnerable communities. This research looks into the economic and educational aspects of covid-19 impact among scheduled tribes and elaborated the moral implications of the outbreak in India. There should be separate alternative plans can be incorporate within current covid-19 pandemic relief plans will be executed by policy makers and central and states governments of India.

I INTRODUCTION

In Globe, Covid-19 has been declared as a pandemic and it is threatening the worldwide (WHO, 2020; Singhal, 2020; Peeri et al., 2020). The Covid-19 impact on the world is yet to be fully assessed. Three seventy million indigenous people are living in over ninety countries. According to Clause (25) of Article 366 of the Indian Constitution, “Scheduled Tribes” means such “tribes or tribal communities or parts of or groups within such tribes or tribal communities” (Chandra 2011). According to Census 2011, India has 10.43 crores of scheduled tribes constitutes 8.6% of total population. Though, they represent a relatively small proportion of the entire Indian population of India. There are 705 individual ethnic groups notified as Scheduled Tribes in 30 States/UTs in India (Ministry of Tribal Affairs, 2014). They were at the “lower end of all indicators of standard of living and household properties” (Bhagat, 2013).

Indigenous peoples living on the margins of the society. Their way of life, culture and language have always been affected by many aspects of globalization and colonialism, and their livelihoods and lives are again at risk in the COVID-19 pandemic. In the background of COVID-19, this article explores the impact on education and economic sectors among scheduled tribes through the experiences of during the pandemic 'lockdown' in India.

Objectives of Study

- To highlight the impact of Covid-19 on education sector among scheduled tribes in India.
- To understand the impact of Covid-19 on economics sector among scheduled tribes in India.

II METHODOLOGY

The present research is of illustrative Research. This present paper focused on current education and economics status of scheduled tribes in India. The researcher focused covid-19 impact on scheduled tribes in education and economy. For the purpose of study, the materials were collected from secondary data like research articles, government data and reports on Covid-19 pandemic, reference books, and so on.

III COVID 19 PANDEMIC AND SCHEDULED TRIBES

The COVID-19 has reported first in Wuhan city of China in end of 2019. On 11 March 2020, World Health Organization (WHO) declared Covid-19 as ‘pandemic’ due to rapid (WHO, 2020). Worldwide, it has erupted in 784,794 reported cases and caused 37,788 deaths by 30 March 2020. Every country has stated following the concept of ‘lockdown’ and felt that it was the only means to curb the disease. It has become a cumbersome process for the government to maintain the total lockdown its correlation with the human culture could give better understanding.

The first Covid-19 positive case was reported in India on 30 January 2020 (MoHFW, 2020). In this very situation, India reacted quickly and effectively to the COVID-19

pandemic by implementing a three-week national lockdown on 25 March 2020, when 536 reported cases and 10 deaths (Ministry of Home Affairs, 2020). As a precautionary to combat the COVID-19 pandemic, lockdown was necessary to minimize the movement of the total 1.3 billion individuals in India (Gettleman & Schultz, 2020; Lancet, 2020).

The concept of 'social distancing' cannot be practiced as the entire habitations of these small communities are living in a small occupied area. In the present scenario, COVID-19 has affected all the sectors and had an uneven impact on the Indian society which strengthens vast inequalities like high population density, under prepared healthcare system and wide socio-economic disparity (Ferrante L and Fearnside PM, 2020). Consequently, the lockdown created uncertainty in everyday life of the marginalised communities added to their existing condition of poverty. The negative consequences of the lockdown on the deprived communities of the country are a major issue. These marginalised communities include day-to-day wage workers, migrants, marginal farmers, and tribes particularly affected during this period (Gracey M, and King M, 2020). Some aspects of impact of Covid-19 pandemic on tribal economy and education are discussed herein.

a. Education

The education sector is worst affected during pandemic. Many countries have been barred from taking classes at educational institutions, and thousands of students are not receiving high-quality education. Due to closure of educational institutions, there are 1.5 billion students from more than 165 countries and 0.32 billion students in India were affected as on 26 March 2020 (UNESCO, 2020).

Besides learning, school is also a place to provide meals for students from poor families. The closure of school closures temporary cessation of mid-day meals which has widespread and significant effects for the food security and nutrition of children across the country (World Food Programme 2013). Children from disadvantaged communities are at a higher risk of going hungry. Livelihoods of poor families are affected during lockdown and this is the time that food aid must reach out to poor families as soon as possible, if not, these children would go hungry.

This crisis has also shown that our education system is lacking in terms of digital preparedness. The outbreak of lockdown results in the education system through digital platform (Strielkowski, 2020; Kumar, 2020). The online way of teaching is also inaccessible to poor and marginalised students. Over this time of closure, the teaching-learning process have been undermined by the closure of educational institutions (India Today, 2020). Children with parents who are less educated would be at a disadvantage and are left to figure out themselves on how to utilize and learn via the platforms. COVID-19 has shown a huge gap in digital divide among our students. In order to learn online via these platforms, a student would need to have access to the platform and provide guidance to the children, parents would need to be educated. Covid-19 has speeded adoption of digital technologies for teaching and learning. Students from socio-economically unsound and disadvantage groups are the most suffering as they may not afford required technical gadgets and high speed internet connection for online learning. These will increase inequality among disadvantaged communities like scheduled tribal students.

Students are restricted to stay at home during this period; naturally they would feel restless physically and emotionally. Students are struck at homes during long lock down period and without adequate mentoring, counselling and online provisioning of education, serious concerns are expressed to have long term adverse impacts on emotional, psychological, behavioural patterns on the student's community and there is a need to support children to ensure their well-being and reduce anxiety during an emergency. The tribal students in higher education system are likely to enter the labour market or pursue further studies is the most critical factor for human capital and creating ideas and inventive capacity.

One of the unintended consequences is the mental well-being of children during this crisis. As highlighted by Winthrop, Therefore, it is important to ensure that there are strategies to help them cope with this "new normal" so that they could express their feelings on this new experience. The traditional rote learning and cramming of knowledge for examinations would not prepare our students for the work of the future. Furthermore, education is also not just about work or the economy; it is about equipping and training our young ones in a holistic manner. This is more than having the capability to earn a good income. This crisis is an opportunity for us to reflect and make changes to our education system.

b. Economy

The coronavirus pandemic has differential impact on different economic classes. Despite concerted efforts towards ameliorating income inequalities across and within nations, the pandemic is bound to widen the gap even more. The unexpected economic problems caused by COVID-19 is not only disruptive but has mass migration effects as it has caused product and service disturbances almost in every form of life activity. In India, informal economy face critical crisis where million dependent are engaged in informal sector (UNDP, 2020). The informal workers are worst affected by lockdown and they are less protected among all types of workers (ILO, 2020). It is estimated that over 91 million of these lost their employment in April 2020 and most hard hit among them are the informal and unorganized sector workers.

The COVID-19 pandemic had a significant effect on movement (Wellenius et al., 2020). In India, scheduled tribes are one of the socio-economically poorest communities mostly engaged in agricultural and allied works. The collection and sale of minor forest products (MFP) had significance as a source of additional income for the livelihood of tribes (Tripathy, 2020). The destructive effect of COVID-19 on the tribal economy is due to the lockdown time correlated with the harvesting season for collectors of minor forest products (MFPs). In the first phase of the nationwide lockdown, there was total restriction on MFP-related activities. From March to June period, MFP could not collect and sell by tribes even though they had collected MFP before lockdown due to restricted access over transport, weekly market and no buyers etc. (Senapati, 2020). The money earned by selling MFP is "critical for their (tribal people's) sustenance during the monsoon season when employments dry up" (Barik, 2020). On 6th May 2020, MONGABAY reported by Hridayesh Joshi which stated that "The nationwide lockdown has affected the economy of India's tribal population, which depends highly on the sale of minor forest products." The government should focus on MFP and ensure the economic sustainability (Ritwika Mitra, 2020).

Seasonal agricultural workers forced remigration to their natives. In a painful incident, a 12-year-old tribal girl who died of dehydration on her way back home migrated from Chhattisgarh to Telangana for chilli harvest (Verma, 2020). On 4th May, 2020, Ritwika Mitra (2020), arguing that “With tribal migrants reportedly having problems accessing the PDS, rations should be made available at the doorsteps and PDS should be universalized, it said. Tribal migrant workers stranded away from their hometowns without any ration, cash and community support were vulnerable to acute mental stress too.

c.OTHER IMPACTS

Before lockdown, North East Indian region scheduled tribes faced various forms of racial discrimination. There were twenty two reported cases of racial discrimination against the Northeast people from February 2020 to March 2020 in the country. Later, the Ministry of Home Affairs provides advice to all States to act appropriately when such cases of abuse are reported.

IV DISCUSSION ND RECOMMENDATION

The pandemic has intensified and challenged human well-being worldwide and this public health emergency induces panic and leads to a range of psychological effects ranging from emotional reactions such as anxiety, depression and drug misuse to changes in behaviour such as sleeping problems and stress eating (Liu et al., 2020).

In fact they have long historical crisis amidst famine and natural calamities; but they may have rarely been exposed to this kind of pandemic situation in their lifetime like the COVID-19 crisis. They need qualified doctor and medical facilities for healing themselves from this disease if they become exposed. But initially they will need social guidance, to heal their minds and also to empower them for this bale by incorporating their own worldviews; society needs to give them a structured guidance or at least empathic acceptance. Scientist have already stated that this virus cannot be completely wiped out within a short period of me and therefore only behavioral change of the populous might resist and protect the masses from becoming infected; among the tribal, this may only be done socio-culturally. In the context of low income to high-income countries, indigenous peoples have higher rates of poverty, mortality, and morbidity than their non-indigenous neighbours (Marmot, 2007, p. 1154). For several factors, indigenous peoples have a particular vulnerability to COVID-19. Chen (2020) has emphasized how a tribal community is being impoverished and left to handle its situation without support. Indigenous people also have limited access to clean drinking water, soap, personal protective equipment (PPE), and public sanitation, in addition to respiratory and other health problems that raise the risk of COVID-19 mortality (Ferrante L, and Fearnside PM, 2020).Studies in the pre-COVID period established that members of the SC/ST groups had comparatively higher risk of depression than higher castes.

This research paper focused on the economic and educational effects of COVID-19 pandemic on scheduled tribes in India. Scheduled tribal communities are not advanced preparation for this pandemic and insufficiency cultural and logistical support. The change

in system drastically affects the socio-economic conditions, the environment, the cultural-political and the indigenous life style practices. Tribes are mainly engaged in unorganized sector and that happened to be not able to hope up with uncertain pandemic. The unplanned remigration to their native place without income leads to more poverty and other allied social-economic issues. The literacy rate of marginalised communities lesser than national average and this pandemic also affected to these communities and made worse than current improvement.

The Covid-19 pandemic may leads to increase of school dropouts and decrease of Gross Enrolment Ratio (GER) among scheduled tribes and other vulnerable communities. There is need for special concern over tribal communities and their development. This community needs specific regional plans. There is urgent need for separate action plans based upon up-to-date information before COVID-19 creates destruction in scheduled tribes.. A close observation needs to be arranged by respecting their sentiments towards their religious beliefs and traditional medicines in relation to COVID-19 control and these should be acknowledged for enhancing their mental strength and minimizing stress. Awareness should be arranged by using native languages. Local advisory council should involve the respective Self Help Groups (SHGs) for more effective migration strategies against COVID-19.

Finally ensuring food and drinking water for every tribal villager irrespective of possessing ration card specifically for migratory tribal labor, even by involving tribal development officers in tribal dominated blocks throughout the country especially in northeast Indian states needs to be done. There should be separate alternative plans can be incorporate exclusively for scheduled tribes within current covid-19 pandemic relief plans will be executed by policy makers and central and states governments of India with the support of non-governmental organisations, civil organisations and etc.

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DINKELBACH BASED GREEN D2D COMMUNICATION MODEL FOR 5G AND IOT APPLICATION

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ABSTRACT

Green D2D communication provides the reliable communication between the different wireless devices which can be used for the maintaining the social distance, the COVID-19 warriors can be able to communicate with Doctors/Families even from the remote locations, and Health monitoring IoT applications. In the work, the Maximization of the Energy efficiency with resource allocation is achieved by using dinkelbatch based formulae with iterative algorithm for the data rate to achieve the optimal solution. Numerical analysis shows that; we achieve better results from the past practices. Dinkelbach based hi-speed Green D2D communication can be implemented in the present 5G/IoT applications and future 6G technologies to ensure the concept of energy conservation with utilizing the available limited energy resources with high data rate.

Keywords: 5G, IoT (Internet of Things), Energy efficiency, Resource allocation

I. INTRODUCTION

In the COVID-19, situation, the social distancing and health monitoring is important measures which should be implemented using the reliable mode of communication. Recently we saw there is a lot of devices and apps are available in the market to maintain the social distancing. But these devices are working in the unlicensed band for the purpose of communication. In the same the pattern the maximum of available IoT health monitoring devices, are working with the unlicensed domain. To ensure the communication reliability and achieve the highest data rate, the use of licenced band is required which is maintain by D2D inband communication. The inband D2D communication provides the efficient way of communication among the smart devices for IoT applications and 5G networks. We are highly motivated with the above mentioned problem and solution and start working in the domain of Inband D2D communication. To maintain the quality of services and reliability higher data is expected which is mentioned in the work. In the D2D communication, for the resource management, there are three types of schemes are present named as cellular mode, dedicated mode and shared mode of communication. In the shared mode communication, the radio channel is shared by both the cellular user device and D2D user devices [1]. Radio resource management is the challenge for the D2D communication which can be solved by energy efficient resource allocation schemes [2]. In [3], author explain the resource sharing between the cellular and D2D links, with improving the QoS (Quality of services). D2D communication resource management for the broadcast communication is done with increasing the communication distance capabilities [4]. The optimization on the basis of maximum sum rate of cellular model is done to increase the throughput [5]. The optimization with SINR to allocate the resource is done with using Lagrange multiplier to enhance the capacity of the number of D2D users [6]. An energy efficient with resource allocation LDD scheme is proposed for advanced cellular networks [7]. In the work [8], author utilizes the three modes CM, DM, CoopD2D mode for the enhancing the energy efficiency and data rate. With the above mentioned literature review and motivation to achieve the better (Quality of Services) QoS and reliability we focus on the energy efficient and higher data rate characteristics of D2D communication. Our work presents the Green D2D communication concept and highlights and author contribution to the works is mentioned below.

1. We do the literature survey for investigating the facts and fundamentals of D2D communication.
2. Explore the concept of Green communication.
3. Proposed the problem and DREE (Data Rate and Energy Efficient) Algorithm.
4. Analyze the results of our proposed algorithm.

The paper comprises with communication model and problem formulation in Section-II. Section-III presents the Proposed DREE Algorithm. The numerical analysis of proposed algorithm with different communication parameters is mentioned in the Section-IV. Section-V concludes the work with their future vision.

II. SYSTEM MODEL AND PROBLEM

The random arranged devices in a cellular region comprises of different cellular user device (CUD) and D2D user devices (DUD) and the resources being shared by them with utilising the cellular spectrum. In the single cell we consider that

$$L = \{1, 2, 3, \dots, L_{CUD}\},$$

$$R = \{1, 2, 3, \dots, S\}$$

$$D = \{1, 2, 3, \dots, t\}$$

that $t \leq L_{CUD} = S$

where L, R, C denotes the set of CUD's and the shared resource slots R_S and D2D users DUD's respectively, m-th resource slot allocated to cellular user device are reused by the k-th cellular user CU. Let us assume that H_{km} is the transmit power of the transmitter of the k-th user on the m-th resource slot R_S and H_{TP} represents the base station transmission power.

Let DR represents the data rate of DUD.

$$DR = W \log_2 \left(1 + \frac{H_{km} F}{H_{TP} f + AWGN} \right) \quad (1)$$

Whereas W and AWGN denotes the bandwidth, additive white gaussian noise. F, f are modalities that considers all the path loss as well as fading effects.

To save the energy we assume that we use several energy saver devices and automatic power generation devices (Like the piezoelectric and rectenna) that actually avails the low power and overall power consumption can be minimized.

Let us assume P_{GN} = value of power generation devices

The total power value for the Communication can be represented as

$$P = \sum_{m=1}^S \sum_{k=1}^t Q_{km} H_{km} - P_{GN} \quad (2)$$

The Green D2D communication can be formulated as Λ_{ee}

$$\Lambda_{ee} = \frac{\sum_{m=1}^S \sum_{k=1}^t Q_{km} DR - P_{GN}}{\sum_{m=1}^S \sum_{k=1}^t Q_{km} H_{km} - P_{GN}} \quad (3)$$

Here, DR is data rate, and $Q_{km} \in \{0, 1\}$ shows that m-th resource slot is given to the k-th of the wireless user.

The Green D2D communication optimization can be mathematically represented as

$$\text{Max}_{Q_{km} H_{km}} \Lambda_{ee} \quad (4)$$

$$\text{Subject to. } Q_{km} \in \{0, 1\}, \forall k \in D, \forall m = S, \quad (5)$$

$$\sum_{m=1}^S Q_{km} = 1, \forall k \in D, \quad (6)$$

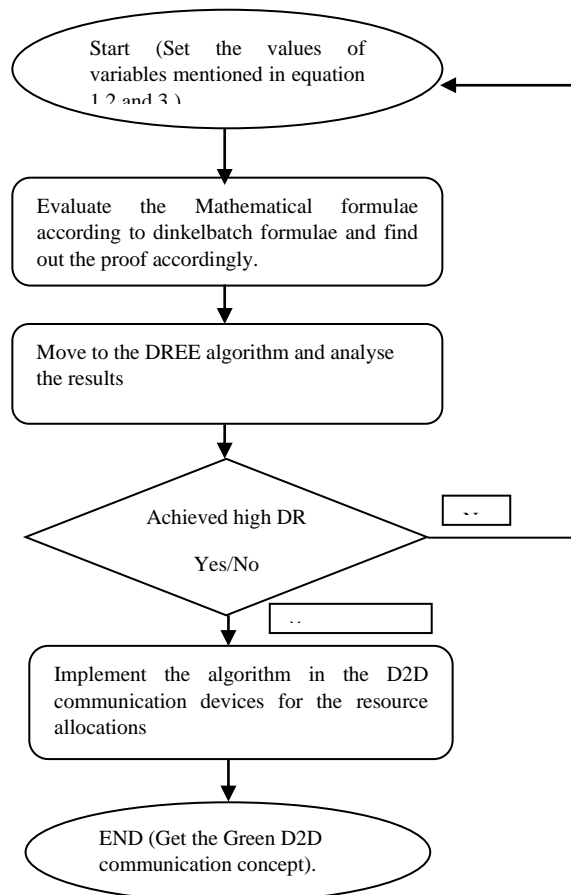
To solve the equation no 4, with eq no 5 and 6, we can use several optimization technique methods like PSO, branch and bound, game theory etc. In our work, we proposed the DREE algorithm to solve the above-mentioned problem.

III. PROPOSED DREE (DATA RATE AND ENERGY EFFICIENT) ALGORITHM

The DREE (Data rate and energy efficient) algorithm provides a platform to enhance the capabilities of D2D communication devices in the terms of data rate for high speed computing devices with considering the low power values and energy efficiency. The DREE algorithm utilizes the dinkelbatch and iterative process to achieve the Energy efficiency with higher data rates. The proof of the DREE algorithm for the Energy efficient is same as proof [12].

Tabular chart I: List of abbreviations

CUD	Cellular User Device
DUD	D2D User Device
AWGN	Additive White Gaussian Noise
D2D	Device to Device
IoT	Internet of Things
QoS	Quality of Services
DREE	Data Rate Energy Efficient
COVID-19	Coronavirus diseases



Flow process to achieve Green D2D communication

Figure.i flow process to achieve green d2d

DREE algorithm: Iterative process for D2D resource slot distributions

Step 1	Set the number of iteration $n=0$, value of α , and equation number 4 equals to $U(Z_i)$, where $Z_i=0$
Step 2	With present value of Z_i optimize the value of DR and H_{km}
Step 3	Get the New values of DR and H_{km} and goto step number 1 with $n=n+1$;
Step 4	Repeat the Step 1, 2, 3 until $U(Z_i) < \alpha$

IV. NUMERICAL RESULT

In this section, we evaluate the performance analysis of DREE algorithm on the simulation tool with our proposed algorithm. For the purpose of analysis, we consider a cellular architecture with approximate radius of 100 metre, and all the mobile devices have same level of transmit power value with including the Energy saver and power saving effects. Other important system values are mentioned below as a Tabular Chart-II.

TABULAR CHART-II

Cell radius	100 meter
Noise	-174dbm/Hz
Threshold value	20 mW
Power Generation value (P_{GN})	0.2 W
Base station transmission power (H_{TP})	1 W
Bandwidth value (W)	2 MHz

After considering all the system values and initial values of parameters, the result of simulation run is achieved with efficient performance of proposed DREE algorithm.

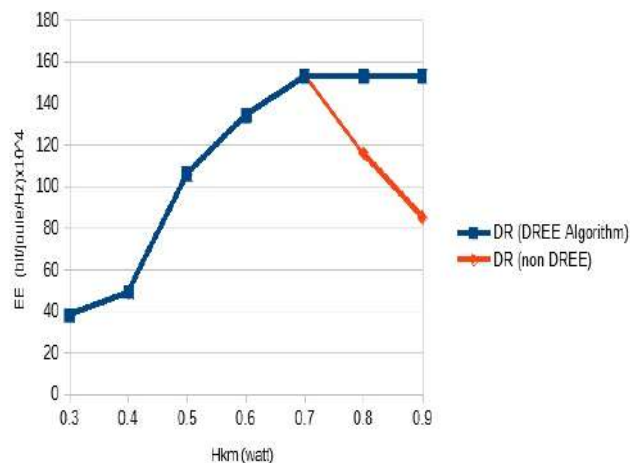


Figure II- EE Graph Of DREE Algorithm And Non-DREE

In figure 2, the performance evaluation of proposed DREE algorithm versus non-DREE is represented. It is clearly seen from the figure that our proposed algorithm is

Energy efficient and the EE value is increases with the increase and attain a constant value, whereas in the case of non-DREE algorithm, when the power value is increases there is decrease in the value of EE.

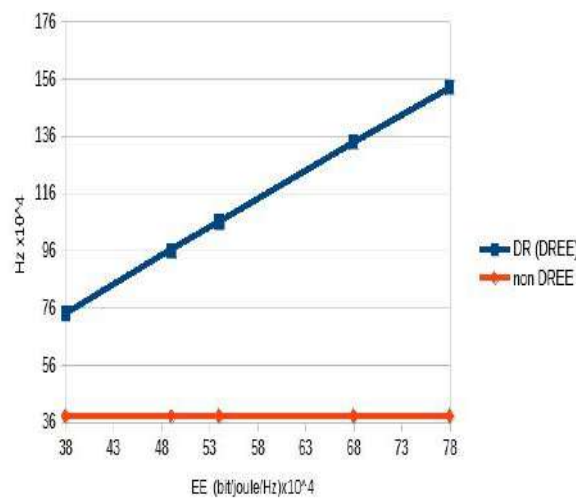


Figure 3. EE versus data rate

In the Figure 3, the graph shows the relationship between the data rate and EE for our proposed DREE algorithm as well as Non-DREE algorithm. It has been from above mentioned figure 3 that data rate of proposed algorithm is increases with EE and have great performance from the prevail researches. Proposed algorithm improves the data rate with Energy Efficiency in comparison of [4,5,8] mentioned algorithms/ scheme for resource allocation. Our proposed algorithm and Green D2D communication model provides a new energy efficient paradigm with optimized data rate and power value.

V. CONCLUSIONS

With the effectiveness of our proposed DREE algorithm, and framework of Green D2D communication, the implementation of Social distancing and Health monitoring in the COVID-19 situation can be done smoothly with efficient communication reliability. The work concludes an energy efficient method for the resource management in D2D communication to achieve optimized high data rate. The numerical results reflect the performance evaluation of DREE algorithm and importance of Green D2D communication from prevail technologies. The DREE algorithm and concept of Green D2D communication framework can be further implemented to enhance the capabilities of 5G and IoT devices for fast computing devices.

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AN OVERVIEW ON HISTORY OF PANDEMICS AND THE OSCILLATING TRENDS OF INDIAN ECONOMY AMID COVID-19

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ABSTRACT

The outbreak of the COVID-19 pandemic has disrupted the global economic system. The first epicenter of this pandemic was Wuhan city, the capital of Hubei province in China which is one of the largest transportation hubs of China. The aftermath of the pandemic spread saw, many countries imposing nationwide lockdowns and shutting down their economic activities as well as transportation services including sea ports and Airports. With respect to the Indian scenario lockdown had a huge impact on the Indian economy confirmed by a sharp decline in the GDP growth rate. The eight main core sectors of Indian

economy were also not been able to remain intangible. The current study provides a clear cut depiction of the global pandemic in the past and the effect of COVID-19 on the India economy.

Keywords: COVID-19, Global Economy, Core Sector, GDP, Trade and Commerce

I. INTRODUCTION

In the first quarter of 2020, the world witnessed, the spread of a deadly pandemic. It was acknowledged as the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-Cov-2), later renamed as Corona Virus Disease-19 (COVID-19)[1]. As per WHO (world health organization), the outbreak originated from Wuhan city, which is situated in the Hubei province of China. The spread of this virus was much faster than expected across the globe, resulting in huge economic slowdown and human tragedy. By mid-September, there had been over 29.1 million cases of COVID-19 across the world, with over 926,000 casualties. The worstly affected countries have been USA, India, Brazil, Russia, and Peru.

To prevent the gradual spread of COVID-19, regimes have adopted numerous health measures, in the absence of vaccines. The most entrancingly used measure adopted has been related to maintain a safe distance from other individuals, which has been unanimously termed as social distancing[2]. As part of social distancing procedure many countries across the globe have imposed lockdown of businesses, schools, NGOs, transportation services, community centers, mass gatherings, etc. Only allowing for essential needs, many countries have taken very strict decisions such as curfew to impose social distancing and lockdown properly. Due to lockdown, approximately 4 billion people have been forced to live in their houses. The motive behind such measures have been to reduce the number of COVID-19 active cases in order to stop the exponential growth ("flatten the curve") and minimize the pressure on health facilities [3].

The result of spreading COVID-19 may be visualized in terms of significant deceleration of economic activities. As per an earlier forecast by the international monetary fund (IMF) in April 2020, it was expected that the global economy would contract by 3% in 2020. However, in the latest update (June 2020) IMF revised the forecast to 4.9% shrinkage in 2020. The report cites some key aspects for the revised estimate like restricted activity in lockdown, more persistence in social distancing activities, deterioration in productivity among corporations which were opened for business, greater uncertainty. The economic consequences are expected to be uncertain and highly fluctuating, with varying effects on the financial and labor markets, production supply chains, and eventually the entire global economy. To further worsen the scenario created by this pandemic, the mitigation strategies adopted by the global regimes can result in problems like mental health hazards in common citizens, upsurge in economic inequality, distrust, and frustration in the mind of the common man against the ruling governments and ultimately damage the socio-economic fabric of the society.

II. BACKGROUND

A) *History of pandemic and economic aspect*

Pandemics are not novel for human beings, they have occurred at different stages in human history. A historic timeline of major pandemics across the globe has been enlisted in Table 1. While there have been similar outbreaks and human disaster in the past, yet there has been a remarkable growth in the frequency of such pandemics from the year 2000 and later than. This is circumstantially due to the embossing of viral disease amongst animals [4].

Table I: Major pandemics: historical timeline

Name	Period	Type/Pre-human host	Estimated death toll
Antonine Plague	165-180	Believed to be either smallpox or measles	5 million
Japanese smallpox epidemic	735-737	Variola major virus	1 million
Plague of Justinian	541-542	Yersinia pestis bacteria/rats, fleas	30 to 50 million
Black Death	1347-1351	Yersinia pestis bacteria/rats, fleas	200 million
New World Smallpox Outbreak	1520-onwards	Variola major virus	56 million
Great Plague of London	1665	Yersinia pestis bacteria/rats, fleas	100,000
Italian Plague	1629-1631	Yersinia pestis bacteria/rats, fleas	1 million
Cholera Pandemics 1-6	1817-1923	V. cholera bacteria	1 million+
Third Plague	1885	Yersinia pestis bacteria/rats, fleas	12 million (China & India)
Yellow Fever	The late 1800s	Virus/Mosquitoes	100,000-150,000 (US)
Russian Flu	1889-1890	H2N2 (avian origin)	1 million
Spanish Flu	1918-1919	H1N1 virus/pigs	40 to 50 million
Asian Flu	1957-1958	H2N2 virus	1.1 million
Hong Kong Flu	1968-1970	H3N2 virus	1 million
HIV/AIDS	1981-present	Virus/chimpanzees	25 to 35 million
SARS	2002-2003	Coronavirus/bats, civets	770
Swine Flu	2009-2010	H1N1 virus/pigs	200,000
Ebola	2014-2016	Ebolavirus/ wild animals	11,000
MERS	2015-present	Coronavirus/bats, camels	850

Source: World Economic Forum (2020) [5][6]

B) Some prominent epidemics in India

Name	Period	Type/Pre-human host	Probable death toll
Sixth Cholera	1910-1911	Vibrio cholera strain	800,000
Spanish Flu	1918-1920	The strain of avian influenza	17-18 million
Smallpox Epidemic	1974	Variola virus	15000
Plague in Surat	1994	Bacterial Strain Yersinia pestis	56
SARS	2002-2004	SARS CoV	0
Dengue and	2006	Dengue Virus/Chik virus	50

Chikungunya outbreak			
Swine Flu outbreak	2014-2015	Virus H1N	2000
Nipah Virus outbreak	2018	Nipah virus/fruit bats	17

Source: World Health Organization [7].

C) Evolution of COVID-19

The earliest symptoms of the spread was reported from a wet market in Wuhan, China on December 8, 2019. Later on, quite a lot of clusters of patients with such symptoms were reported throughout the second half of December 2019 [8]. Table 2 provide an itinerary of key events, beginning from January 2020.

Table II: Covid-19 timeline

Date	Events
4 January 2020	WHO reports a cluster of pneumonia cases in Wuhan, China
7 January 2020	WHO identifies COVID-19
11 January 2020	China announces 1 st death from COVID-19
13 January 2020	1 st official case of COVID-19 reported outside China in Thailand
17 January 2020	Authorities in Nepal, France, Australia, Malaysia, Singapore, South Korea, Vietnam, and Taiwan confirm cases
21 January 2020	1st case of COVID-19 reported in the United States of America (US)
22 January 2020	WHO finds evidence of human-to-human transmission from China
23 January 2020	China imposes lockdown in the cities of Wuhan, Xiantao, and Chibi of the Hubei province
30 January 2020	WHO declares COVID-19 to be a Public Health Emergency of International Concern
30 January 2020	India reported 1 st COVID-19 cases
31 January 2020	US declares COVID-19 a domestic public health emergency
2 February 2020	1st death due to COVID-19 outside of China in the Philippines
9 February 2020	The death toll in China surpasses that of 2002-03 Severe Acute Respiratory Syndrome (SARS)
14 February 2020	Egypt reports 1st case of COVID-19, the 1st case in the African continent
15 February 2020	France reports 1st death from COVID-19 outside of Asia
23 February 2020	COVID-19 cases rise in Italy in what becomes the largest outbreak outside of Asia
26 February 2020	Brazil confirms 1st case of COVID-19, the 1st case in South America
27 February 2020	1st case of community transmission reported in the US
29 February 2020	1st death due to COVID-19 in the US
8 March 2020	Over 100 countries report COVID-19 cases Italy imposes quarantine in the Lombardy region
11 March 2020	WHO declares COVID-19 a pandemic
13 March 2020	Donald Trump declares a national emergency in the US
17 March 2020	All 50 states in the US have at least one confirmed case of COVID-19 California first state to implement 'stay-at-home' order in the US
19 March 2020	Italy's death toll surpasses that of China
21 March 2020	EU suspends public deficit rules to inject fiscal stimulus across countries
25 March 2020	The White House and Senate leaders of both the Democratic and Republican parties in the US agree on a US\$2 trillion stimulus to aid workers, businesses, and the health-care system in response to the pandemic
26 March 2020	US leads the world in COVID-19 cases
2 April 2020	Global cases of COVID-19 reach 1 million
8 April 2020	China lifts lockdown in Wuhan, 76 days after it was sealed off to contain COVID-19

11 April 2020	The US records 2,000 deaths in one day, the highest single-day death toll recorded by any country
15 April 2020	Global cases of COVID-19 reach 2 million
24 April 2020	US's death toll surpasses 50,000
27 April 2020	Global cases of COVID-19 reach 3 million
28 April 2020	COVID-19 cases in the US surpass 1 million
21 May 2020	Global cases of COVID-19 surpass 5 million
22 May 2020	Brazil surpasses Russia as the country with the 2nd highest number of cases, after the US
27 May 2020	US's death toll surpasses 100,000
9 July 2020	US surpasses 3 million COVID-19 active cases
11 July 2020	US recorded the highest single-day spike in COVID-19 Active cases in the world 77,638
16 July 2020	India cross 1 million COVID-19 cases
30 August 2020	India Records world's highest single-day COVID-19 spike with 78,761

Source: Records from the Coronavirus Resource Center, John Hopkins University[3]

Table III: Some major event of covid-19 in india

Date	Events
30 January 2020	India reported its 1 st COVID-19 positive cases
12 March 2020	India reported its 1 st death from COVID-19
24 March 2020- 31 May 2020	India imposed a nationwide lockdown in four Phases
18 May 2020	India crosses tally of 1lacks active cases of COVID-19
21 May 2020	Indian government announce stimulus worth of \$265 billion
1 June to Till now	Started Unlock of 1.0
16 September 2020	India cross tally of 5 million active COVID-19 cases

Figure 1 illustrate the accumulative cases and casualties from the pandemic. As of 21 September 2020, the total cumulative cases had crossed 31.2 million, while there were 965,178 casualties across the world. Table 4 represents the top ten countries in terms of COVID-19 cases and deaths. The table illustrates that the U.S, India, Brazil, Russia, Peru, Colombia, Mexico, South Africa, Spain, and Argentina are top worstly affected countries.

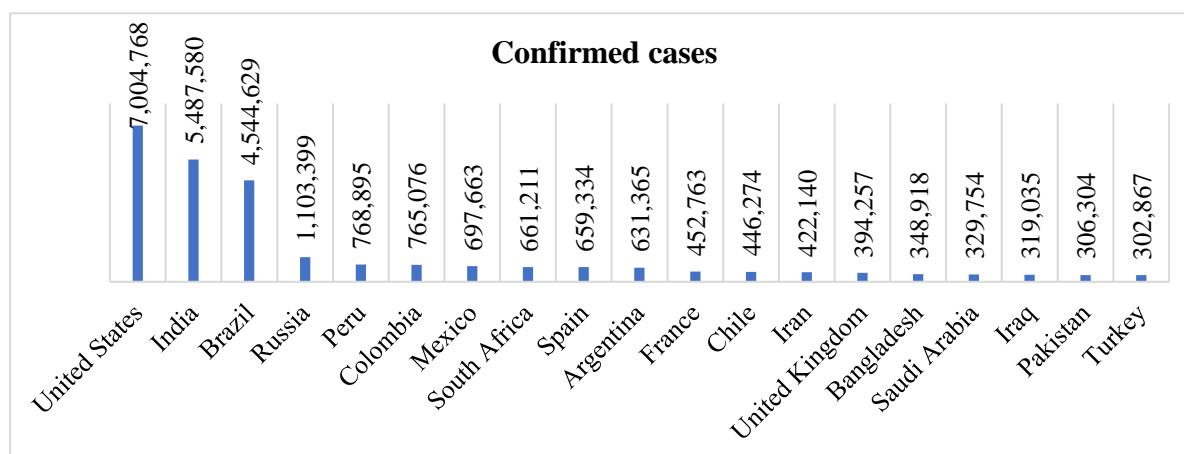


Figure I: Covid-19 confirmed cases and deaths global pandemic (as on 21september 2020)

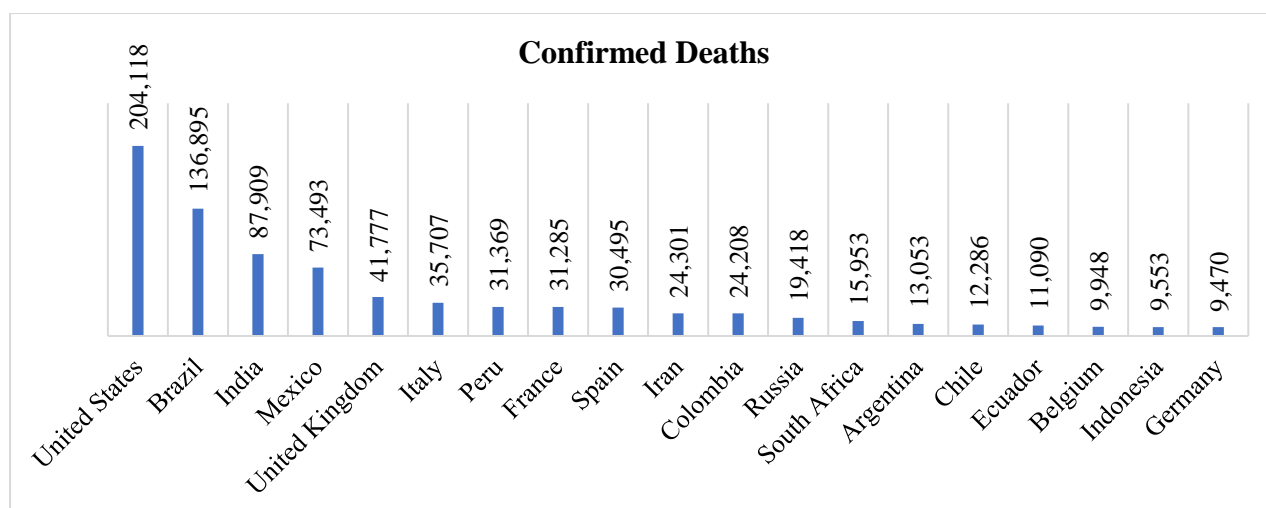


Table IV: Cumulative cases top 10 countries (as 21 september 2020)

Rank	Country	Confirmed cases	Rank	Country	Confirmed deaths
1	United States	7,004,768	1	United States	204,118
2	India	5,487,580	2	Brazil	136,895
3	Brazil	4,544,629	3	India	87,909
4	Russia	1,103,399	4	Mexico	73,493
5	Peru	768,895	5	United Kingdom	41,777
6	Colombia	765,076	6	Italy	35,707
7	Mexico	697,663	7	Peru	31,369
8	South Africa	661,211	8	France	31,285
9	Spain	659,334	9	Spain	30,495
10	Argentina	631,365	10	Iran	24,301

Sources: Statistics from the coronavirus resource center, John Hopkins University[9].

Compare to the earlier pandemic, COVID-19 has an inconsistent impression on the elderly from a healthy outlook. The lockdown measures, though, are additional global in scope and scale than their ancestors, and they have to interrupt the global supply chain as well as cumulative requirement and consumption outlines. This in turn has run to sharp financial market instability and amplified the economic shock. Additionally, bigger borrowing and higher liability level among corporations and households throughout this time make the short term shocks more impactful compared to earlier pandemics [10].

III. IMPACT OF COVID-19 ON ECONOMIC AND FINANCIAL

To comprehend the potential unassertive economic impression of COVID-19, it is very significant to recognize the economic transmission channel by which the shock will adversely distress the economy.

A) *Global Economic implication*

The outbreak of COVID-19 is already having a damaging economic and business impact, affecting everything from aviation to tourism, supply chain to FMCG, manufacturing to

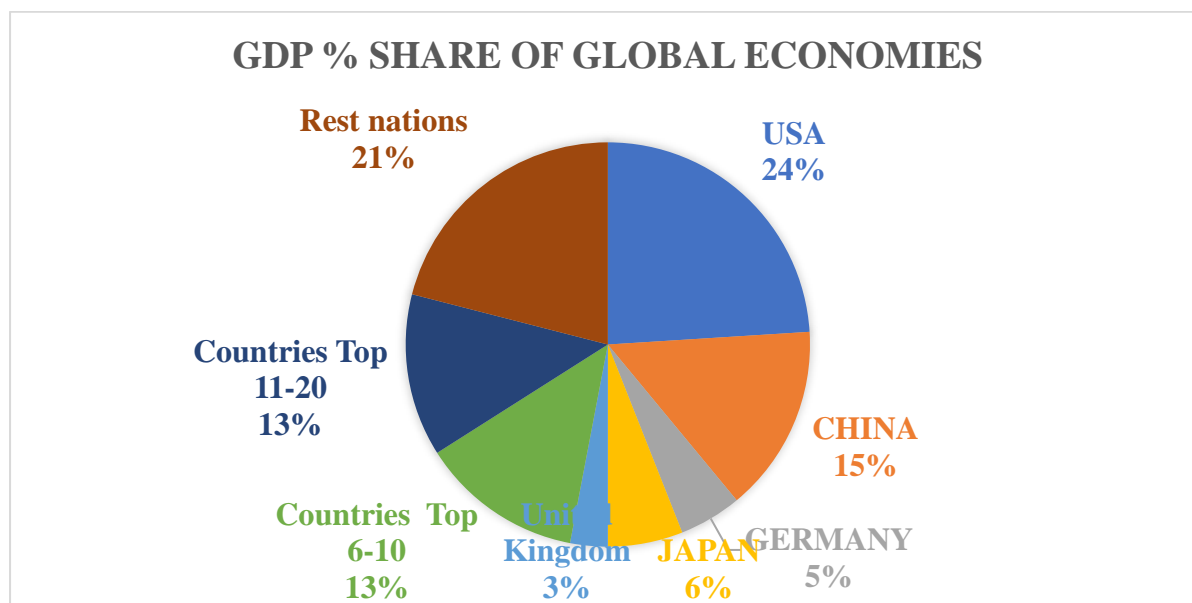
technology industries. The impact of COVID-19 on the global economy can be lye mainly three ways: i) It can directly affect production ii) Its financial impact on firms and financial markets iii) it can lead to disrupting the supply chain and consumption market.

It is very crucial to know about the contribution % of GDP in the global economy by different countries to understand the impact of COVID-19 on the global economy. The different phases of the economic cycle have an oscillating effect on the global economy, perhaps since 40 years 17 out of 20 top economies didn't budge from their position. These economies are known as the engine of growth and commanding a majority of the global wealth. The nominal GDP of the top ten economies is contributing about 66% of the global economy, the top twenty economies contribute up to 79% of world GDP, and the remaining 173 economies contributing less than one-fourth of the world economies[11].

Nominal GDP= Gross domestic product, current prices, U.S. dollars

GDP based on PPP= Gross domestic product, current prices, purchasing power parity, international dollars.

FIGURE II: % GDP SHARE BY GLOBAL ECONOMIES.



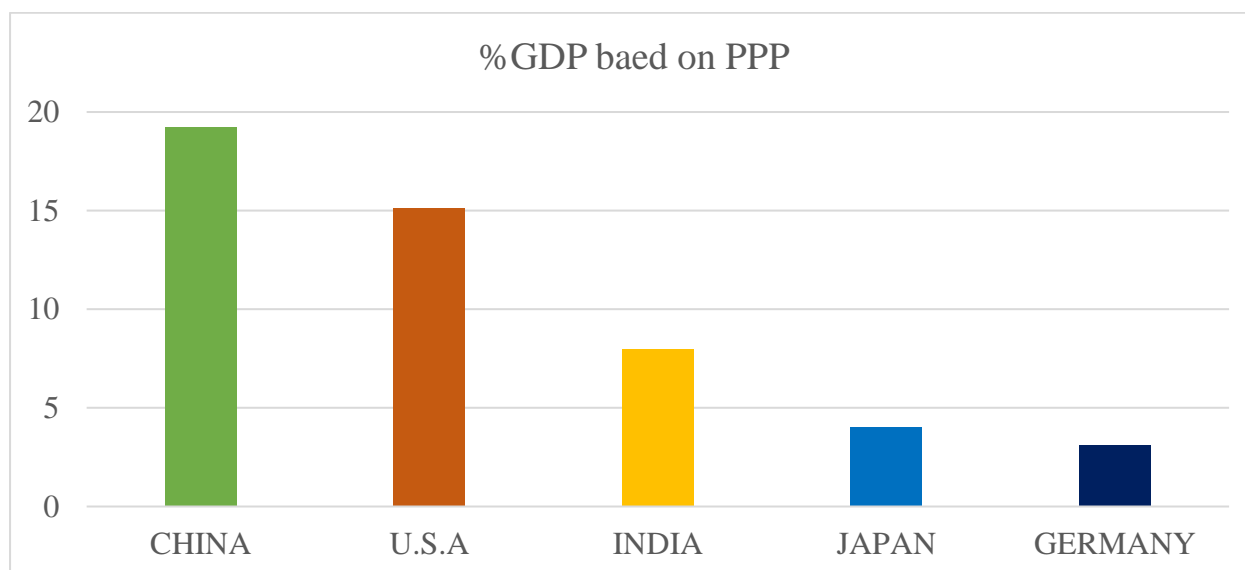
Source: IMF’s World Economic Outlook Database, October 2019[12].

Figure 2 shows the nominal GDP percentage share of the global economies, in which major contributors are the U.S.A. (24%), China (15%), Japan (6%), Germany (5%), and United Kingdom (3%). As per the IMF outlook in October 2019, it is visible that the top 6-10 countries and top 11-20 countries share GDP % is 13% and 13% respectively. Perhaps the rest of nations contribute around 21% of share in global GDP.

Figure 3 shows the % GDP contribution based on the PPP, where the top five contributors are China (19.25%), U.S.A. (15.11%), India (7.98%), Japan (4.05%), and Germany (3.13%). Out of these five economies, four are top economies contributing to global GDP both in terms of nominal GDP and GDP based on PPP. It is also visible that in PPP contribution

China has outclassed the United States of America, so these nation's economic health are decisive units for the future of the Global economy post corona pandemic.

Figure III: Top 5 countries with the largest proportion of the global GDP based on PPP.



Source: IMF's World Economic Outlook Database, October 2019 [12]

B) *Economic Implication: Indian Context*

Economic development matters very to a great extent if concerned with developing countries like India. Where so many factors get involved in making the nation progressive and competitive with the world's developed economies, as it is known that economies completely depend on the function of demand and supply chain. There will be not any supply until the demand reaches the suppliers. But demands are too changed with the current pandemic period, people are bound to arise their limited and essential demand only and so suppliers are also limited. This is ultimately hampering the economy as this function has disturbed and with that developing nations re facing drawbacks in their existing positions.

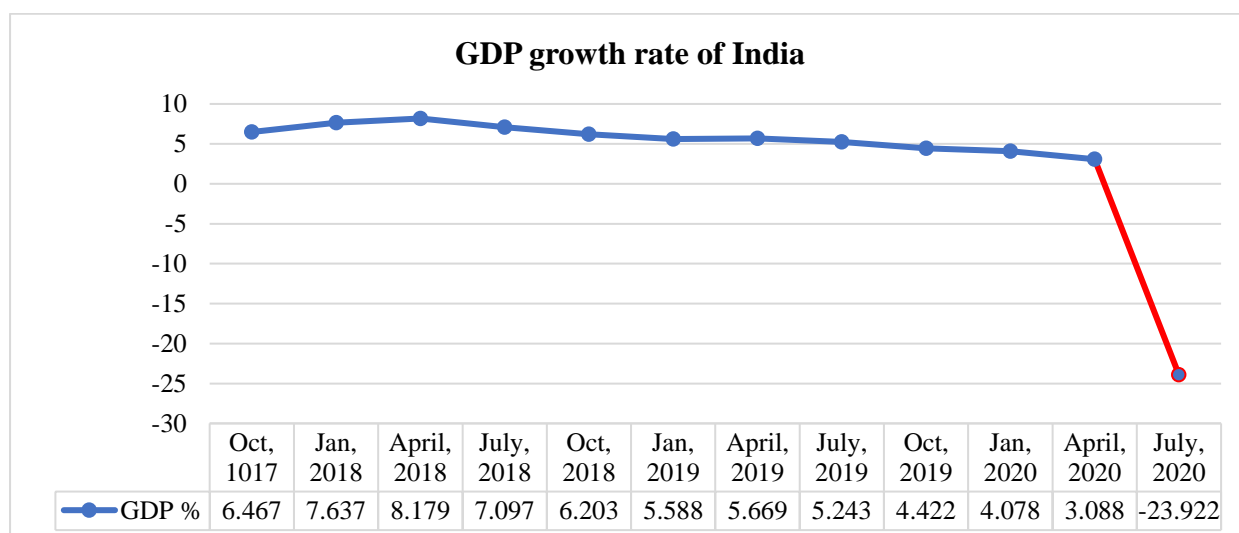
Steps toward the lockdown of the nation as the pandemic outbreak worldwide was taken by the Government of India in the month of mid-March, 2020 to control the spread of COVID-19. Shutting down the cities, businesses or all the running economics activities have emerged as a break towards developing the economy. It, in due course of lockdown, has slowed down and hampered the speed of the economic transition of India. Some big industrializes states of India like Gujarat, Maharashtra, Karnataka, and Delhi have been converted into the most shattering and devastated in terms of economic contribution. Lockdown is not that easy to be implemented but it has some bitter consequences. Both global markets are tightly interconnected in this new era. It will have a low to large influence globally if it occurred in some regions of the world. This would have a significant impact on one of the largest economies like China in the world. Worldwide, over 25 million workers are reported to be affected by corona-virus spread by the international labor organization (ILO)[13].

a) Growth of Indian Economy

India is situated at the fifth number in the world, in terms of GDP of \$2.94 trillion, by surpassing the United Kingdom and France secure position 5th in the year of 2019. In PPP terms India's GDP is about \$10.51 trillion, exceeding that of Japan and Germany. India secures the position 3rd in the global contributors in the world GDP. India's GDP growth premium over the emerging economies is observed dipping to a seven-year low of 1.1% in current fiscal 2019-20 (FY20), mostly because of slow demand, weak investment, credit issues, rising inflation, and currency fluctuations as per data released by IMF. India has also declined in the GDP growth rate like other economies, which are in the top list of global GDP contributors. The GDP of India has expanded 4.7% YoY in Dec 2019, following a growth of 5.1% in the previous quarter. As per Central Statistics reports, the nominal GDP of India reached up-to \$728.6 bn in December 2019 and its GDP (deflator implicit price deflator) increase raised 2.9 percent in December 2019. Per capita GDP in India reached \$2044.6 in March 2019. The real GDP of India keep decelerating to its lowest in the last two financial years, in Q3 2019-20 [14]

India's real GDP showed that GDP braked to its deepest in the last six years in the 3rd quarter 2019-20 and the outburst of the COVID-19 posed additional challenges. Steps taken to comprise its spread, such as nationwide constraints for twenty-one days and a whole lockdown of the province, have conveyed economic activity to cessation and could sway both consumption and investment. While Indian corporates, excluding a few sectors, can probably isolate themselves from the global supply chain distraction caused by the outburst due to relatively minor reliance on intermediate imports, their exports to COVID-19 pandemic-ridden nation could take a hit. In sum, three main contributors to GDP are private consumption, investment, and external trade will be exaggerated[15].

Figure IV: Quarterly gdp growth of india (base year: 2011-12 at current prices)



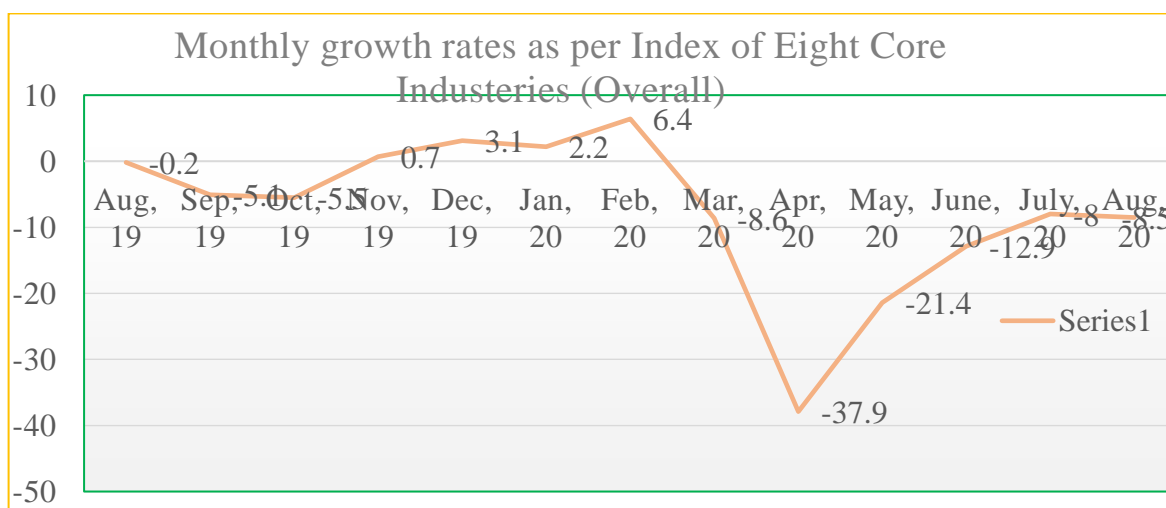
Source: Ministry of Statistics and Programme Implementation[16].

Figure 4 shows the quarterly GDP growth of India, for the financial year 2020-21 quarter 1st GDP growth is set a record contraction up to 23.9 %, which is ultimately the result of strict lockdown and shutdown of all economic activities. It leads to an increase in the inflation rate, fiscal deficit, employment rate, poverty.

b) Sectoral Impact

Indian sectoral growth has been shown a sharp decline due to the COVID-19 pandemic and it seems that it will take more time to recovery. The growth in the eight core sector's output has been contracted by 13% YoY on June 20, slower than the negative growth of 38 % on April 20, and 22% in May 2020. Other than fertilizers, all other core sectors have recorded contraction in growth. The low pace of contraction in June, July, and August 2020 indicates the relaxation in controlling people's movement since June 1st, 2020[17].

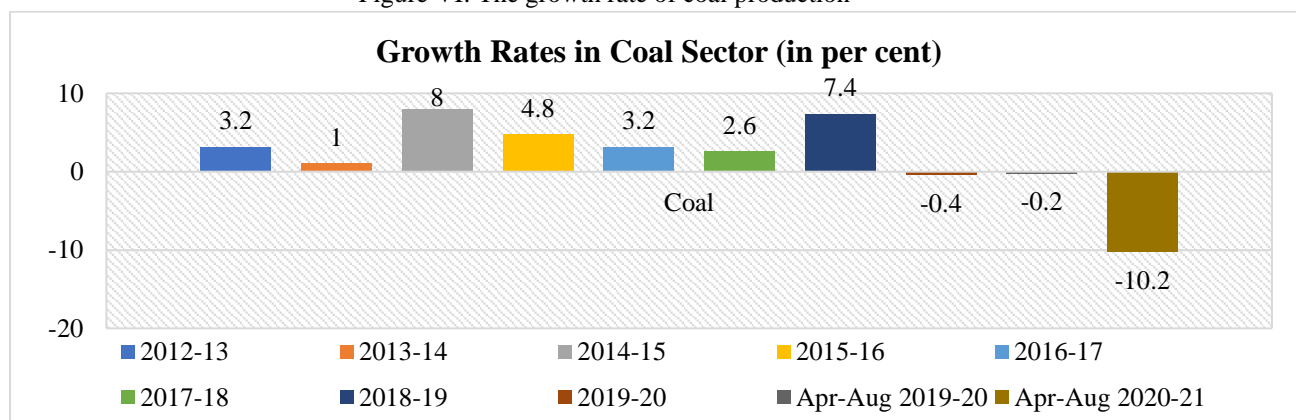
Figure V: Eight core sector growth rate (monthly).



Source: Ministry of Commerce and Industry[18].

Coal Production of coal raised by 3.6% in August 2020 over August 2019. The cumulative index declined by 10.2% from April to August 2020-21. (YoY)

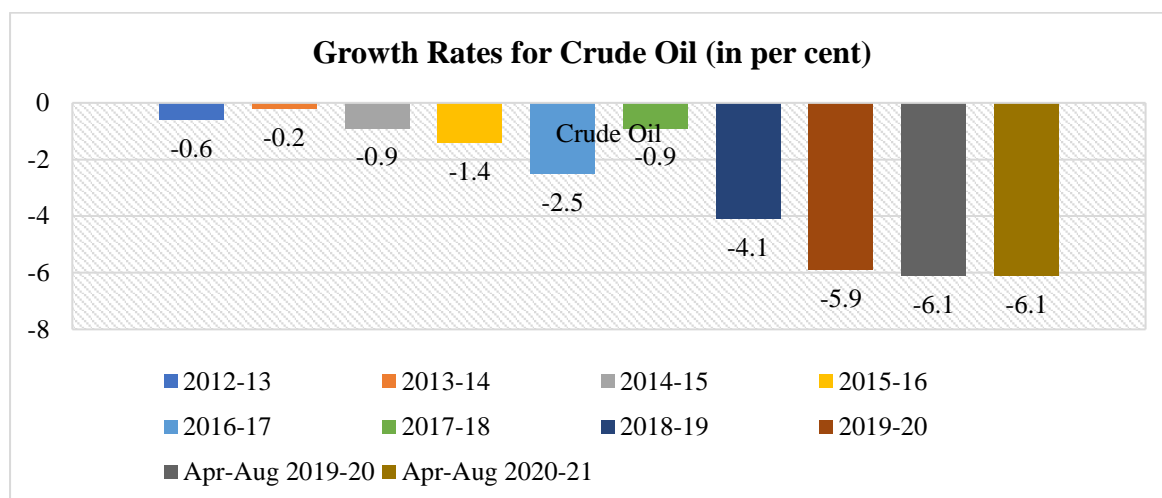
Figure VI: The growth rate of coal production



Source: Ministry of Commerce and Industry

Crude Oil: Production of Crude Oil has been declined by 6.3% in August 2020 over August 2019. The cumulative index declined by 6.1% from April to August 2020-21. (YoY)

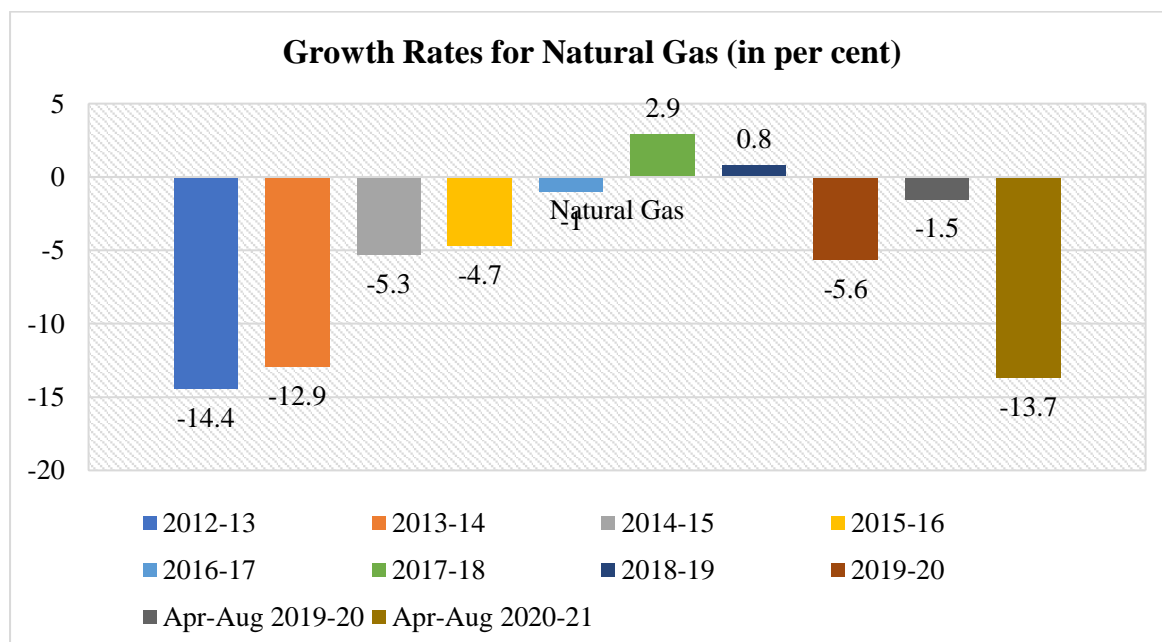
Figure VII: The growth rate of crude oil



Source: Ministry of Commerce and Industry

Natural Gas: Production of Natural Gas has been declined by 9.5% in August 2020 over August 2019. The cumulative index declined by 13.7% from April to August 2020-21. (YoY)

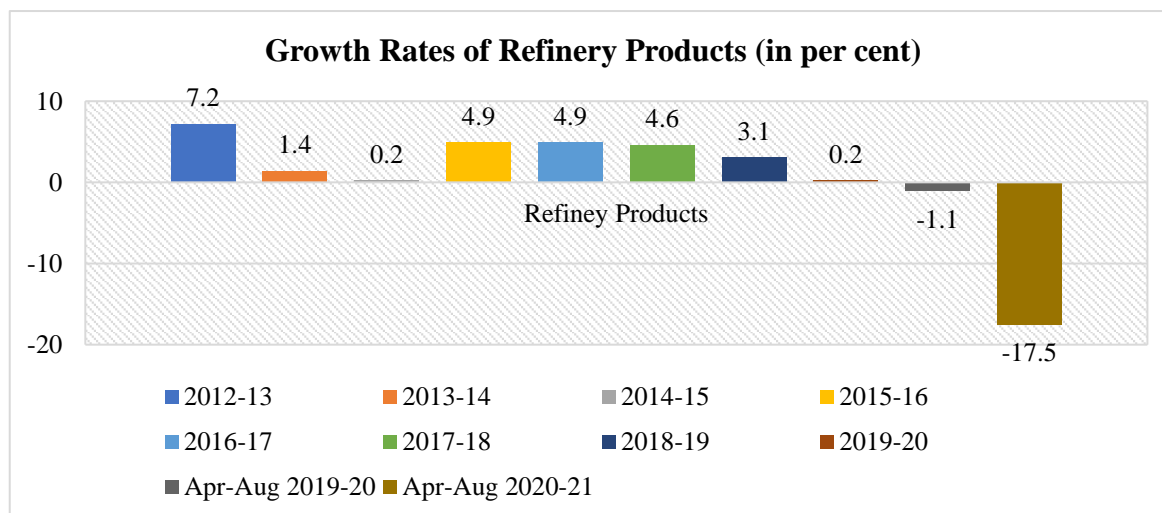
Figure VIII: The growth rate of natural gas production



Source: Ministry of Commerce and Industry

Refinery Products: Production of Refinery Products has been declined by 19.1% in August 2020 over August 2019. The cumulative index declined by 17.5% from April to August 2020-21. (YoY)

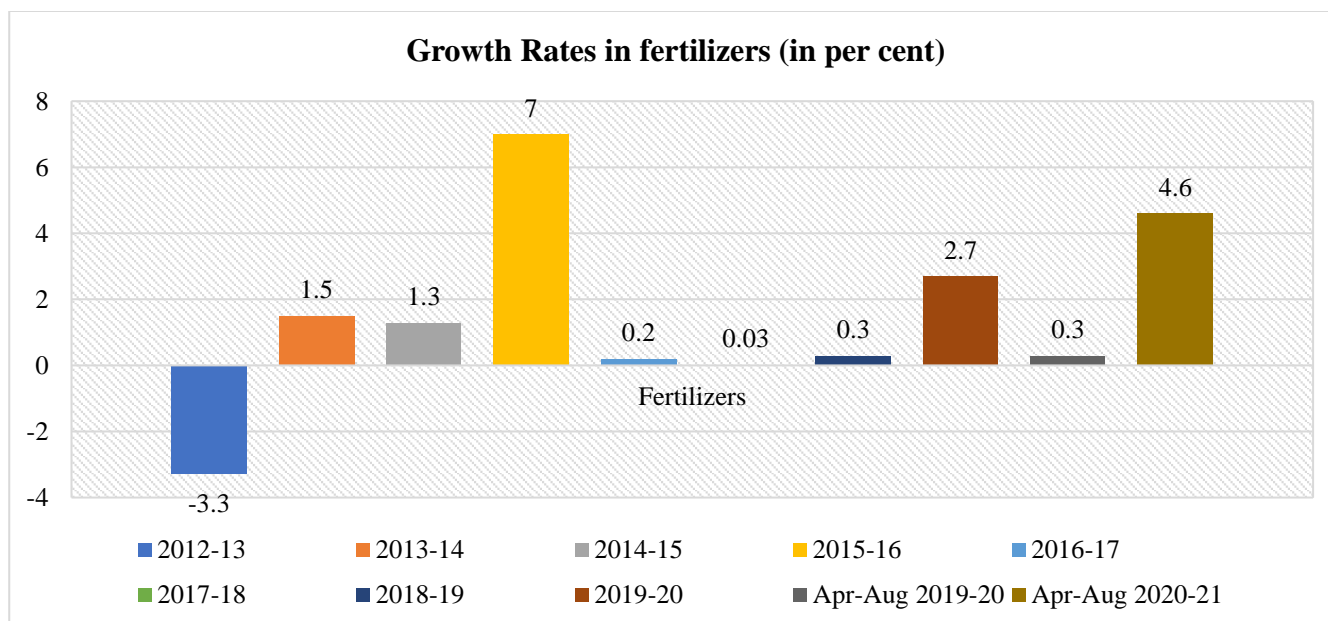
Figure IX: The growth rate of refinery products



Source: Ministry of Commerce and Industry

Fertilizers: Production of Fertilizers has been raised by 7.3% in August 2020 over August 2019. The cumulative index raised by 4.6% from April to August 2020-21. (YoY)

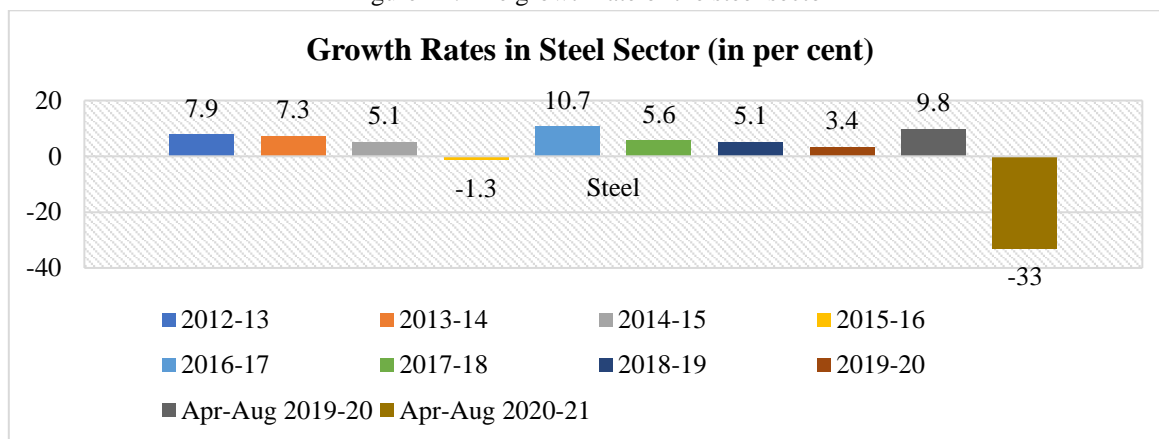
Figure X: The growth rate of fertilizers



Source: Ministry of Commerce and Industry

Steel: Production of Steel has been declined by 6.3% in August 2020 over August 2019. The cumulative index declined by 33.0% from April to August 2020-21. (YoY)

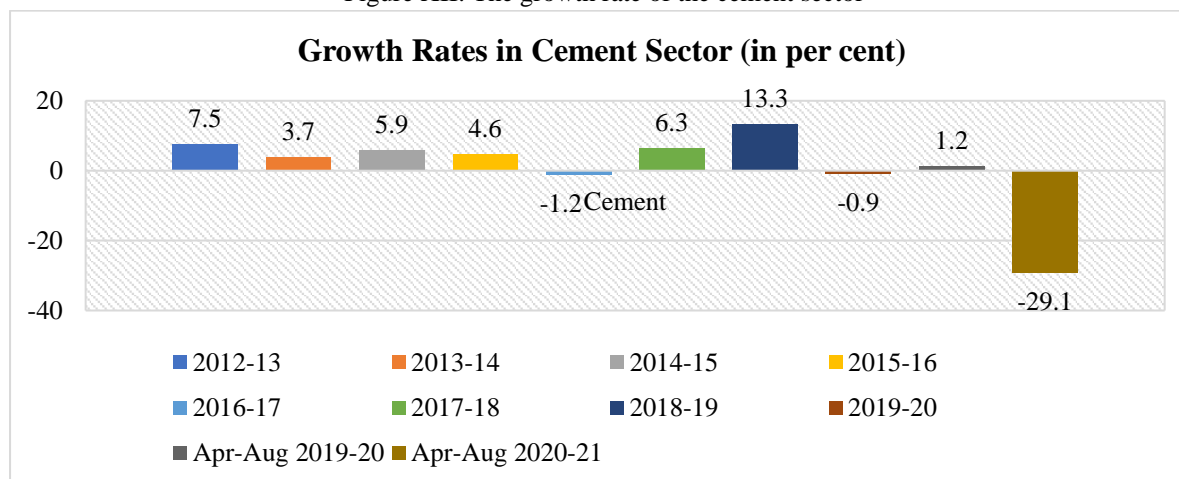
Figure XI: The growth rate of the steel sector



Source: Ministry of Commerce and Industry

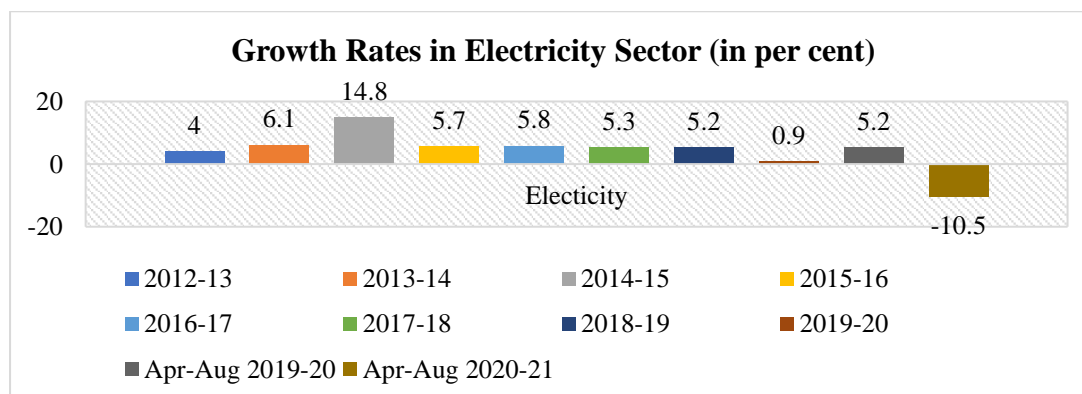
Cement: Production of Cement has been declined by 14.6% in August 2020 over August 2019. The cumulative index declined by 29.1% from April to August 2020-21. (YoY)

Figure XII: The growth rate of the cement sector



Source: Ministry of Commerce and Industry

Electricity: The generation of Electricity has been declined by 2.7% in August 2020 over August 2019. The cumulative index declined by 10.5% from April to August 2020-21. (YoY). Figure XIII: The growth rate of electricity generation.



Source: Ministry of Commerce and Industry

It is very crucial to identify the economy to look like a “flatten the curve” problem. Without significant and timely macroeconomic intervention, the productivity that vanished from the economic recession will be significantly amplified. Exclusively as economic representatives try to secure themselves from COVID-19, by dipping in consumption spending, fetching in lower credit transactions, and investment spending [19]. The level and type of fiscal and monetary stimulus deliberate to safeguard the economic dip will differ significantly across the nation.

Most developed countries exist a high amount of government debt and historically low-interest levels. To tackle the COVID-19 economic fallout, a coordinated monetary and fiscal policy is required. Fiscal policy can be utilized to consent an emergency budget through a ceiling on the debt to GDP fraction. This cause would raise the inflation rate, increase aggregate spending, and minimize real interest rates. With adopting an above-normal inflation target, monetary authority and fiscal policy authorities can be coordinate together. In the long-running cycle, the government can try to balance the upcoming monetary policy and the budget would intention to bring inflation back to usual levels [20].

IV. CONCLUSION

The gradually rising spread of the COVID-19 pandemic has pushed the global economies, hustle in a too deep degree of uncertainty. However one thing that seems certain is that the current economic' downturn fundamentally different from the financial and economic recessions of the past. This research paper has covered a wider section of eight core sectors of the Indian economy and the GDP rate of the world as well as India after the pandemic period. So a fresh normal for India would once more lead to a more digitally enhanced service-oriented growth, held by the growth of the health industry and agriculture. If we consider all the pros and cons, the Indian economy post-COVID-19 is likely to rise more than any other country's economy. It can be result from global investments, excessive growth in the supply chain, and providing a new normal to the rest of the world as many developed economies may like to opt-out from China and choosing India as a trading partner. This is not the time for fiscal consolidation, but we need further fiscal expansion.

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IMPACT OF COVID-19 PANDEMIC ON PSYCHOLOGICAL AND PHYSIOLOGICAL HEALTH STATUS AMONG ACADEMIC PERSONNEL: A SURVEY-BASED STUDY

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ABSTRACT

This study is focused on to find out the impact of COVID-19 pandemic on human health (psychological and physiological) during work from home. A computer-based questionnaire was sent to around 1586 active emails and received optimistic response from across the India. This questionnaire is divided into two categories: psychological and physiological health based and each category have at least 5 questions also each question responses are collected in 5-point Likert scale strongly agree as '1' and strongly disagree as '5'. Out of 380 responses, 14 responses are incomplete. Hence, this study is only limited with 366 responses from the professors, research scholars and students. This study is highlighting the changes in human health during the pandemic period among education sector. This study is containing 21.4% female and 78.6% male responses within 21-73 years age group. First, the reliability of the responses is calculated. In second, the Bi-variate Pearson correlations were analyzed in the descriptive statistics. In third, ordinal regression was analyzed. All the steps are followed by the use of IBM SPSS Statistics (Statistical Package for Social Science) in the 25th version. This study found that psychological and physiological health related problems is increased significantly during the COVID-19 pandemic period amongst *academic personnel* as per survey response.

I. INTRODUCTION:

COVID-19 (Corona-virus disease 2019) is a global pandemic of 2020, an outbreak of the viral respiratory disease this year worldwide. Currently, all over the world is affected by the recently discovered infection disease corona-virus. COVID-19 began from Wuhan (Hubei, China), and quickly spread all through the world with infected disease and deaths [1]. COVID-19 first patient sample was found in Wuhan jing in tan hospital on 30 December

2019 [2]. Moreover, this virus was also found in some special animal lungs and abdominal tissues [3]. This virus is more sensitive to the peoples due to lack of immune system [4].

India reported its first corona patient on January 31, 2020. On 24 March, 600 confirmed cases in India including the 9 deaths with this virus. To stop and control, India has led a serious step against this quickly spread disease. On midnight 24-25 march, honorable Prime Minister Narendra Modi announced the 21 days lockdown in India after the discussion with health experts and WHO. This includes shelter in place order, quarantine necessary for the confirmed cases, wear a mask, interdiction the public gathering, intra-public transportation prohibited. This virus is spreading or transmitting human to human by the breath or contact of infected droplets and the symptoms period ranges from 2 to 14 days [5].

After the 21 days of lockdown, Corona patients are continuously increasing and the government decides to extend the period of lockdown till 30 June (98 days). Toward the end of March, around the world confirmed cases increments up to 7,50,890 with 36,405 deaths and in India 1071 confirmed cases and 29 deaths [6]. According to late updates (03 October) of WHO, worldwide confirmed case increments up-to 3,43,96,222 with 10,24,675 deaths while in India it 64,73,544 (18.82% globally contribution corona patient) confirmed case and 1,00,842 (9.84%) deaths.

During this lockdown, restricted outside activity and limited physical activity, and prolonged indoor spending time will affect most of the individuals [7]. Some previous studies reported that spending prolonged sitting activities, playing games, watching television, and reducing regular outdoor activity and other physical exercise activities lead to the risk of chronic health conditions [8]. In the absence of vaccine lockdown phases strategy, social distancing 6 feet from each other in a public place, term and conditions in travel wear mask in outdoor and closing crowded public places (School, Colleges, Theaters, etc.) [9].

This is a historical decision of pandemic lockdown for 98-days for the second largest populated country in the world, which was unprecedented and sudden but necessary. Besides, also took an impact on the country of socio-economic, unemployment, migrant individuals, especially homeless and daily-wages labors heavily disturbed with the financial trouble. Resources and mental preparedness have been analyzed as significant variables for the status of natural disasters like pandemics. Unpreparedness for pandemic can be harmful to public health especially in lower- and middle-income countries.

Several types of research have shown that a long time indoor environment for the individual led to various health problems, long-lasting stress and deficient recovery [10], immunological, gastroenterological, obesity, neurological and cardiovascular diseases, and other mental disorders [11,12]. Extension of lockdown in India (for 98 days), previous research shows that pandemic, the COVID-19 pandemic significance stress impact on the individuals [13]. Moreover, a recent survey in China showed that the general public reported 8.1% moderate several stress levels [14]. Similarly, another survey among the Italian population reported that 27.2% of individuals experienced high stress during this pandemic [15]. Prolonged indoor sitting significantly led to poor health, psychological disorders, and mortality [16]. Therefore, very difficult to manage such stress during this pandemic. Researchers examined that short walking and an increase in physical activity fall a significant impact to improve health (psychologically and physiologically).

Several recent studies examined the effect of COVID-19 on psychological health prominent prevalence of stress, depression, anxiety [17], post-traumatic stress [17], and insomnia [18]. This study is focused on the qualitative study examines between the two-age group of male and female of psychologically and physiologically health status among the academic personnel.

II. METHODOLOGY:

A. Questionnaire Design:

The descriptive survey was created by using an online google sheet form. The questionnaire contains 3 sections; 1st section demographic information of the respondents, 2nd section the psychological based which contains 11 questions, and 3rd section physiological based which includes 8 questions. This questionnaire was sent to professors, research scholars, and students through e-mails. In this survey responses are containing only via e-mail there is no such personal and telephonic interview to avoid face-to-face contact. Moreover, this survey data was collected in the holiday's session due to Lockdown from 24th March to 30th June 2020. Out of 380 responses, 14 responses are incomplete so this study is only limited to 366



Figure 1: State wise Survey Response

responses. This study includes the academicians and researchers by a simple random sampling method. The contribution of state-wise survey response is represented in Figure 1.

B. Procedure:

This study was not approved by the Research Ethics Committee due to the pandemic lockdown from March to June. Before responding to the survey, consent had taken from all the participants by the purpose of the survey, and to make a secure the respondent's personal information was already mentioned in the e-mail very respectfully. Respondents were responding to the survey in three sections; demographic, psychological, and physiological as listed above.

C. Respondents Measure:

This survey is divided into two categories: psychological (section 2nd) and physiological (section 3rd) health-based and section 2nd have 11 questions while on the other side section 3rd has 8 questions and each question response is collected in 5-point Likert scale strongly agree as '1' and strongly disagree as '5' [19]. Participated rated in a number from range 1-5 Likert scale 1 is for strongly agree and 5 strongly disagrees for each question in the

psychological and physiological section. This study is containing 21.4% female and 78.6% male responses within 21-73 years age group and 38.7 ± 12.8 (mean \pm std. dev).

Table 1: Question wise Contribution of Respondents in Percentage on basis of 5-Point Likert Scale

Psychological based:						
S. No.	Questions	Strongly Agreed (1)	Agree (2)	Not Agree and Disagree (3)	Disagree (4)	Strongly Disagree (5)
1.	(A) Sweating Profusely this Pandemic COVID-19.	39 %	18 %	26 %	11 %	6 %
2.	(B) Feeling Dejected after Outbreak of COIVID-19.	28 %	25 %	20 %	17 %	10 %
3.	(C) Feeling Scared about this Pandemic.	14 %	25 %	24 %	21 %	16 %
4.	(D) Feeling Hopeless about the Future after this Pandemic COVID-19.	30 %	21 %	20 %	17 %	12 %
5.	(E) Feeling Monotonous while Work from Home in the Lockdown Period.	13 %	16 %	26 %	30 %	15 %
6.	(F) Feeling Relaxed in the Lockdown Period.	18 %	22 %	20 %	23 %	17 %
7.	(G) Unable to feel the Happiness, Contentment, Joy, and Love in this Pandemic.	30 %	21 %	18 %	19 %	13 %
8.	(H) Usage of Mobile Phone is Increasing.	09 %	07 %	11 %	25 %	48 %
9.	(I) Spending more time watching Television.	25 %	20 %	22 %	19 %	14 %
10.	(J) Hard Time to Falling a Sleep.	42 %	21 %	18 %	11 %	08 %
11.	(K) Changes in Blood Pressure during this Lockdown.	48 %	21 %	20 %	05 %	06 %
Physiological Based:						
1.	(A) Feeling Tired Whole Day?	32 %	30 %	23 %	11 %	04 %
2.	(B) Feeling Excessive Fatigue or Eye Strain.	34 %	21 %	19 %	14 %	12 %
3.	(C) Feeling Pain or Discomfort in Arm or Shoulder or Backbone?	42 %	19 %	21 %	13 %	05 %
4.	(D) Awkward Posture of the Head or Neck.	23 %	27 %	18 %	23 %	09 %
5.	(E) Inadequate Support or Lack of Support for Back, Legs, and Lumber Spinal.	30 %	24 %	22 %	16 %	08 %
6.	(F) Overeating during this Pandemic COVID-19.	30 %	21 %	18 %	18 %	13 %
7.	(G) Space Issues on or Under Work Surface which Leads to Discomfort.	31 %	23 %	22 %	16 %	08 %
8.	(H) Doing Exercise in this Pandemic Period.	14 %	11 %	23 %	20 %	32 %

In this survey, a total of 168 cities contribute with minimum qualification is a bachelor of science & bachelor of technology and maximum is pursuing a doctorate (Research Scholar) & doctorate holder (Professors). Respondent's response is calculated for each question in the percentage of 1-5 for both sections as shown in Table 1.

D. Data Analysis:

The motive of this survey was to explore the impact of the COVID-19 pandemic on psychological and physiological health issues among academic personnel. In this survey, psychological and physiological questions responses were analyzed in three steps. First, the reliability of the responses is calculated. In second, the Bi-variate Pearson correlations were analyzed in the descriptive statistics. In third, ordinal regression was analyzed. All the steps

are followed by the use of IBM SPSS Statistics (Statistical Package for Social Science) in the 25th version.

III. RESULTS AND DISCUSSION:

Out of 380 responses, 14 responses are incomplete. Hence, this study is only limited to 366 respondent’s responses among academic personnel. This study is highlighting the changes in psychological and physiological health issues during the pandemic period in the education sector.

Table 2: Descriptive Statics for Psychological based Questions Responses

Variable	A	B	C	D	E	F	G	H	I	J	K
Mean	2.3060	2.5738	2.9781	2.6612	3.0710	2.9590	2.7022	3.9563	2.7104	2.2541	2.0137
Std. Dev.	1.2559	1.3237	1.3115	1.3927	1.2564	1.3532	1.4340	1.3338	1.3861	1.3235	1.2572
N=366; Minimum Value=1; Maximum Value=5 for all the 11 variables											

Table 3: Descriptive Statics for Physiological based Questions Responses

Variable	A	B	C	D	E	F	G	H
Mean	2.3825	2.6639	2.2432	2.9180	2.5683	2.5874	2.5902	3.5383
Std. Dev.	1.2545	1.4427	1.2642	1.4021	1.3587	1.4168	1.3873	1.4074
N=366; Minimum Value=1; Maximum Value=5 for all the 08 variables								

Descriptive data has been shown in table 2 for the psychological (11 variables or questions) and table 3 for physiological (08 variables or questions) the mean and standard deviation of respondents’ response.

A. Cronbach’s Alpha Test:

Cronbach’s [20] test is used to evaluate the reliability in the given data in the given theoretically ranges from 0 to 1. If the quantified data α value is found near to 0 then there is no reliability in the given data and if the α value is near to 1 then the given data is more reliable [21]. In the reliability response the psychological (11 variables ranges 0.742-0.827) Cronbach Alpha value is 0.758 and the physiological (08 variables ranges 0.689-0.845) Cronbach Alpha value is 0.765 which is considered reliable.

Cronbach’s alpha is evaluated as a function of the total number of test items and inter-correlation between them. Mathematically, the Cronbach alpha value is calculated by equation (i):

$$\alpha = \frac{N\bar{c}}{\bar{v}+(N-1)\bar{c}} \dots\dots\dots (i)$$

Where N stands for the number of items, \bar{c} is average inter-correlation among items and \bar{v} is the average variance.

Table 4: Reliability Test for Psychological Data

Variable	Total Correlation	Squared Multiple Correlation	Cronbach’s Alpha Value	Valid Range
A	0.415	0.285	0.771	>1
B	0.564	0.431	0.755	>1
C	0.571	0.387	0.754	>1
D	0.512	0.344	0.760	>1
E	0.482	0.306	0.764	>1

F	-0.118	0.103	0.827	>1
G	0.657	0.537	0.742	>1
H	0.383	0.287	0.775	>1
I	0.433	0.246	0.769	>1
J	0.485	0.295	0.764	>1
K	0.513	0.370	0.761	>1
Cronbach's Alpha		Cronbach's Alpha based on Standardized items	No. of items	
0.785		0.786	11	
Status= Fairly High				

Table 5: Reliability Test for Physiological Data

Variable	Total Correlation	Squared Multiple Correlation	Cronbach's Alpha Value	Valid Range
A	0.456	0.383	0.741	>1
B	0.618	0.518	0.710	>1
C	0.549	0.451	0.726	>1
D	0.731	0.638	0.689	>1
E	0.714	0.603	0.694	>1
F	0.397	0.216	0.752	>1
G	0.600	0.504	0.715	>1
H	-0.200	0.086	0.845	>1
Cronbach's Alpha		Cronbach's Alpha based on Standardized items	No. of items	
0.765		0.768	08	
Status= Fairly High				

The psychological Cronbach alpha value is shown in table 4 with 11 number of items and the physiological Cronbach alpha value is defined in table 5 with 8 number of items. A wide range of different alpha values has been used in the manuscripts here are some lowest and highest values that way in article surveyed: alpha values are described as excellent (0.93–0.94), strong (0.91–0.93), reliable (0.84–0.90), robust (0.81), fairly high (0.76–0.95), high (0.73–0.95), good (0.71–0.91), relatively high (0.70– 0.77), slightly low (0.68), reasonable (0.67–0.87), adequate (0.64–0.85), moderate (0.61–0.65), satisfactory (0.58–0.97), acceptable (0.45–0.98), sufficient (0.45–0.96), not satisfactory (0.4–0.55) and low (0.11) [22].

B. Bi-Variate Pearson Correlations:

Table 6 shown the Bi-variate Pearson correlation of psychological variables and table 7 for physiological variables. In which defined the relationship between the variables whether is it positively significant or negatively significant.

Table 6: Bi-Variate Pearson Correlations of Psychological based Questions

	A	B	C	D	E	F	G	H	I	J	K
A (Sig.)	1										
B (Sig.)	0.453** (0.000)	1									
C (Sig.)	0.265** (0.000)	0.372** (0.000)	1								
D (Sig.)	0.199** (0.000)	0.406** (0.000)	0.474** (0.000)	1							
E (Sig.)	0.158** (0.000)	0.249** (0.000)	0.430** (0.000)	0.343** (0.000)	1						
F (Sig.)	0.109* (0.037)	-0.100 (0.056)	-0.109* (0.038)	-0.087 (0.095)	-0.019 (0.714)	1					
G (Sig.)	0.366** (0.000)	0.567** (0.000)	0.436** (0.000)	0.454** (0.000)	0.295** (0.000)	-0.132* (0.012)	1				
H (Sig.)	0.077 (0.143)	0.292** (0.000)	0.299** (0.000)	0.260** (0.000)	0.330** (0.000)	- (0.250**)	0.370** (0.000)	1			
I (Sig.)	0.260** (0.000)	0.303** (0.000)	0.330** (0.000)	0.223** (0.000)	0.367** (0.000)	- (0.062**)	0.289** (0.000)	0.341** (0.000)	1		
J (Sig.)	0.251** (0.000)	0.301** (0.000)	0.298** (0.000)	0.331** (0.000)	0.236** (0.000)	-0.055 (0.291)	0.456** (0.000)	0.275** (0.000)	0.212** (0.000)	1	
K (Sig.)	0.226** (0.000)	0.295** (0.000)	0.391** (0.000)	0.280** (0.000)	0.338** (0.000)	-0.013 (0.811)	0.519** (0.000)	0.196** (0.000)	0.216** (0.000)	0.436** (0.000)	1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

This indicates the positive significant means both variables are moving in the same direction if one is increasing another will also increasing. On the other hand, if indicates the negative significance means both variables are moving in the direction and if one is increasing another variable will be decreasing.

Pearson’s r ranges are defined as the following:

r = 0 (which indicates no relationship between variables)

r = 1 (which indicates a perfect positive relationship between variables)

r = -1(which indicates a perfect negative relationship between variables)

In table 6 highest positive correlation value noted 0.567, which means variables are very near to a strong positive relationship between the variables, and the highest negative correlation value is -0.250 that means variables have not a perfect negative relationship between variables. So, Therefore it is evaluated that psychological variables have significant impact on most of the variables. In table 7 highest positive correlation value noted 0.525 which means variables are very near to a strong positive relationship between the variables and the highest negative correlation value is -0.271 that means variables have not a perfect negative relationship between variables. So, Therefore it is evaluated that physiological variables have a significant impact on most of the variables.

Table 7: Bi-Variate Pearson Correlations of Physiological based Questions

	A	B	C	D	E	F	G	H
A (Sig.)	1							
B (Sig.)	0.304** (0.000)	1						
C (Sig.)	0.525** (0.000)	0.503** (0.000)	1					
D (Sig.)	0.452** (0.000)	0.651** (0.000)	0.528** (0.000)	1				
E (Sig.)	0.420** (0.000)	0.509** (0.000)	0.425** (0.000)	0.702** (0.000)	1			

F	0.311**	0.267**	0.289**	0.308**	0.377**			
(Sig.)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	1		
G	0.287**	0.532**	0.248**	0.547**	0.637**	0.379**		
(Sig.)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	1	
H	-0.271**	-0.136**	-0.134*	-0.144**	-0.096	-0.151**	-0.090	
(Sig.)	(0.000)	(0.009)	(0.010)	(0.006)	(0.067)	(0.004)	(0.085)	1

***. Correlation is significant at the 0.01 level (2-tailed).*

**. Correlation is significant at the 0.05 level (2-tailed).*

The independent variables shows at least some relation to the dependent variable i.e. higher correlation to 0.300, and less than correlation 0.700 indicates the correlation between independent variables is not very high [23].

C. Ordinal Regression Model Fit

Ordinal regression is used to predict the relation between the dependant variables and given one or more independent variables. Entire data has been divided into gander category as shown in table 8 also evaluated the goodness of fit because the test may detect different types of lack of fit [24]. As shown in table 8 most variables models are significantly fit rather than D, E, F, G & I in male category and B, C, F, H, I & J in female category in the psychological section. Similarly in the physiological section in table 9, variable A, C & H in male category and B, D, G & H variables are in female category significantly fit in the ordinal regression test.

Table 8: Ordinal Regression Model Fit for the Psychological based Questions

	Male			Female		
	Goodness-of-Fit		Model Fit	Goodness-of-Fit		Model Fit
	Pearson	Deviance	Significant	Pearson	Deviance	Significant
A	1.00	1.00	0.009**	1.00	1.00	0.002**
B	1.00	1.00	0.003**	0.121	0.244	0.535
C	1.00	1.00	0.008**	0.185	0.165	0.748
D	0.235	0.258	0.202	1.000	1.000	0.016*
E	0.307	0.327	0.366	1.000	1.000	0.000**
F	0.067	0.339	0.322	0.163	0.453	0.118
G	0.189	0.160	0.864	1.000	1.000	0.025*
H	1.000	1.000	0.000**	0.299	0.309	0.132
I	0.198	0.280	0.742	0.273	0.364	0.249
J	1.000	1.000	0.0493*	0.317	0.217	0.312
K	1.000	1.000	0.0332*	1.000	1.000	0.000**

Table 9: Ordinal Regression Model Fit for the Physiological based Questions

	Male			Female		
	Goodness-of-Fit		Model Fit	Goodness-of-Fit		Model Fit
	Pearson	Deviance	Significant	Pearson	Deviance	Significant
A	1.000	1.000	0.000**	0.121	0.244	0.535
B	0.535	0.121	0.244	1.000	1.000	0.0371*
C	1.000	1.000	0.000**	0.172	0.278	0.781
D	0.159	0.099	0.496	1.000	1.000	0.025*
E	0.307	0.327	0.366	0.235	0.258	0.202
F	0.286	0.208	0.349	0.169	0.339	0.320
G	0.170	0.290	0.606	1.000	0.99	0.0483*
H	1.000	1.000	0.000**	1.000	1.000	0.0413*

IV CONCLUSIONS

Present study focused on the impact of COVID-19 on psychological and physiological health status among academic personnels. Psychological support and physical fitness is more important during this pandemic period. In recent years, indoor health fitness products, applications and streaming sessions has been increased (e.g. indoor cycling, treadmill, health fitness applications and yoga streaming sessions) also various options in exercise can do without a single use of gym equipment. It should be more awareness of various indoor fitness products to maintain social distance and safe environment. Cronbach's alpha values are 0.785 for psychological and 0.765 for physiological section, it means responses status is fairly high which indicates the data is reliable and valid. Bi-Variate Pearson Correlation is evaluated to assess the relationship between the variables for the both sections and shows the highly significantly relationship between the variables. At the end, ordinal logistic regression test is computed for the relationship between an ordered categorical variables for both section. A gender-wise regression fit has been shown the significantly fit in the given response. This study found that psychological and physiological health related problems is increased significantly during the COVID-19 pandemic period amongst *academic personnel* as per survey response.

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SOCIO-ECONOMIC IMPACT OF COVID 19 PANDEMIC IN KASHMIR

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ABSTRACT

This study examines the trend of the spread of coronavirus disease (Covid-19) pandemic and to explore the community perception of the socioeconomic impact of the Covid-19 pandemic in Kashmir. The 2019 corona virus is a public health emergency of international concern and poses a challenge to the economy and social life of people. World Health Organization (WHO) announced the coronavirus which is also referred to as Covid-19 as a disease on 11th February 2020. The Covid-19 was originated from Wuhan city of Hubei province in China in December 2019. It is a viral disease due to the severe acute Respiratory Syndrome Coronavirus 2 (SARS-COV-2) virus. The symptoms of the virus include, fever, cough, sore throat, and difficulty in breathing. The results of the study show that Covid-19 cases spiked amid ease of lockdown in the country and the spread of a novel coronavirus pandemic has a significant socioeconomic impact. It is a respiratory disease that affects the health of the individual as a whole. Financial uncertainty, a decrease in income, fear of job loss, and food insecurity are some major challenges that Kashmiri communities face due to the outbreak of coronavirus. The results further show that lack of community cooperation with government agencies, lack of awareness about the severity of coronavirus, and insufficient Covid-19 testing kits are the major factors that caused the spread of coronavirus cases. Social connections, interactions, and relations have become an important part of our life, and the absence of such connections lead to anxiety, depression, mental disorder, health problems which affect the life of the individual and collective society as a whole. Finally, it was suggested that to cope with Covid-19 lockout stress, keep ourselves busy in physical activities, religious activities, and social work. The Central and State governments are taking several measures and formulating several wartime protocols to achieve this goal. This paper aims to study the economic downfall of disturbing the social life of people.

Keywords: Covid-19, Socio-economic factors, Impact on Kashmir, Economic downfall.

I. INTRODUCTION:

In March 2020, the World Health Organization (WHO) referred to the corona virus as a pandemic disease which means the deadly virus is spreading outside containment measures in most of the countries around the world. The corona virus belongs to the coronaviridae family and appears just like spiked rings when observed through an electronic microscope. The surface looks with various spikes, which are helpful to attack and blind living cells. Corona. These are the viruses causing the simple common cold disease to severe illness like the Middle east the source of this virus is from animals including bats. The word coronavirus is a derivative of the Latin corona, which means crown or halo, that states to the typical look indicative of a crown or a solar corona around the virions. These viruses are having a positive-sense single-stranded RNA genome (27 to 34 kilobases) and helical symmetry nucleocapsid (Su et al., 2016; Sexton et al., 2016). Typically, the coronaviruses are of ~20 nm size draped with a large petal or club-shaped surface appearance. The first coronavirus was discovered in 1937 in the birds and later on in the 1960s in humans (Coronavirus: Common Symptoms, Preventive Measures, and how to Diagnose it. Caringly Yours, 2020). The various types of viruses, capable to infect human beings are 229E, OC43, HCoV-NL63, SARS-CoV, MERS-CoV, HKU1, and SARS-CoV-2. There are several outbreaks from time to time due to these viruses. The most notorious outbreaks were in 2003, 2012, 2015, and 2018 with 774, 400, 36, and 42 deaths, respectively. It is important to mention that the 2019–2020 outbreak is started in Wuhan, Hubei Province, China in December 2019 (The Editorial Board, 2020) when a new strain of coronavirus was detected on 31st December 2019 (WHO, 2020). World Health Organization (WHO) has given name to this virus as 2019-nCoV (Novel Coronavirus 2019, 2020) which was later renamed as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses. The diseases caused by this virus is called as coronavirus disease 2019 and abbreviated as COVID-19 [CO: corona, VI: virus, D: disease and 19: 2019 year]. This virus was found to have 86.9% resemblance to a bat coronavirus, and, hence, is suspected to develop from bats (Lu et al., 2020; Wan et al., 2020; Zhu et al., 2020). This virus is out broken in pneumonia type of disease with respiratory problems, leading to death due to respiratory failure. About 210 countries and territories have been reported to be infected with major outbreaks in the USA, China, South Korea, Italy, Iran, Japan, etc. tolling about 2.2 million patients with more than 0.15 million deaths globally. The United States of America is the most affected country with the highest patients of about 0.7 million and about 35,000 deaths.

These viruses infect the upper gastrointestinal and respiratory tract of the mammals (including humans) and the birds. These viruses cause many diseases in animals and human beings. The common signs of infection are fatigue, muscle pain, sneezing, sore throat, dry cough, high fever, respiratory problems, etc. with some severe cases having pneumonia, serious respiratory syndrome, kidney failure, and even death (Huang.et al., 2020; Hui et al.,2020; Ren et al., 2020).



Source: <https://www.sciencedirect.com/science/article/pii/S0048969720323780>

During the last few decades, it was observed that coronaviruses can infect rats, mice, cats, dogs, horses, cattle, and pigs. Occasionally, these animals may communicate coronaviruses to humans the coronavirus is spread by sneezing, cough droplets, and contact. Normally this enters the body through the mouth, nose, and eyes. Prevention and management are very important issues to control COVID-19. Therefore, there is a great need for the collective efforts of the public and the government. The regular and proper care of the homes and hospitals is very important to control this calamity. The regular recommendations to minimize the infection are cleaning of your area. The most important to avoid sneezing and cough at the public place. The hand cleaning with soap and sanitizer, mouth and nose coverage with a mask during sneezing and coughing are essential. Regular cleaning of the surface by the disinfectants may control the virus outbreak. Therefore, it is urgently advised and requested that all the persons should follow the preventive measures,

management, and quarantine strictly without any religious discrepancy otherwise the situation may be the worst. The first confirmed case of the Corona Virus infection in India was reported on 30 January 2020 in the state of Kerala. The affected had a travel history from Wuhan, China. The government of India also issued an advisory for voluntary home quarantine (self-isolation). They are asked to self-segregate in the home-settings to evade contact with others to avert the spread of the virus at the initial stage of infection. As per the Ministry of Health and Family Welfare Government of India, there is a total of 114 confirmed cases of COVID-19 till March 16-2020. Protective self-separation is recommended for a person who is at high-risk for severe illness from COVID-19 which includes old- persons, sick people, and children. Voluntary avoidance of crowded places is recommended for a person who is asymptomatic and who is considered to have less risk of exposure to the virus that causes COVID-19. Masks should be used by the asymptomatic individual, if available, to provide a physical barrier that may help to prevent the spread of the virus.

In the present scenario, COVID -19 has affected all the sectors of society. There is a big loss globally and it cannot be estimated exactly. Now-a-days, the whole world is just like a family where everyone has to contribute to run the family. The whole world is affected economically very badly due to a decrease in industrial production. Social distancing involves staying away from people to avoid spreading and catching the virus. It is a new emerging terminology which means to avoid the crowd. This has forced people to work from home and avoid social gatherings and contacting even their near ones. Man is a social animal and social relations and the social interactions are integral to human civilization, and the absence of such meaningful connections leads to stressful states of anxiety both in mind and in the body. Loneliness, Anxiety drives, depression, panic states, mental disorders, health hazards, and many other issues impact the life of the individual and society as a whole. The researchers based on online survey and media reports that emerging studies into COVID -9 together with lessons from past outbreaks suggest that the pandemic could have profound and potentially long-term impacts on psychological, health, economic, social, and religious life. The corona virus is impacting the lives of individuals as a whole. It creates a sense of fear and also stress, anxiety, and other mental disorders. According to the Center for Disease Control and Prevention (CDC) “The outbreak of Corona Virus disease 2019 (COVID-19) may be stressful for people. Fear and anxiety about a disease can be overwhelming and cause strong emotions in adults and children. Coping with stress will make you, the people you care about, and your community stronger. There is a big shift in the world economic market and the share market has witnessed crashes day by day. Factories, Restaurants, Markets, Flights, Super Markets, Malls, Universities, and Colleges, etc. were shut down. The fear of coronavirus has limited the movement of individuals. People were not even going to buy the daily essentials and these all were somewhere impacting the economy of the world as a whole. The Organization for Economic Cooperation and Development (OECD) also revealed that they cut their expectation for global growth to 2.4% from 2.9%, and warned that it could fall as low as 1.5%. According to Economic Times, India faces a huge decline in government revenues and growth of the income for at least two quarters as the Corona Virus hits the economic activity of the

country as a whole. A fall in investor and other persons which also impacts privatization plans, government, and industry. industry. The researchers based on online survey and media reports that emerging studies into Covid-19 together with lessons from past outbreaks suggest that the pandemic could have profound and potentially long-term impacts on psychological health, economic, social, and religious life. Rapid and rigorous research accessing the impact of Covid-19 on the psychological health of people is needed to limit the impact of the pandemic. The present pandemic is having a major social and psychological impact on the whole population, increasing unemployment, separating families, and various other changes which are generally considered as major psychological risk factors for anxiety, depression, and self-harm.

Table II: District-wise cases of covid-19 in jammu and kashmir

COVID-19 pandemic in Jammu and Kashmir by district				
District	Total cases	Recoveries	Deaths	Active cases
Total	81,793	69,020	1,291	11,482
Anantnag	3707	3325	69	313
Bandipora	3646	3207	41	398
Baramulla	4761	3187	126	1448
Budgam	5263	4408	89	766
Doda	2371	1504	38	829
Ganderbal	3075	2780	30	265
Jammu	14950	13128	212	1610
Kathua	2218	2051	28	139
Kishtwar	1471	1200	11	260
Kulgam	2317	2188	43	86
Kupwara	3827	3114	70	643
Pulwama	4169	3745	72	352
Punch	1957	1113	18	826
Rajouri	2921	2355	39	527
Ramban	1430	1303	11	116
Reasi	1098	898	6	194
Samba	1926	1431	24	471
Shopian	2079	1896	32	151
Srinagar	16164	14078	310	1776
Udhampur	2443	2109	22	312
As of 08-10-2020				

Source: https://en.wikipedia.org/wiki/COVID-19_pandemic_in_Jammu_and_Kashmir

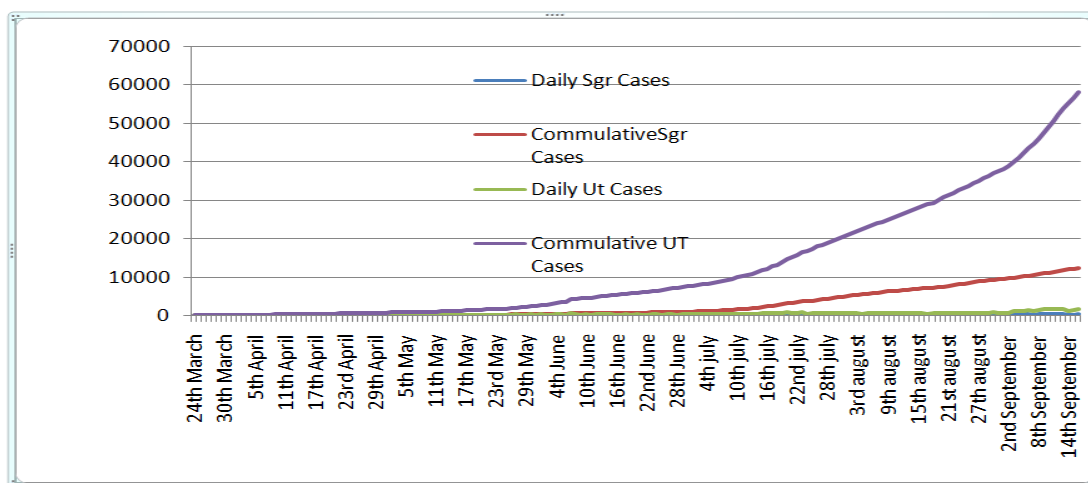


Fig II Confirmed cases of COVID-19 reported from the union territory of Jammu & Kashmir

Source: <https://thekashmirimages.com/2020/10/07/the-statistical-analysis-of-corona-in-jk/>

II. OBJECTIVES OF THE STUDY

1. To study the socio-economic impact of CO-VID 19 in Kashmir valley.
2. To provide awareness among people of Kashmir related to CO-VID 19.
3. To assess the knowledge about COVID 19.

III. MATERIALS AND METHODS:

A literature search was conducted by using Pub-med and Google scholar. Besides, existing guidelines including those by the Ministry of Health and Family Welfare, Government, and articles from non-academic sources (e.g. news websites, etc.) were accessed. This research uses a qualitative case study approach. The review drew on a wide range of data sources, including books, journal articles, government documents, policy reports, and conference papers.

IV. FUTURE PERSPECTIVES

As expected, SARS-CoV is zootomic and originated from the bats. It is observed that many people are consuming bats. It is observed that many people are consuming various animals like food-setups. Some animals like bats, snakes, cats, mice, rats, dogs, pigs, etc. should not be consumed as they may have dangerous microbes while the only safe animals should be consumed. Moreover, it is also advisable that we should consume vegetables and fruits as maximum as possible in our food. There is an urgent need to educate our new generation for science and technology

V. DISCUSSIONS

The threat of influenza pandemic has drastically increased during the last century with the emergence of highly contagious influenza viruses such as H5N1, H1N1, and the most recent one, COVID-19. Evidence suggests that the likelihood of pandemics has increased because of increased global travel and integration, urbanization, changes in land use, and greater exploitation of the natural environment (Jones et al., 2008; Morse, 1995). These trends seem to intensify in the case of COVID-19 which requires significant policy attention on the need

to identify and limit emerging outbreaks. Despite the efforts and progress toward preparing for and mitigating the impact of pandemics, COVID–19 has challenged the global health system and has impacted millions of lives around the world.

Evidence suggests that epidemics and pandemics can have significant social consequences causing mobility restrictions, travel bans, closure of borders, and, in extreme cases, area quarantines (Espinoza, Castillo-Chavez, & Perring's, 2019). Our findings support the evidence that the current crisis has changed the way people have managed their lives by restricting mobility and social distancing. The consequence of the pandemic is not only limited to social life but also affect financial constraints at the household. The findings of the research reveal that individuals perceive the persistence of pandemic may lead to financial uncertainty and reduction in income due to longer lockdown periods. Our findings are in line with the results of Blake, Blendon, and Viswanath (2010) that reveal job insecurity as a real consideration for many working adults in the United States during the influenza outbreak. In the absence of well-implemented social safety nets and unemployment benefits, financial problems may weigh heavily on the minds of workers during a pandemic, and these problems may result in comprise on compliance consideration.

The global health impact of the COVID-19 pandemic has affected workforces, transportation systems, and supply chains around the world. But this kind of emergency has threatened geographically isolated communities at another level by creating a food crisis even before the virus causes severe health problems in the community. This is mainly because it is hard to get food supplies locally, and economic activities are disrupted as a result of lockdown. The most at-risk populations during a severe pandemic are those that are already struggling with hunger, health, and poverty. Studies provide substantive literature to support the evidence that food insecurity is significantly higher in the mountain areas of Kashmir. Our findings are, similar perceived risk of food insecurity is significantly high among the Kashmiri community and food support is considered as the foremost and first priority of households during the lockdown. As the mountain communities are already dealing with the epidemics of poverty, geographic isolation, and subsistence farming, the food crisis in the long term is inevitable for communities and may result in lesser compliance with strategies of lockdown and social distancing. Besides, many households are vulnerable because of the way the pandemic has affected economic and social systems. Policy-makers must take necessary actions to prepare for food security and ensure food supply during a severe pandemic to cope with the impacts of spreading disease.

VI. CONCLUSION

Covid-19 disease is originated from Wuhan city of Hubei Province in China in December 201 and has become pandemic as per WHO. The pandemic of the corona virus is severely impacting the lives of the individuals on the whole. Everyone in the world is directly or indirectly facing the severe consequences of this disease. Many countries have declared unprecedented lockdowns and emergencies. The schools, colleges, universities, market, mall, shopping complex, etc. are shut down by the Governments. It has created an

environment of fear, anxiety, and stress among the developed and developing societies. WHO and all the member nations have issued advisories related to the impact of the Novel Corona Virus. But this disease due to its extreme isolation and lockdown measures creates several other issues including social anxiety, panic states due to uncertainty, economic recessions, and extreme mental stress. To contain this virus, coordinated efforts are required and people need to make uncomfortable yet necessary changes in their daily routine under the advisories and suggestions by the Government and WHO. This will provide for more opportunities for the medical staff to intervene effectively with the limited resources at their disposal and buy significant time to place additional resources for controlled management of this novel Pandemic.

LIMITATIONS OF THE RESEARCH

The purpose of this research is to analyze the impact of the Covid- 19 in the life of an individual as a whole. The data is based on secondary information which is available on the internet.

SUGGESTIONS

The Covid-19 pandemic is spreading day by day and now has become a part of our lives so we have to be prepared for it. Here are some of the suggestions below to prevent Covid-19 until we invent vaccines or medicine to cure this disease.

1. Physical Distancing.
2. Wearing a Mask.
3. Keeping rooms well ventilated.
4. Avoiding crowds.
5. Use sanitizer.
6. Cleaning your hands.
7. Coughing into a bent elbow or tissue.
8. Maintain at least a 1-meter distance between yourself and others to reduce your risk of infection when they cough sneeze or speak.
9. Avoid the spaces 3Cs space that is closed, crowded, or involve close contact.
10. If you have a fever, cough, and difficulty breathing, seek medical attention immediately.
11. Stay home and self-isolate even if you have minor symptoms such as cough, headache, mild fever until you recover.
12. Daily use of warm water, garlic, ginger, turmeric powder will make our immunity strong and we can fight from this pandemic.
13. Keep up to the date on the latest information from trusted sources, such as WHO or your local and national health authorities.

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Challenges in Education in the Time of Pandemic in India

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ABSTRACT

Covid 19 brought about many challenges worldwide that were not dealt with before. Education in the time of this pandemic is one of them. Since middle of March 2020, all educational institutions across India has been shut down. The new normal pedagogy depends on e-learning. However, this has created a digital divide nationwide. Although major steps are being taken by different state government, yet sudden digitalization for all remains a problem. There are many regions with lack of digitalization and network access. In addition to this, World Inequality Report of 2018 positions India as the second most unequal region. This also means not all students will have the access to the data required for

online video classes. Availability of laptops or even android phones in every household is not there. The study materials sent to the students are mostly in English and the possibility of study material in regional languages can be another challenge. Shutting down of schools also led to the halting of mid-day meals. A number of under privileged children were sent to school for the promise of this one meal. With the loss of jobs in the pandemic situation and the migrant workers traveling back will result in pulling these children out of the school. While a part of the society is still able to attend the e-learning sessions, they are facing a different set of problems. With long hours sitting with their phones and laptops are giving rise to a different set of musculoskeletal problems. With the requisite of all the citizens to stay indoors during the lockdown period, the physical activity of these children in their growing years have also been reduced to a major extent. Learning is a cognitive process. Apart of the content of the subject and curriculum, there are many things that the students learn in their years in the schools and colleges. The interactions that students generally have in the campus of any educational institute, affects their social behavior. With the institutions closed, the students are missing out a major experience. The objective of this research is to identify and analyze the various challenges faced by the education system in the pandemic situation and the develop a framework to meet those challenges. A qualitative research methodology, including case studies and interviews, is followed for the same. In this time of pandemic, a holistic educational practice is required for the capacity building of young minds. The education system needs to develop skills that will help in employability, new job creation and well-being of the generations for the progress of the country.

I. INTRODUCTION

Around the middle of March 2020, state governments all over India started closing down schools and universities briefly as a measure to contain the spread of the novel Covid. There is still no assurance when they will return. This is a critical time for the training division—load up assessments, school admissions, entrance of different colleges and assessments, among others, are totally held during this period. As the days pass by with no quick answer for stop the episode of Covid-19, school and college terminations won't just have a momentary effect on the coherence of learning for over 285 million youth and children in India yet in addition cause broad financial and cultural outcomes.

The structure of teaching and learning, including instructing and evaluation systems, was the first to be influenced by these closing of schools. Just a few private schools could begin e-teaching. The less expensive private and government schools, however had totally closed down for not having e-learning arrangements. The students are not only missing out on the learning opportunities, but can no longer have access to the mid-day meals during this time of crisis. The pandemic has essentially interrupted the higher education part as well. This is a basic determinant of a nation's financial future. An enormous number of Indian students—second just to China—enroll in colleges abroad, particularly in nations most impacted by the pandemic, the US, UK, Australia and China. Numerous such students were barred from leaving these nations.

Obviously, the pandemic has changed the old, chalk–talk pedagogy to one driven by innovation. This disturbance in the conveyance of training is pushing policymakers to make sense of how to drive commitment at scale while guaranteeing comprehensive e-learning arrangements and handling the advanced partition. A multi-pronged technique is important

to deal with the emergency and assemble versatile Indian education framework in the long haul.

II. OBJECTIVE

The objective of this research is to identify and analyse the various challenges faced by the education system of India in the pandemic situation and the develop a framework to meet those challenges.

III. METHODOLOGY

Qualitative research is a type of scientific research. Furthermore, it looks to comprehend a given research problem or point from the viewpoints of the local population it includes. Qualitative research is particularly compelling in acquiring socially explicit data about the qualities, conclusions, practices, and social settings of specific populaces[1].

The strength of qualitative research is its capacity to give complex literary depictions of how individuals experience a given problem. It gives data about the "human" side of an issue – that is, the regularly opposing practices, convictions, sentiments, feelings, and connections of people. Qualitative techniques are additionally compelling in recognizing impalpable variables, for example, accepted practices, financial status, gender roles, identity, and religion, whose part in the examination issue may not be promptly clear. At the point when utilized alongside quantitative techniques, qualitative exploration can assist us with interpreting and better comprehend the mind-boggling truth of a given circumstance and the ramifications of quantitative information. In spite of the fact that discoveries from qualitative information can frequently be reached out to individuals with qualities like those in the investigation populace, increasing a rich and complex comprehension of a particular social setting or marvel ordinarily outweighs inspiring information that can be summed up to other geological territories or populaces. In this sense, subjective examination varies somewhat from logical exploration by and large[1].

A qualitative research methodology, including case studies and secondary data collection, is used for this paper. The data collected through various literature available in secondary sources is then summarized and analyzed. The challenges thus identified is targeted to resolve through a suggested framework.

IV. CHALLENGES IN EDUCATION IN THE TIME OF PANDEMIC

The Covid 19 pandemic led to a number of challenges for online education in India. The paper targets to categorize analyze these challenges.

A. *Digitalization in India*

a. *Inequal standards of living:*

A study by UNESCO has projected an estimate that due to the COVID 19 pandemic, education of 1.26 billion children across the world has been interrupted [2]. This accounts for 70% of the total children worldwide. A majority of this children are from regions which according to UNESCO are “low tech or no tech”. India contributes to 300 million in this number [3].

According to an estimate of International Labour Organization (ILO), 40 crore workers from unorganised industry may get poorer amid this crisis[4]. The loss of jobs and livelihood of these workers are going to impact their families as well the children. There will be scarcity of food. A number of these children may be pulled out of school and compelled to join the

workforce for extra income. Some of these children have already joined their parents to work in the farms or assisting in the shops and local markets. The condition is currently that of a crisis and the impact of this pandemic on the children needs special attention.

In the 2018 edition of the World Inequality Report, India has been rated as the second most unequal region across the world[5]. The unequal distribution of wealth and resources do not clearly express that the 10% of advantaged class holds half of the national income. However, it agrees with regional, cultural and financial aberrations among different regions creating institutional courses of actions. In the current pandemic situation, the less privileged and lesser resourced segment of the society moves toward support of the democratic government than having a practical approach.[6]

b. Network Access:

As indicated in a national sample survey done by Indian government, less than a quarter of the families have web access. The telecom regulation authority of India shows that 78% of the Indians have cell phones, out of which just 57% dwell in the rural regions where the major percentage of the population lives.[7] A study by Quantum Satis indicates that out of 7500 students, 72.6% utilize the hotspot from their mobile phones for internet access and 97% of them face network issues, just 15% utilize the broadband connection.[7]

According to OOKLA speed test analysis, global speed for mobile internet is 34.82 mbps, whereas India ranks 129 in this speed test report with 12.10mbps. The global fixed broadband speed is 84.33 mbps, whereas India ranks 71 with a speed of 43.04 mbps [8].

In a webinar hosted by ORF's Mumbai Chapter around the theme "The explosion of online education in India during the COVID-19 Pandemic: What have we learnt?" Dr. V. Sridhar, Professor, Centre for IT and Public Policy, IIT Bangalore spoke on the "Taxonomy of Online Education ", which incorporates "Learning Management", "Course Delivery", "Assessment and Evaluation" and "Sync Course Conduct." On the topic of overloaded network connections which leads to connectivity problems faced by students in online education, he recommended a few possible solutions. According to him, the sessions should be recorded first for future reference. He also suggested the possibility of providing internet connection through DTH or local cable networks or through landline foundation. Another challenge in online training, is the checking of online evaluation. So as to improve network connection in remote territories, connections could be taken from urban communities or spots with a chance of higher network access.[3]

c. Availability of compatible devices:

According to a survey to analyse the usage of internet around the world, it is seen that only 32% of Indian own a smart phone, which is less than one third of the population [9]. In families with more than one child, this becomes a bigger challenge when the classes run parallelly. According to a report by NSO, only 4.4% rural households and 23.4% urban households have a computer. In this survey, all devices like, desktop, laptop, palmtop, notebook, netbook, smartphone, tablets etc is included [10]. The same report shows that only 14.9% rural households and 42% urban households have internet access [10].

According to the IAMAI report of 2019, the internet penetration percentage in India is 36%. Out of this 51% is from urban regions and 27% is from rural regions [11]. Out of this 36%, 67% internet users are male and 33% is female. Yet, most students use their mother's smartphones for these online classes.

B. Availability of Study materials in regional languages

English is used as a medium of science education in most places in India. However, only 12% of the Indian population is able to read or write the language [12]. Up until now a

number of government schools or schools in rural regions used vernacular medium as a medium of instruction. But the e-learning in the pandemic situation has led to a challenge in teaching in regional languages. A study on the impact of regional languages on the development of e-learning shows that even translating the English available content into regional languages poses a number of problems [13]. This challenges include the translated terminologies of the content, the lack of experts to translate the subject matter in the regional languages, the availability of font options, graphical or audio representation of the topic etc [13].

In the same webinar, Dr. Shakila Shamsu, Former Officer on Special Duty (New Education Policy), Department of Higher Education, Ministry of Human Resources Development, GOI shed light on the utilization of technology in education ought not be viewed as a result of the pandemic, yet as a thought that has been proceeding for quite a while. She confirmed this point by laying out the endeavours of the National Mission on Education Through ICT which was a solid suggestion of the eleventh five-year plan. She clarified how the Satellite Instructional Television Experiment during the 1970s and instructive telecom that occurred over the radio were manners by which innovation was utilized in the field of training, giving "even-handed access" to each one of those learning through those mediums. [3]

The Union HRD Ministry had initiated a TV channel for students to take online courses and at present 15 million students are enlisted with it. It likewise launched an auxiliary direct-to-home channel in 2019, called Swayam Prabha [14]. The viewing numbers has been multiplied contrasted with its parent channel. She accepted that the explanation India can't change quickly from conventional instruction mode to online learning is the absence of institutional readiness and openness by students to the new method of pedagogy. She additionally proposed that "advanced education organizations should start to develop an academic plan of action." Therefore, there is a "need to manage establishments, workforce and understudies to repurpose e-content in a way that fits into the educational plans for accomplishing the ideal learning targets of that specific course". She closed her initial articulations by saying that to reach a bigger crowd, it is important that e-material has to be made accessible in regional languages.[3]

C. Training of Teachers

The challenges are not just limited to the problems faced by students. A major number of school teachers were not familiar with the concept of e-teaching before this pandemic. Maharashtra State Council of Educational Research and Training (MSCERT) has launched a program to train 40,000 government school teachers for e-teaching as a part of the first phase [15].

The various reasons adding to how the Indian framework contrasts from different nations and whether India is prepared to move to online mediums are a portion of the inquiries answered by recognized panellists on the webinar facilitated by ORF's Mumbai Chapter around the subject, "The explosion of online education in India during the COVID-19 Pandemic: What have we learnt?". Professor Sahana Murthy, Interdisciplinary Program in Education Technology, IIT, Bombay clarified the setting behind the flood of online instruction in India as the possibility of "Crisis Remote Teaching". She attested, in any case, that there is a contrast between crisis distant educating and successful web-based learning. She clarified that for web-based educating, alongside the prerequisite of instruments, for example, online stages, one needs access just as prepared instructors. She finished up her initial explanation by underlining on the significance of changing the outlooks of the educators just as students since internet showing just limits through a web camera. One manner by which this could be actualized is through the LCM Model, which focusses on a "student driven methodology towards the planning and leading of online courses." [3]

D. Availability of uninterrupted power supply

According to Soubhagya scheme by Indian Government, 99.99% of households are electrified [16]. However, according to a report by Inventiva, major power failures are faced in the Indian rural regions. According to their survey, 16% of households got 1-8 hours of power every day, 33% have 9-12 hours of power supply and just 47% got over 12 hours of electricity.[7] The online learning sessions need uninterrupted power supply which is a big challenge in regions like these.

Dr. Ashwin Fernandes, Regional Director – Middle East, North Africa and South Asia, QS Quacquarelli Symonds and CEO, QS IGAUGE Rating called attention to that COVID-19 brought an “second wind to higher education in India.” He accepted this is a result of three fundamental reasons. Primarily, the increase in utilization of technology for different thoughts, particularly for teaching, has “instilled confidence for users” Secondly, India has attempted to follow the strides of UK, US and UNESCO models of online training and finally it relies upon how both these elements “even the odds for Indian colleges.” Discussing the survey directed by his organization which focussed on whether India was prepared for digitalization, he expressed that more than 80% of Indians utilize their mobile hotspot for internet access. 96% of students among them who utilized mobile hotspots to access academic resources had issues with connectivity. This, as indicated by him, could be going on account of the minimal cost of internet in India, as it prompted the over-loading of systems. He accepted that India is right now in Stage 1 of the progress from face to face teaching to online instruction, where classes have started to be taken on the web. Stage 2 of this change is the place there is “100% course conveyance on the web (evaluation, reviewing)” and Stage 3 is the place there is “finished conveyance obviously credit on the web (online degrees).” He closed by recommending that, for India to make a successful move to online stages for instruction, it needs to address the power supply issues as soon as possible, empower a move in outlook towards internet educating and learning and lead powerful preparing for teachers and students on ed-tech devices. [3]

E. Disruption of Mid-day meals

According to the World Food Programme 2013, India’s Mid-day Meal Scheme(MDM) is the largest school feeding programme worldwide [17]. It caters to 144 million school children, 80% of which belong to primary division [18]. The MDM program targets to provide cooked meals to all government primary school children. According to Ministry of Human Resource Development, Department of school education & literacy, circular on food security allowance, July, 2020 minimum food requirement for primary students is 100 grams and upper primary students is 150 grams. In spite of this, nearly 50% of Indian children are undernourished or malnourished [19]. However, MDM has significantly improved a number of aspects like enrolment, retention, attendance, learning outcome, gender equity and nutrition [20]–[23]. The lockdown phase in India has caused major supply chain disruptions in agriculture which in turn has led to food shortages. Thus, the disruption in the MDM scheme may increase the food insecurity. This may be a bigger issue for girl students who in rural Indian families eat last like the older women. This may lead to long term health and economic impacts. As per a survey, approximately 9.12 crore Indian children lost the midday meal access due to pandemic[7].

F. Ergonomic challenge due to lack of physical activities

According to a study, when more than 6 hours is spent to use any visual display unit, a significant increase in eye symptoms is found. This is one of the highest contributing factors that impacts eye symptoms like tired eye and blurred vision. Another common symptom due to prolonged use of VDU is dry eyes. The study demonstrated that 23% of subjects had

moderate to severe visual and ocular symptoms. The symptoms were more prominent in female subjects. These conditions have significant adverse effect on the overall productivity and quality of life [24].

The students often use headphones or earphones for online sessions. However, earphones or headphones are not calibrated for exposure time on relation to loudness. The levels of volume vary according to user. If set at the highest level of volume, these can deliver 90dB to 120dB of sound in the ears. This level of volume can be damaging to the hearing [25]. Though ENT specialists recommend not to exceed 4 hours of online teaching per day, most college and university class schedules are much more than that [26].

According to a study, subjects who used computers for more than 6 hrs tend to develop symptoms of musculoskeletal disorders in different body parts like neck, shoulder, wrist and headache. Sitting for prolonged hours where the workplace is not ergonomically designed can develop risks of lower back pain. According to a study 44% of VDU users develop lower back pain after 4 hours and 35% developed after 3 hours. This kind of prolonged sitting hours can also lead to static contraction in muscles, increased pressure on the inter vertebral discs and tension on ligament and muscles. According to a study done in a software company in Kolkata 90% of the respondents showed similar symptoms of muscular pains in neck and upper back [27].

G. Psychological impairment due to lesser interactive learning process

Stress and anxiety during pandemic affects the adults and children alike. In fact, one study found that the post-traumatic stress in quarantined children is four times higher than the ones who were not quarantined [28]. A study to understand the psychological effects during the quarantine phase of SARS has certain common aspects with the Covid 19 crisis. The said report shows presence of high psychosocial distresses like depression, stress, irritability and post-traumatic stress symptoms [29][30][31]. According to a study conducted in China, younger children of age group of 3-6 years are more susceptible to develop symptoms like clinginess and insecurity. Children of age group between 6 years to 18 years exhibit inattention and persistent inquiry. The most prominent psychological conditions manifested in children of all age group are clinginess, irritability and inattention. Children from regions where the rates of infections and deaths are higher, demonstrated higher levels of fear and anxiety [32].

As per a survey conducted in UK on people with mental illness history by YoungMinds, a mental health charity, 83% of the participants said that Covid 19 pandemic made their conditions worse. 26% of the respondents said that they were not able to access mental health support. Due to the social distancing and stay at home norms for the pandemic, peer-support groups and face to face consultation has been cancelled. Most of the respondents felt phone and online services were not up to their satisfaction. According to Dr. Chi-Hung Au, Psychiatrist, University of Hong Kong, China, children with special needs for education are at higher risk. These specially abled kids can become short tempered and frustrated if their routines are interrupted [33].

41% of Indian population falls below the age of 18 years. Closing the schools as a measure to protect the children from corona virus may be effective, but the impact on their psychology may be adverse. The day to day interactions that students have with their peers and teachers are disrupted [34].

H. Lack of holistic development

Learning is surely going to be disturbed and even more for children whose guardians are not proficient or literate or who cannot have access to web-based learning. There is no conviction concerning when schools will continue; the long gap will affect children's ability

and capacity to return to learning. On the off chance that schools keep on being closed down for a significant stretch, education will be a setback.

Teaching and learning process requires 4Cs. These are – communication, collaboration, creativity and critical thinking [34]. These are equally missing in the web-based learning approach as well as the present-day classroom learning measure. Learning and teaching is not the same. Learning is a cycle that happens in a living creature and because of it, the conduct of the living being changes. This cycle is the object of mental exploration. The part of teaching, then again, is to sort out the environment so as to empower learning. So as to compose the earth, we should know the conditions under which learning happens. Guidance, as per its own rationale, may dismiss certain learning exercises, (for example, teaching or moulding) and favour others, (for example, learning by revelation or learning dependent on comprehension). When guidance has endorsed specific sorts of learning, mental investigation into them should direct the exercises of guidance. On the off chance that all these are absent for the youngsters, school is unbending, dreary and eventually estranging. The outcome is the jumble between the student and instructor. Yet, it isn't the youngsters who are bungled to the schools; rather the schools are crisscrossed to the kids.

V. SUGGESTED FRAMEWORK

A. *Revising Policies*

The change brought about by the novel Covid ought to move an essential survey of past decisions, strategies and policies. A portion of these arrangements had picked up so much acknowledgment that one felt there was no reason for addressing them. General wellbeing and training are two zones in which India took definitive turn during the 1990s. At the point when a few states chose to quit giving permanent appointments to doctors and teachers during the 1990s, they were guided by a philosophical move at the public level towards permitting wellbeing and training to be opened for private venture. This was seen as a significant strategy change, a vital aspect of the greater package of monetary changes. They were introduced as a package, offering minimal decision for explicit territories. The new buzz has been public-private organization. It secured everything from streets to schools. The structure it took made it abundantly evident that the state would take a secondary lounge subsequent to giving a lot of rules for private administrators while the state's current foundation is appropriated and will bit by bit recoil. Before sufficiently long, cost effective measures turned into the need in both wellbeing and training. Ongoing deficiency of functionaries turned into the standard while young people who got qualified needed to trust that years for opening will be declared, or potentially taking a shot at transient agreements, with little security and nobility, that got normal. As we envision the post-Covid situation, a key inquiry to consider is whether we ought to return to the arrangements set up since the time the 1990s. Some will without a doubt contend that the clock can't be returned and that we ought not falter from the way we had picked, regardless of what difficulties individuals need to persevere. Certain strategies were explicit to areas, for example, wellbeing and instruction. Others were more similar to structures inside which arrangements for specific zones rose and advanced. One such system had to do with towns. Exceptional measures were intended to choose the 'best' among rural youngsters and make them sufficiently serious to get by in the metropolitan world that was treated as standard.[34]

B. *A possibility to improve public services instead of getting privatized*

The ultra-privatization wave of administrative products and ventures has efficiently obliterated the underestimated gathering of individuals in India. From clean water

accessibility, disinfection, transport, wellbeing, and instruction are not really organized opportune, enough impartial, or in a noble way to the least fortunate. Philip Alston, a rapporteur from the UN General Assembly, featured the crucial basic liberties ensured by significant world constitutions is the home government duty and couldn't be ousted by privatizing sensible social assurance, fundamental wellbeing, and instructive administrations. The 10-year survey of the World Bank and reports from the National Audit Office in UK gave a comparative end that the hyper-privatization model and tasks are too costly and less human inviting to give them ease wellbeing and training availability [35]. The changing patterns of the decision party and unschooled political authority at the middle today have affected every pellet of clerical activities. The reformist propensity of privatization eventually centres around hyper-benefit expansion through health services, ICU bed charges, and medication, reliable with premium medicines reasonable by the favoured class and less helpful to the minimized in numerous metropolitan urban communities. The legislative organizations and administrative bodies ought to mediate to decide a normalized accessibility of administrations to all. Fortunately, the Novel Coronavirus doesn't expressly separate as far as 'haves' and 'have not.' But Amnesty International even-handedly saw how lopsidedly the infection had affected the transient specialists, medical clinic cleaning staff, Dalits, or Adivasi. Pandemic made individuals cautious about the fake data spread by awful media focusing on minorities, social activists, and safeguards of social popular government. [6]

Pandemic connotes the significance of Social Democracy upheld by B.R Ambedkar to be the base for Political Democracy, hidden the privilege to freedom, fairness, and organization as a pivotal segment in human life. However, the private messengers' charging pointless vehicle expense, research centre expenses, and different heads in school, universities, and other basic administrations which have in any case been treated as customary for quite a long time scorning social-majority rule bearing. The Right to Education Act confines compulsory purchasing of school material like outfits, course readings, and other extreme things from indicated providers, along these lines thinking of it as a 'reluctant lavish expenditure' and a culpable offense in numerous states. One certain effect because of pandemic is the stirred participatory populism clarifying to renew public assistance conveyance in each circle of activities. A cutting-edge condition of new 'divided parental unionism' has delivered a dormant intellectual disclosure in students as well as generally among guardians about the lopsided dissemination and disguise about the organizations' quality blessing. [6]

C. Availability, Accessibility, Acceptability, and Adaptability of Education

It is critical to review an exhaustive plan examined in the World Conference on 'Education for All' in Jomtien, Thailand, 1990: Recalling Education as the fundamental right for all individuals, of any age worldwide. Article 3 under World Declaration on Education for All affirm Universalizing access and promoting equity was not just in primary education to kids, youth, and adults. It should expand the successful measures to annihilate teaching inconsistencies. All must be given the chance to accomplish and keep up a worthy degree of learning. Marginalized communities: people below the poverty line, street children and working kids, rural and distant populaces, children of migrant workers and so forth ought not experience the bias in learning openings. [6]

In addition, the International Covenant on Economic, Social, and Cultural Rights (ICESCR) gives two articles, Article 13 and Article 14, incorporating a wide scope of thorough talk on the privilege to equitable education inside global common freedoms law. Article 13 (2) (c) of ICESCR called as 'the right to higher education' incorporates crucial segments of Availability, Accessibility, Acceptability, and Adaptability, which are normal to instruction

in the entirety of its structures at all level [36]. Today, the productive civic education in developing countries ought to truly eye on invigorating a feeling of affirmation towards the previously mentioned four 'A' in all educating and learning stages to underwrite logical personality and network commitment during this drawn out COVID-19.[6]

D. Communication and Coordination

The teacher to student virtual relationship has to be founded on trust-building and adaptability. The most testing errand of covering the schedule and content by faculty should supplement adaptable assignment dates for the students. All educational establishments are not implied for mandatory academic heave. Rather it is about creating multi-prolonged certainty, empathy, and collaborative conduct. People seeing their family and relatives debilitated and suffering because of the crisis and emergency require fundamental availabilities of food for endurance rather than virtual learning materials for career building. The instructor to-guardians correspondence and coordination among schools and colleges will plan a technique not to assess the evaluations just, however this time their degree of fulfilment, satisfaction, and dynamic ability to fix their planned employability openings.

A teacher to teacher approach, articulated by Kristina Rizga's 'On Teaching' American project, affirms dire associates coordinated effort to set up a rundown for giving crisis help to financially weaker families. Schools, colleges and universities can receive to organize and make a list of Below Poverty Line (BPL), Scheduled Caste (SC), Scheduled Tribe (ST) students, and advance an outline to connect for network wellbeing and steadiness to weak students. [6]

VII. CONCLUSION

In conclusion, education sector needs arrangements from the entrance front, teaching method point, the teacher training front and the coordinated effort edge to successfully handle the issue of giving training through innovation. There is likewise the requirement for more technically knowledgeable instructive establishments to "handhold" lesser technically knowledgeable ones, setting up a legitimate strategy for understudies, instructors and organizations just as the guaranteeing educator preparing in the utilization of innovation for training. The organizations ought to work together to improve the amount and nature of training gave through innovation. The government must give better web associations with its residents, while instructive establishments must proceed onward from simply online classes to 100% online conveyance and evaluation and furthermore complete online conveyance obviously credits. India should attempt to utilize the current chance to improve its training base with lower costs. The conversation furnished numerous higher instructive organizations with a path forward notwithstanding a few answers for the issues they would confront on account of the pandemic. Instructive foundations should start to team up – as the issues they would face would be comparable - to attempt to arrive at a more productive mixture of instructive segment and innovation.

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HELPLESS EDUCATION SECTOR IN INDIA DURING COVID-19

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ABSTRACT

In this paper, we discuss the implications of lock-down on school, college and educational institutes. In response to the COVID-19 pandemic, governments across the world implemented lockdown policies to limit the spread of infections. Due to COVID-19 induced lockdown, schools and colleges across the country have now been shut for over three months. But currently, India has slowly started to open its economy back up, following months of nationwide lockdowns. Along with interventions in the education sector, initiatives are also needed to cushion the economic impact on poor families to discourage the use of child labour along with monitoring mechanisms set up to ensure children remain in school, whenever they re-open. There is also the issue of mental stress and trauma that young children may be facing, both as a result of reduced mobility due to the lockdown and the economic stress being faced by families. In current research we discuss the implications

of such lockdowns on overall education system.

Index Terms—COVID-19, Lockdown, Student problems, education, online education

I. INTRODUCTION

Most governments used lockdown as a strategy to prevent the spread of novel coronavirus. Human Rights Watch [1] reported that more than 1.5 billion students are out of school already. According to a UNESCO estimate [2], nearly 321 million Indian children were asked to stay home. Seven months later, students remain away from classroom studies and have been advised distance or online learning. Pratham nonprofit organization published annual report on Status of education [3], offers some disturbing answers. In 2018, just 50 percent rural children in Class 5 standard student could read a Class 2 level text, and only 28 percent could do simple mathematics problems like division and multiplies. In Jharkhand for instance, 66 percent of Class 5 rural children could not meet the bar for reading - the lowest in the country. Other parameters were also low - 57 percent of mothers and 67 percent of fathers had not been to school, 89 percent of the families had not a computer-literate member. India is not a developed country, we have very limited resources. The Indian government has already taken already lots of debts. The data suggest that students had so little academic support, that they may need educated and computer-literate relationships during lockdown. Worse, the dropout rate is also high. With widespread insecurity of jobs and financially, income reduction also increases the chances of child labor, sexual exploitation. The education sector is facing unprecedented challenges and desires to find solutions that are conducive and conducive to motivate children and stay on the path of learning. For students, lockdown does not mean low income or professional setback, this represents a disruption to their learning journey. And in the case of dropout, this was the final straw for the at-risk children who struggle to get education at the best time. The International Fund (IMF) has said that the possibility of a worldwide recession is very high [4]. The lockdown has increased deep-set class and social differences, particularly between private and public school systems. The government of India spends 4.6 percent of its GDP on education. It is often lower than sub-Saharan countries like Kenya, Togo and Zimbabwe. It suggests that, for many Indian students, the lockdown has prevented complete education. Many Indian students go to school due to the mid-day meal, If the lockdown continues for a long time, there's high chance that India's dropout rate increase.

II. ONLINE EDUCATION

On the other hand, a minority of students attending urban private schools are looking to continue their education through standard digital platforms. Children under 8 years old need parental support to do the basics, yet their learning experience is equal. There is enough data to suggest that online schools can help children of all ages, but brick and mortar schools are not an option. Teachers across the country are finding ways to teach their students in a situation where physical contact is not possible. Again, class and social divisions play a large role in determining how successful teachers are in teaching school children during an epidemic. Teachers at the country's premier private schools are tech-savvy: most have internet access at home, as well as other digital infrastructure required for sharing crafts and content. Nearly one teaching position in five primary schools is vacant today. Even in better times, many schools in rural India were run by just one teacher. According to the World Bank [5], only half of India's teachers are actually teaching on any given day because of sky-high teacher absence rates. A large number of teachers also do not teach when schools are open, it is difficult to imagine a better result when there is lockdown in schools.

According to CRY, Poverty and resource availability are the main reason for dropout school in India. Non-proper family planning is the main cause of poverty in India. School going children are unable to help their parents at the farm or shop. This makes many parents reluctant supporters of the school. It is not yet clear how parents of schoolchildren are responding to the lockdown, especially in rural areas. Many of them are now unemployed and are running out of savings early or are already in debt. In India, the technology solution to the challenge is currently limited to leading, urban-focused institutions. But if the lockout and education crisis continued, there is a real, pressing need for innovators who can come up with technologies that can help Indians learn remotely, especially in the farthest and weakest parts of the country. Not much has changed in the area for long time; perhaps it is the wake-up call that was needed. This is not the time to wait and pass the tide, but to develop and re-engineer the education sector to benefit all stakeholders.

A. Computer Literacy

Digital learning has many benefits such as digital learning has no physical limitations., it has more learning engagement experience rather than the traditional learning, It is also cost-effective and allows students to learn within the scope of their comfort zone. However, digital learning has its limitations and challenges. Since face-to-face interaction is generally considered the best form of communication, as compared to the impersonal form of distance learning globally. In the case of India, we still have a long way to go before we can see digital education as mainstream education, because students living in urban areas have the option to opt for digital education, however, students in rural areas do not have the necessary infrastructure nor are they financially strong to take advantage of the resources required for digital education. Currently, the construction of digital education infrastructure by the Government of India seems difficult due to budget constraints. Further, regardless of how digital infrastructure is created, teachers must be trained to use digital systems to provide authentic and appropriate, uninterrupted and seamless education to the students. As an immediate measure to stop the spread of COVID-19, most educational institutions have closed since late March. In India, some private schools may agree to online learning methods. But, low-income private and government school may not be able to adopt online teaching methods. In addition to learning opportunities, students will also miss their mid-day meals and can result in economic and social stress. There are few options other than shifting from the traditional face-to-face mode of the class to the digital platform. Teachers and school administrators have been advised to continue communication with students through virtual lectures or open lectures such as portals. However, in the absence of physical classrooms and proper digital infrastructure, both teacher and student are facing unprecedented challenges. From Fig. 1 we can see that the students which belong to poor state like Bihar, Jharkhand, Odisha they have very less computer literate. States are mapped based on the percentage of families with at least one computer-literate member. At the bottom of the learning ladder, students are likely to lose financial privileges, This is key because families already dealing with poverty get thrown even further behind the rich during the lockdown, and children may have to leave school and start working for recovery. There are also incidents where parents are selling their main livelihood means to buy essentials of online education for their children [6]

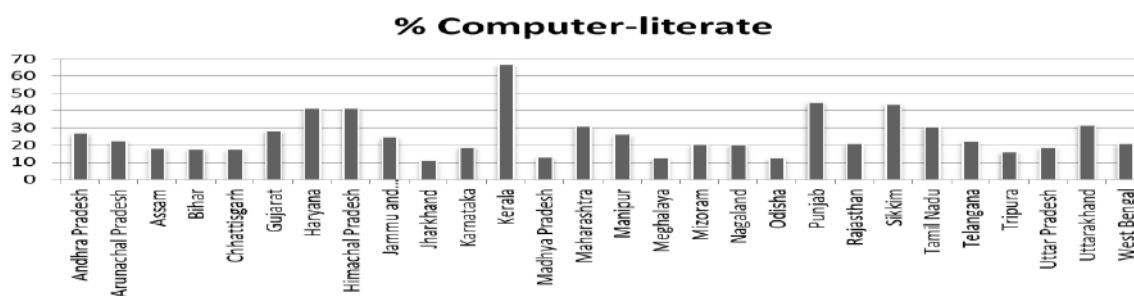


Fig. 1: Percentage of computer literate (at least one computer- literate member in home)

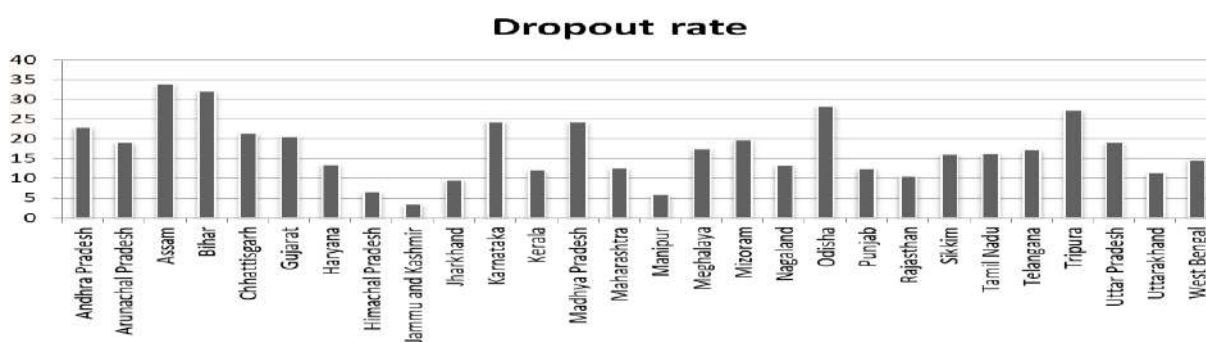


Fig. 2: Percentage of Dropout student rate

III. INDIAN EDUCATION SYSTEM

There are two major problems related to basic education system in India: high dropout and low attendance. Children dropping out or not attending school has consequences: this leads to a decrease in the productivity of the education system as the rate of high decline in per-unit cost of school education increases, and human resource development decreases. While discussing about the Indian education system in rural areas during the COVID-19, the situation of the students is not good. Schools in rural areas have deplorable condition. In rural area the biggest problem is the lack of awareness and education among the parents, who are mostly uneducated, labourers, farmers, or odd-job people. Most of families in rural areas have access to mobile phones. But instead of each member of the household, usually, only the head of the household has that phone. There is also a large population that does not use smart phones. They still have traditional mobile phones instead of smart phone. Those who have smart phone are also not comfortable or not familiar with using smart phone features. Those who are already working may be the first casualty to drop out of schools. According to the 2011 Census, marginal or part-time workers between 15 and 19 years old are around 3 million. Such children have left school to earn money to survive. Financial constraints and economic work are main reasons for rural boys to leave school, the NSS data for 2017-18 showed. That year, 19 percent of students dropped out of secondary education across India. Children who belonged to poor families, the learning ladder may not have enough resources to fight the lockdown. Child worker/labour, child trafficking and school dropout rates may increase after lockdown phase, according to a survey by Kailash Satyarthi. Students can also drop out of school because parents have lost their livelihood during the lockout. Those who are at the lower end of the economic spectrum are forced to

face financial issues. Many students have turned to child workers to support their families. Students in the age group of 12-14 will be sent to work outside so that they can support families to increase their economic potential. Loss of learning skills of students is typical every year during the summer holidays and even more so for destitute students. However, the current shutdown of schools will last much longer - that too amid other concerns such as lack of social interactions and access to educational resources. As it happens, some states with poorer learning levels may not want to open an education institute soon enough as their COVID-19 cases are still growing rapidly. Bihar, for instance following the influx of migrants returning home in special trains reported a new increase in infection. In such situations, girls who fight in favor of education will have problems too. Child marriages and unintentional pregnancies may be common consequences. According to the World Bank, girls in Sierra Leone were down about 16 percentage points, less likely to be in school after losing an entire year in 2015 due to the Ebola outbreak. The same report stated that secondary school enrollment in the Philippines fell by about 7 percent during the Asian financial crisis of 1998–99.

IV. GOVERNMENT AND OTHER INITIATIVES

The national institutions of UGC and Ministry of education are at the forefront of technology-enabled learning through audio-video mode or through e-books and magazines. Second, Swayambh initiative aims to resolve the problem of non-uniform internet penetration in the country, by offering 32 educational channels through DTH (Direct to Home) across the nation. All programs and content for these channels are provided by top highly respected academic institutions of the nation like IIT, UGC, NCERT, etc. Third, they provide a digital repository of journals and books, which can be accessed in the data warehouse at one location in the Digital National Library of India (NLDI). MHRD has also ensured virtual laboratories that simulate the environment to perform. For economies like India, where Internet penetration is 36 percent, the number of Internet users per 100 is 78, per broadband is 1.34 per fixed subscription, and 46 percent of households have television, which dictates the way education is distributed. In essence, the current digital system has many challenges related to access to education. While schools and institutions operating outside metro cities and Tier 1 and 2 cities are adapted to distance learning technology, schools in Tier 3 and 4 cities bring all students together in one classroom on one platform. There have been instances in Tier 3 or 4 cities where parents have raised the issue of not having a Smartphone, which may prevent their lockdown-has-put-321-million-indian-children-out-of-school-widened wards from accessing school-sent teaching materials. In order to solve the problem of driving on a large scale, it is mandatory for the government to make a crisis-sensitive educational plan in view of these obstacles. This forces it to function at both the policy and operational levels. Second, there is a growing need to meet the demand and supply trends developed in the education sector. In the field of school education, to build teachers' capacity for digital mode and teaching mechanisms (eg emailing students / parents, making and uploading online video clips, online video live-conferencing, online instruction) becomes necessary. Through messages, etc.) Meanwhile, in higher education, it becomes mandatory to standardize courses offered by institutions other than national institutions and raise standards for online educational content in the context of accredited courses. This step will not only promote the development of reliable content and institutions in place of offering online education, but will also mark a phased shift towards e-education. To ensure a streamlined flow of lessons, at the operational levels,

it becomes necessary to take the following actions: to ensure coordination among teachers at all levels to discuss the challenges encountered in day-to-day digital operations. Towards this end, UNESCO proposes clustering and organizing schools in a way so that teachers can build networks and get support from head teachers/coaches/subject matter experts/heads of institutes. Another challenge that will have to be addressed at the operational level is assessment of students after imparting education through digital medium. Towards this point, a novel assessment method has to be designed in terms of correcting learning outcomes at each level of subject progress. This can give way for open-book assessment, online presentation, group discussion etc. by students. Instead of grading in the context of a crisis, these methods of assessment identify the strengths and weaknesses of each student, which is the need of the hour. It is a matter of debate whether e-learning will facilitate high-level learning skills such as creativity, problem-solving, curious questions, etc. However, e-learning contributes to the capacity building of all stakeholders involved in the education gamut.

V. CONCLUSION

We have discussed the different implications that the lock-down induced restrictions will have on the education sector. Our already crippled education system will suffer a lot and most unfortunate will be the under-privileged students. Government will have to come up with more innovative methods so that under-privileged students can be served.

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THE IMPACT OF COVID-19 LOCKDOWN ON THE PERCEIVED STRESS LEVEL AND THE MENTAL WELLBEING OF THE EMERGING ADULTS

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ABSTRACT

The COVID-19 pandemic has put a stoppage to the rapid moving world, challenging the very nature of human existence along with other beings. While the nations across the globe strategized plans and policies to curb the raising COVID cases, almost every time the potential risks of the same over the mental health of the people were hardly recognized. This study aimed at evaluating the Impact of COVID-19 lockdown on the perceived stress level and the mental wellbeing of the emerging adults belonging to Indian population. A three-week online survey was conducted from September 09, 2020 to September 30, 2020 where the survey link was circulated through social media platforms such as Facebook, WhatsApp, Instagram and so on. The survey questionnaire included Perceived Stress scale, Warwick-Edinburgh Mental Well-being scale to assess perceived stress level and mental well-being of the participants. A total of 211 participants participated in the online survey of which 202 responses were analyzed. Of the total participants, nearly three-fourth of them (70.3%) were female and a little more than one-fourth (29.7%) of them were male. More than three-fourth of them (78.2%) were students belonging to the age group between 18 and 25. Moderate level of stress and moderate mental wellbeing was reported by most of the participants. Findings from the present study suggests that perceived stress level had influenced the mental wellbeing of the individuals during the COVID-19 lockdown period. Considering the COVID-19 pandemic as a disastrous one and providing emergency mental health services not only to emerging adults but also to all other population shall help in alleviating stress and improving their mental wellbeing thus resulting in a feasible combating option against such pandemics.

Keywords: COVID, Emerging Adult, Pandemic, Perceived Stress, Wellbeing.

I INTRODUCTION

The end of 2019 was the beginning of the novel coronavirus disease 2019 (COVID-19). The COVID-19 pandemic has put a stoppage to the rapid moving world, challenging the very nature of human existence along with other beings. This contagious respiratory disease was caused by the Severe Acute Respiratory Corona Virus 2 (SARS-CoV-2) that was later identified to be emerged from the market of Wuhan city in China (Zhu et al., 2020). The World Health Organization (WHO) declared COVID-19 as a pandemic on March 11, 2020. Eventually, as on March 24, 2020, the number of COVID cases crossed 3.5 lakhs reporting over 14,000 deaths from 190 countries worldwide (World Health Organisation, 2020). Until now, the virus tends to affect the human population from 214 countries and territories across the globe and two international conveyances infecting 38,372,412 people and deaths leading to 1,090,955 people (Until 14 October 2020; Worldometer, 2020). To curb and limit the spread of the coronavirus pandemic among the common public, the countries imposed various degrees of lockdown that was considered to be effective by many (Barkur et al., 2020; Flaxman et al., 2020).

For India, the dramatic rise and spread of corona cases were tackled with the imposition of national lockdowns effective with various phases. Lockdown is nothing but an emergency protocol established to prevent public moving from one place to the other. These lockdowns play a preventive role and an emergency action in saving the vulnerable lives. Besides implicating a positive role in preventing the community spread of the coronavirus, these lockdown strategies may also impact the mental health of the common people in many ways.

Basically, isolation or quarantine of any kind or as in the context of a pandemic such as SARS (Severe Acute Respiratory distress Syndrome, 2003) has closely been studied to reveal their significant implications over the mental health of the affected individuals (Reynolds et al., 2008). Even, there are a number of studies emerging in the present pandemic situation which are mostly focusing on the economic, environmental and physical health significances of the disease. Nevertheless, there is a void in studying the impact of the COVID-19 pandemic lockdown over the mental health aspects of the emerging adults.

Emerging adulthood or young adulthood is a transitional life course period between the age of 18 and 25 years characterized with various demographic, psychological and environmental transitions such as school completion, career acquisition, obtaining financial independency, leaving parental home, securing personal identity formation, choosing partner and emerging a new family (Arnett, 2000). Younger adults have a greater difficulty in compartmentalizing emotional experiences and in managing their emotions thus incorporating negative coping mechanisms towards mediating the effects of stress (Clarke, 2019). Therefore, the present study was aimed at evaluating the impact of COVID-19 lockdown on the perceived stress level and the mental wellbeing of the emerging adults belonging to Indian population.

II METHODOLOGY

A three-week online survey was conducted (from September 09, 2020 to September 30, 2020) on students, scholars, employees, housewives and other professionals with their age group ranging from 18 to 25. A cross-sectional survey design was adopted to assess the impact of COVID-19 lockdown on the perceived stress level and the mental wellbeing of the emerging adults.

We collected data using an online survey platform (KoboToolbox) in accordance to the Indian government's guidelines to minimize one on one/physical interaction between the researchers and the respondents. The survey link was circulated through social media platforms such as Facebook, WhatsApp, Instagram and through personal mails. A snowball sampling technique was used thus encouraging the participants to roll out the survey link to as many people as possible. Upon clicking the survey link the participants were directed to the information about the study and the informed consent. Additionally, the survey link was designed in such a way that only one response could be generated through one device. Since it was an online study, participants with internet access were only got accessed to the study participation and the individuals who can understand English could give the survey. However, the age group for participation was restricted between 18 and 25 years of age. The socio-demographic variables of age, gender, religion, locality, marital status and educational status were included. The survey questionnaire included Perceived Stress scale (4-item), Warwick-Edinburgh Mental Well-being scale (7-item) to assess perceived stress level and mental well-being of the participants. Descriptive statistics have been used to analyze the findings of the study. Mean, standard deviation and proportions have been employed to estimate the results of the study.

III RESULTS

Little less than one fourth (22.8%) of the respondents fall under the age of twenty-four and very few (5.9%) of the respondents belong to the age of eighteen. Nearly one-third (70.3%) of the respondents were self-identified themselves as female and a little more than one-fourth (29.7%) of them were identified to be male population. Among the respondents, more than half of them (64.9%) were belonging to Hinduism and very little of them (2%) were

TABLE 1

SOCIO-DEMOGRAPHIC PROFILE OF THE RESPONDENTS

Variables	Frequency (n=202)	Percentage (%)
Age	18	5.9
	19	7.9
	20	6.4
	21	11.4
	22	12.4
	23	18.3
	24	22.8
	25	14.9
Gender	Female	70.3
	Male	29.7
Religion	Hinduism	64.9
	Islam	9.9
	Christianity	7.4
	Other	2.0
	Prefer Not To Say	15.8
Marital Status	Single	76.7
	Married	21.8
	Separated / Divorced	1.5
Locality	Rural	28.7
	Urban	43.1
	Semi-Urban	28.2
Educational Status	Bachelor's Degree	32.2
	Master's Degree	46.0
	MPhil	4.5
	PhD Scholar	14.9
	Other	2.5

TABLE 2

PERCEIVED STRESS LEVEL

VARIABLES	FREQUENCY (N=202)	PERCENTAGE (%)
LOW	34	16.8
MODERATE	133	65.8
HIGH	35	17.3
TOTAL	202	100.0

TABLE 3

MENTAL WELL-BEING

VARIABLES	FREQUENCY (N=202)	PERCENTAGE (%)
LOW	15	7.4
MODERATE	115	56.9
HIGH	72	35.6
TOTAL	202	100.0

identified to practice other religion such as Bathoism, Buddhism and Parsi respectively. Interestingly, quite a number of respondents (15.8%) preferred not to reveal their religion. Little more than three-fourth of the respondents (76.7%) were identified to be single in their marital status whereas only very few of them (1.5%) were identified to be separated/divorced (Table 1).

Less than half of the respondents (43.1%) were belonging to the urban locality besides having an equal amount of them (28.7%, 28.2%) coming from rural as well as semi-urban locality respectively. The educational status of the respondents reveals that nearly half of them (46%) were pursuing Master's degree and a minimum number of them (2.5%) had completed their schooling. From Table 2 and 3, nearly two-third of the respondents (65.8%)

were found to have a moderate level of perceived stress and more than half of them (56.9%) were having a moderate level of mental wellbeing respectively.

IV DISCUSSION

The current study involved the investigation of the impact of the COVID-19 lockdown on the perceived stress level and mental wellbeing of the emerging adults belonging to Indian population. With time passing by, the concerns over the impact of COVID-19 on the mental health, economy and living increased. The impact of the disease and the lockdown due to the same has found to be seriously affecting the mental health of individuals from all sections of the society. Nonetheless, the study showed emphasis over the emerging adults of the population because of two reasons; one is due to the lack of significance shown towards the age group in evaluating their mental health problems during this pandemic and the other is essentially because of their inability to manage their emotional experiences during the same. Besides the collection of socio-demographic data, the survey included validated psychometric scales of PSS and WEMWBS to evaluate the perceived stress level and the mental wellbeing of the participants respectively.

A recent online study conducted on the common Indian population revealed that three-fourth (74.1%) of the participants reported a moderate level of stress (Grover et al., 2020). The findings of the present study seemed to provide a similar result in accordance with the previous study reporting a moderate level of stress among two-third (65.8%) of the participants (Grover et al., 2020). However, the findings of the present study reporting a moderate mental well-being with more than half of the survey participants (56.9%) contradicted with the results of the study that reported poor well-being (71.7%) respectively.

V CONCLUSION

The COVID-19 pandemic has created a mild and moderate impact (though not seriously) over the stress level and the mental well-being of the emerging adult population of India. However, it becomes paramount to consider the COVID-19 pandemic as a disastrous one and imparting emergency mental health services to the emerging adult population shall help in alleviating stress and improves their mental wellbeing as they contribute towards the country's socio-economic development in near future as well as in the long run.

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Instructions for Faculty/Staff & Students Regarding COVID-19

- Get yourself thermally scanned at the entrance of the Institute.
- Clean your hands frequently. Use soap and water or an alcohol-based hand rub.
- Maintain social distancing. Be at a physical distance of at least 2 meters from one another.
- Be disciplined and have patience, be in queue.
- Wear a three-layered mask and follow guidelines on how to wear a mask.
- Wash your hands every time you end up touching a doorknob or press the lift buttons, using bank ATM or any common surface with your bare hands.
- Don't hug or shake hands with anyone. Come up with your own preferred greeting- with folded hands.
- Use of Aarogya Setu App is mandatory.
- Do not roam about unnecessarily, use personal cell phone, intercoms/electronic media for interpersonal communication.
- Wipe down your desk, mouse keyboard and screen daily at least two times with a paper towel & alcohol-based sanitizer before you start working.
- Go Digital: Scan and send important documents instead of moving files. Use a digital wallet to make all payments.
- If you feel unwell STAY HOME.
- If suffering from high fever/cough/sneezing/difficulty in breathing voluntarily report the same as well as seek immediate medical advice for timely detection and treatment.
- In case of a cough/ sneeze, use the paper napkin and dispose of in closed Bin.
- Refrain from touching face, mouth, nose and eyes with your hands at all times.
- Do not spit.
- Preferably use self-transport, avoid public transport and avoid physical meetings.
- Use of Air Conditioners: Temperature Range 24-30°, Humidity level 40-70%, keep at least one window open for proper ventilation, keep one pan full of water.
- Beware of Fake News and Misinformation. Avoid spreading and believing them.
- Encourage frontline corona warriors.

How to Wear & Dispose off Mask for Protection Against Covid-19?

- Before putting on a mask, clean hands with alcohol-based hand rub or soap and water.
- Cover mouth and nose with mask and make sure there are no gaps between your face and the mask.
- Avoid touching the mask while using it; if you do, clean your hands with alcohol-based hands rub or soap and water.
- Replace the mask with a new one as soon as it is damp and do not re-use single-use masks.
- To remove the mask: remove it from behind (do not touch the front of mask); discard immediately in a closed bin; clean hands with alcohol-based hand rub or soap and water.



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