About the Book

The nine research papers included in this volume from young researchers encompass some major aspects of economic transformation. They include issues such as health and economic issues with a valuable cross-section of opinions relating to emerging trends mostly of rural India. The book will be helpful to students, researchers, teachers and policy makers at all levels.

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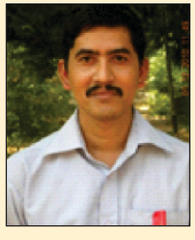

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Dr. Debasis Bhattacharya
Chair Professor
A. K. Dasgupta Centre for Planning and Development
Visva-Bharati

Contents

Chapter 1

Effects of Biomass Burning on Lung Functions in Rural Tribal Women in Kaliganj Village, Santiniketan

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Abstract: Today, developing countries, like India, are facing a major problem of air pollution (both indoor and outdoor). Indoor air can be much polluted than outdoor particularly when there is combustion process associated with cooking. Indoor air pollution resulting from combustion of biomass burning in rural households of developing countries is now documented as a major contributor to the global burden of diseases. The present study focused on the respiratory health status of rural tribal women who strictly use biomass fuel for cooking. Epidemiological studies have reported that women in rural villages are suffering from impaired health due to prolonged and repeated contact with the harmful pollutants emitted from biomass burning which adversely affects their respiratory functions. Pulmonary functions test (PFTs) is of great importance in the evaluation of respiratory diseases. Spirometry is a simple non-invasive and has been most commonly used technique for PFTs. It measures the volume of air inhaled or exhaled as a function of time during forced breathing manoeuvres and is an essential tool in the diagnosis of airway obstruction. The PFTs was performed from December 2017 to June 2018 in 80 tribal women (age varying from 16 to 30 years) who use biomass fuels for cooking in tribal areas of Santiniketan. The analyzed pulmonary parameters were focused on Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV_1), Peak Expiratory Flow rate (PEF) and the Forced Expiratory Flow between 25%-75% ($FEF_{25-75\%}$) expired volume. The mean ± SD value of the age, height, weight and BMI of women participants are 23.83 ± 4.55 years, 149.64 ± 6.55 cm, 46.89 ± 7.25 kg and 20.91 ± 2.95 kg/m^2 respectively. The mean ± SD value of the FVC, FEV_1, PEF and $FEF_{25-75\%}$ are 1.96 ± 0.74 litres, 1.11 ± 0.46 litres, 1.88 ± 0.97 litres/second and 1.10±0.84 litres/second respectively. A correlation coefficient was calculated for each pulmonary parameter (like FVC, FEV_1, PEF and $FEF_{25-75\%}$) with height (cm), weight (kg), and age (years). PFTs were performed with different age, height and exposure group, where

the results show a lower value of lung functions in higher age group whose extent of exposure were higher. Using multiple regressions, both linear and non-linear models were developed with transformations of dependent and/or independent variables to present prediction equations for various spirometric parameters for women which can be used to produce updated spirometry reference data for the general population of the same ethnicity and lifestyle.

Keywords: Biomass fuels, Indoor air, Respiratory health, Rural health, Spirometry, Tribal women.

Introduction

The recent study of Global Burden of Disease estimates that, the air pollution alone stands at first rank as a major risk factor for premature deaths and disabilities in India, while unsafe water and poor sanitation is ranked sixth among major risk factors (IHME, 2015). Among the outdoor and indoor air pollution, indoor air pollution is being given importance in the world due to its vulnerability and health deterioration and mortality. According to World Health Organization, around 3 billion people still use solid biomass fuels for cooking and other purposes (WHO, 2014) and one of the major source of indoor air pollution (IAP) is burning of these biomass fuels (BMF) like wood, charcoal, animal dung, straw, and crop residue for cooking (Viegi *et al.*, 2004) which affects half of the world's population and has been documented as a major reason of environmental exposure related to deaths (Martin *et al.*, 2014). There are mainly two forms of biomass fuels used for cooking in rural areas such as traditional fuels which derived from animal dung usually cow and buffaloes, and the second form is biomass grown in agricultural fields such as agricultural residues *i.e.*, straws, rice husk, corn cob, twigs, processed waste of sugarcanes etc. Burning of these two types of solid biomass fuels directly affects the respiratory system (Gulia *et al.*, 2017; Gurjar *et al.*, 2010; Laumbach and Kipen, 2012; Pope *et al.*, 2014; Smith, 2013). In developing countries like India, a huge proportion of people lives in rural households, having a single room for cooking and sleeping; this type of lifestyle makes them vulnerable to toxic Household Air Pollution (HAP) exposure (Sidhu *et al.*, 2017). As a

result the pollution levels in typical Indian households during cooking are much higher than the indoor air quality standard recommended by the US Environmental Protection Agency (Balakrishnan *et al.*, 2002). As similar to the cigarette smoke, biomass smoke also contains a huge number of toxic pollutants like particulate matter of different sizes, carbon monoxide, oxides of nitrogen, formaldehyde, acrolein, benzene, toluene, styrene, 1,3-butadiene, and polycyclic organic hydrocarbons including benzo(a)pyrene and transitional metals like Cu, Fe, Ni, Al, and Zn (Morawska and Zhang, 2002).

The epidemiological studies indicate that the risk of respiratory symptoms and illnesses have increased due to exposure of biomass smoke (Kurmi *et al.*, 2013, 2010; Kamal *et al.*, 2016; Regalado *et al.*, 2006). Exposure to HAP is also a leading cause of disability, being associated with a range of illnesses including acute and chronic respiratory diseases, cardiovascular diseases, low-birth weight and cataracts (Gordon *et al.*, 2014). Women and children are the main victims of household air pollution from burning of biomass fuels as they spent maximum time in indoor which leads to higher exposure of pollutants (Smith *et al.*, 2004). In rural areas of Santiniketan, the use of liquefied petroleum gas (LPG) is rare and people highly depend on biomass fuel. So, their dependency on solid biomass fuel has become a necessity than a choice, women are at high risk of developing various respiratory diseases. Thus, the present study focused on the respiratory health status of rural tribal women who strictly use biomass fuels for cooking. Pulmonary functions test (PFTs) is of great importance in the evaluation of respiratory diseases. Therefore, in this study, an attempt has been made to find out the relation of biomass use for cooking to pulmonary function (PF) of tribal women in Santiniketan tribal areas who are economically poor and cannot afford cleaner fuels.

Materials and Methods

Study Design and Study Area:

The present study was a cross-sectional observational study over rural women of Kaliganj Adibasi Pally, Santiniketan, West Bengal, India. People, who live in this village, are mainly belonging to Santali tribes, who depend on farming. Due to free availability of biomass from the nearby Ballavpur forest, without any additional cost to the user, and it lead to less incentives in switching to cleaner and costlier fuels and the choice of fuel mainly depends on the availability and ease of fuel.

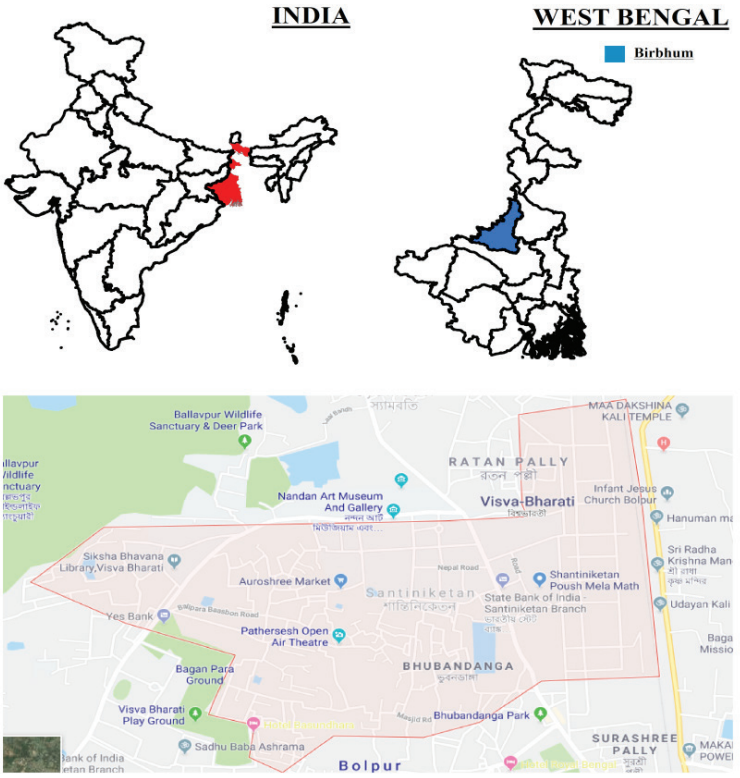

Fig 1.1: Map of the study area

Study population:

Among 200 women, total 80 tribal women were selected on the basis of standard respiratory questionnaire of IUATLD (International Union against Tuberculosis and Lung Disease) which is adopted in INSEARCH multicentre study with additional questions about tobacco smoke exposure, cooking related activities, cooking time exposure, non-respiratory general health problems and various socioeconomic aspects.

Inclusion Criteria

- ◊ Age 16-30 years.
- ◊ Non-smoker.
- ◊ Non-pregnant
- ◊ Performance of spirometry meeting American Thoracic Society (ATS) / European. Respiratory Society (ERS) criteria.
- ◊ Answers to standard respiratory questionnaires.
- ◊ Willingness to enrol in the study with written consent.

Exclusion Criteria

- ◊ Pregnant women.
- ◊ Smoking women.
- ◊ History of active respiratory infections and cardiovascular diseases.
- ◊ Recent stroke, eye surgery, thoracic/abdominal surgery.
- ◊ Uncontrolled hypertension.
- ◊ Pulmonary problem.
- ◊ Rejection for enrolment in the study.

Pulmonary Function Test:

Pulmonary function of these subjects was estimated using computerised pulmonary function testing device *i.e.* an electronic spirometer (Medikro Spirometer, Finland) interfaced with a personal computer. The spirometer detects the flow rate from the sensor and digitally integrates flow to volume

$$V = \int v dt \quad \text{..... (l)}$$

Where V denotes the inspired or expired volume, and

v = dV/dt (l/s) is the measured flow.

The recording of breathing traces and the calculation of derived parameters are usually performed by an integrated microprocessor or a personal computer (Schlegelmilch and Kramme, 2011). To ensure the accuracy of the reading, the devices were calibrated regularly. As per standard guidelines, the height and weight were measured and the technique was explained and demonstrated prior to the testing.

Anthropometric parameters:

Age, height, weight and BMI (Body-mass Index) were recorded for each participant. Weight and height were measured to the nearest 0.5 kg and 0.1 cm in standing position, respectively. Body mass Index was calculated using the formula.

BMI = Weight in kg/Height in m^2

Spirometric parameters:

Pulmonary Functions Tests (PFTs) included forced vital capacity (FVC in litre), forced expiratory volume in 1 s (FEV_1 in litres), peak expiratory flow (PEF in litres / second) and flow between the twenty-fifth and seventy-fifth percentile of forced expiratory flow ($FEF_{25–75\%}$ in litres/second). Best of three readings was recorded meeting the ATS (American Thoracic Society)/ERS (European Respiratory Society) criteria for the flow-volume loop.

Statistical Analysis:

Data of at least 3 trials for each subject were collected and the highest values were selected for analysis. Statistical analysis like means and standard deviations of all the sets of observations was done in the different groups. Analyses were also done by correlation coefficient, descriptive analysis and multiple linear regression through the Microsoft Excel 2013 and SPSS 23.

Results and Discussion

Among 200 women, total 80 biomass user women were selected through questionnaire survey and enrolled for PFTs in the present study, age varied between 16 to 30 years. The mean ± SD value of the age, height, weight and BMI of women participants were 23.83 ± 4.55 years, 149.64 ± 6.55 cm, 46.89 ± 7.25 kg, 20.91 ± 2.95 kg/m^2 respectively. The most significant spirometric parameters *i.e.* forced vital capacity (FVC), forced expiratory volumes in one second (FEV_1), peak expiratory flow rate (PEF) and forced expiratory flow between 25-75% expired volume ($FEF_{25-75\%}$) of different age and weight were calculated. The mean ± SD value of the FVC, FEV_1, PEF and $FEF_{25-75\%}$ were 1.96 ± 0.74 litres, 1.11 ± 0.46 litres, 1.88 ± 0.97 litres/sec and 1.10 ± 0.84 litres/sec respectively. All the women participants were categorized into three groups depending on their age *i.e.* Group-A (16-20 years), Group-B (21-25 years) and Group-C (26-30 years) for evaluation of pulmonary functions by analysing the spirometric data. Statistical analysis was done for all the parameters in different age groups and the p-value was determined by anthropometric parameters where $P<0.001$-highly significant (HS), $P<0.01$-significant (S) and $P>0.05$ were considered as non-significant (NS). (Table 1.1) shows the anthropometric parameters of the different age groups. Mean age difference between the three age groups was found to be significant, whereas the mean height, weight and BMI were almost similar and there were no significant difference were found between the study groups.

Table 1.1: Mean ± SD of anthropometric parameters different age group of tribal women

Parameters	Group A (16-20 years)	Group B (21-25 years)	Group C (26-30 years)	P-Value
Age (year)	17.75 ± 1.49	22.23 ± 1.36	28.47 ± 1.55	S
Height (cm)	146.50 ± 7.56	150.08 ± 4.03	150.93 ± 7.57	NS
Weight (kg)	42.63 ± 6.23	47.92 ± 7.85	48.27 ± 6.76	NS
BMI (kg/m^2)	19.69 ± 1.50	21.32 ± 3.66	21.22 ± 2.84	NS

Pulmonary functions of the tribal women depending on age:

Based on the different age (16 to 30 years), women were categorized into three age groups *i.e.,* Group-A (16-20 years), Group-B (21-25 years), Group-C (26-30 years) for evaluation of pulmonary functions by analysing the spirometric data. Mean values of the spirometric parameters *i.e.* FVC, FEV_1, PEF and $FEF_{25-75\%}$ showed highly significant variations in all pair wise comparisons across groups. The mean ± SD value of FVC, FEV_1, PEF, $FEF_{25-75\%}$ parameters having lower value in age groups C compared to group A and group B. All the spirometric parameters were showing lower value with increasing age (Fig 3.1). A small difference of FEV_1 was observed between Group A and Group B in the present study. The mean value of FEV_1 in Group-A, Group-B and Group-C were 1.15 ±0.41litres, 1.13 ± 0.70 litres and 1.07 ± 0.38 litres respectively. Long term exposure to the biomass smoke creates various health problems mainly respiratory health. Rural women in developing countries are forced to start cooking regularly in their teenage and that may continue up to their old age. In these cases, their exposures to biomass smoke are also increased with increasing age. A study undertaken by Sukhsohale *et al.*, (2013) found that increased morbidity was associated with the increased exposure or exposure index (EI = average hour daily exposure X years of exposure). Similarly, in the present study, it was clearly observed that with increasing age their lung function deteriorate.

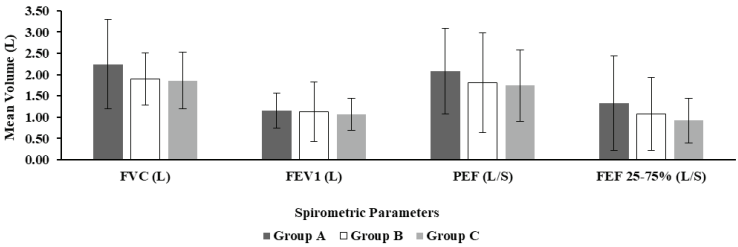

Fig 1.2: Pulmonary parameters (Mean ± Standard Deviation) of different age groups

Pulmonary functions of the tribal women depending on different body weight:

Body weight is one of the most important anthropometric parameters for PFTs and it may have effects on PFTs including impairment on small airway dysfunction and expiratory flow limitation, alterations in respiratory mechanism, decreased chest wall and lung compliance, decreased respiratory muscle strength and endurance, decreased pulmonary gas exchange, lower control of breathing, and limitations in exercise capacity (Faintuch *et al.*, 2004; Rasslan *et al.*, 2004; Al Ghobain, 2012). In this study, based on different body weight, women were categorized into two groups *i.e.* Group-X (<50kg) and Group-Y (>50kg). The mean value of all the spirometric parameters (except PEF) having lower value in group Y (>50kg) compared to group X (<50kg) (Fig 1.3). The PEF values of Group X and Group Y were respectively 1.87 ± 1.02 and 1.89 ± 0.87 litres/sec. This study observed that overweight leads to decreasing lung functions in women.

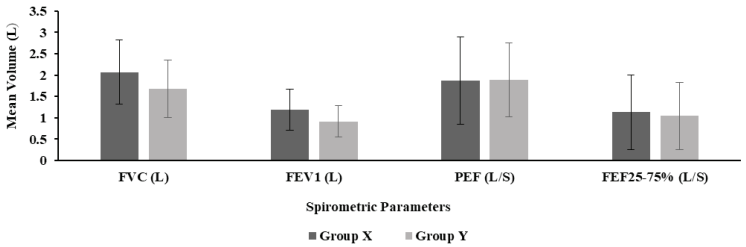

Fig 1.3: Pulmonary parameters (Mean ± Standard Deviation) of different weight groups

Pulmonary functions of the tribal women depending on different exposure groups:

Lifetime exposure to cooking smoke was expressed as hour years (cooking hours per day × years of cooking × 365) following the procedure of Ozbay *et al.*, (2001). Lifetime exposure was classified into three categories on the basis of hour-years: category 1, ≤5,000; category 2, 5,000–10,000; and category 3, ≥10,000 hour-years.

Biomass using women exposed to smoke exhibited lower pulmonary functions with increasing exposure time (hour-years). In the present study it was observed that category 3 (≥10,000 hour-years) exhibited lower pulmonary functions than category 2 (5,000–10,000 hour-years) and category 1 (≤5,000 hour-years) (Fig 1.4). Dutta and Ray, (2013) in their study stated that women who cook maximum hour years *i.e.* whose lifetime exposure were higher exhibited higher prevalence of respiratory symptoms, both upper respiratory symptoms and lower respiratory symptoms than others.

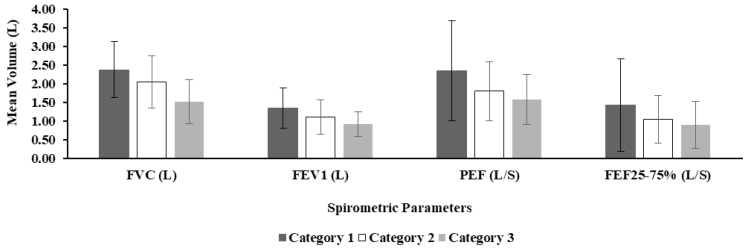

Fig 1.4: Pulmonary parameters (Mean ± Standard Deviation) of different exposure groups

Ventilation functions of study groups:

The typical responses of a spirometer showing the variation of ventilation function of 2.77% women were normal whereas, 5.55% of women were showing mild decrease, 2.77% of women showing moderate decrease, 16.66% showing moderately severe decreases, 33.33% of women showing severe decrease and 38.88% women were showing very severe decreases lung functions (Fig 1.5). So in this study, these percentage values clearly indicate that, the ventilation functions of tribal women are seriously deteriorating due to excessive use of biomass fuel.

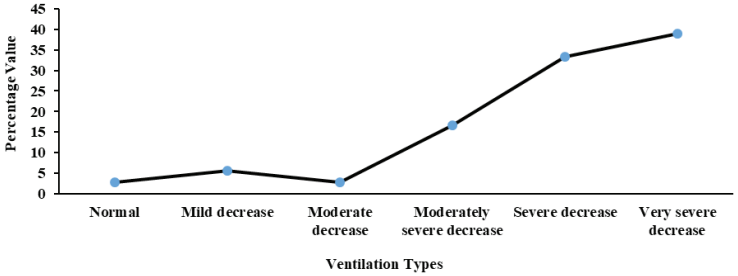

Fig 1.5: Percentages (%) of types of ventilation functions of the study groups (tribal women)

Pearson's correlation coefficient between different anthropometric and spirometric parameters:

For the better understanding between anthropometric and spirometric parameters, a Pearson's correlation coefficient analysis was done between these two parameters of the women participants. The results shows that the age and BMI were negatively correlated with pulmonary parameters which indicate decreasing lung functions value was observed with increasing age and BMI. Another negative correlation was found between FVC, FEV1 and $FEF_{25-75\%}$ and weight, whereas PEF was positively correlated with weight. The negative correlation was also found between height and FVC (Table 1.2).

Table 1.2: Correlation coefficient of anthropometry and pulmonary parameters of women

	Age	**Height**	**Weight**	**BMI**	**FVC**	**FEV_1**	**PEF**	**$FEF_{25-75\%}$**
Age	1							
Height	0.250	1						
Weight	0.288	0.433	1					
BMI	0.189	-0.123	0.838	1				
FVC	-0.084	-0.050	-0.304	-0.305	1			
FEV_1	-0.001	0.132	-0.275	-0.375	0.602	1		
PEF	-0.051	0.238	0.100	-0.249	0.161	0.635	1	
$FEF_{25-75\%}$	-0.086	0.226	-0.074	-0.207	0.005	0.583	0.804	1

Prediction Equations for Spirometric Parameters of Women:

The current study presents prediction equations for various spirometric parameters for women, of study area. Age, height, weight, and BMI remain the most important determinant variables for lung function parameters. Multiple linear regression models are a generalization of simple linear regression in cases where we have more than one independent or predictor variable. The aim of such multiple regressions is, therefore, to explore and quantify the relationship between a numerical dependent variable and one or more qualitative or qualitative predictor variables.

A multiple linear regression model has the following structure:

$$Y= \beta_0X_0+ \beta_1X_1 +\beta_2X_2 + \ldots\ldots\ldots \beta_nX_n+ \varepsilon$$

Where Y = dependent or explained variable; X_0, X_1, X_2, X_n = independent predictor or explanatory variables; β_0, β_1, β_2, β_n = regression coefficients (constants); and ε is the error term, with a normal distribution and which contemplates the part not explained by the independent variables (Del Águila and Benítez-Parejo, 2011).

This study established predictive equations using regression analysis for spirometric parameters in women age 16-30 years living in Kaliganj village of Santiniketan, West Bengal, India which is allowing prediction of the reference value in the further study. By using this equation we can easily predict the lung function status of the women population of the area.

Prediction Equations for Pulmonary parameters (FVC, FEV_1, PEF and $FEF_{25-75\%}$)

$$FVC = [(- 0.001 \times Age) + (0.002 \times Height) + (-0.02 \times Weight) + (-0.034 \times BMI) + (3.305)]$$

$$FEV_1 = [(0.003 \times Age) + (0.41 \times Height) + (-0.08 \times Weight) + (0.074 \times BMI) + (-3.928)]$$

$$PEF = [(- 0.019 \times Age) + (0.103 \times Height) + (-0.114 \times Weight) + (0.187 \times BMI) + (-11.675)]$$

$FEF_{25-75\%} = [(0.208 \times Age) + (-0.089 \times Height) + (-0.149 \times Weight) + (0.204 \times BMI) + (12.959)]$

These reference values can be used to evaluate pulmonary functions in diseased women of the same ethnicity and lifestyle in further study.

Conclusions

This study was intended to conduct a comprehensive characterization of pulmonary functions test parameters in 80 tribal women at the age 16 to 30 years. The results of this study indicated an association between biomass use and reduction in lung functions. The study found the correlations between anthropometric (age, height, weight and BMI) and spirometric parameters (FVC, FEV1, PEF and FEF25-75%) of the study subjects. A relationship exists between anthropometric parameters and the prevalence of lung function deficits. Correlation coefficient analysis showed that the correlation was significant. From the correlation it was observed that the decreasing in pulmonary function with increasing age and exposure duration. The tribal people having lower economic status and they cannot afford cleaner fuel; therefore, they use wood for cooking because it is easily available in the nearby forests. Hence, educating the rural tribal people about the ill effects of biomass burning help to prevent the adverse effects of biomass burning in this population.

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Chapter 2

Malnutrition in Odisha: How to Address this Challenge

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"Odisha recorded six child malnutrition-driven deaths in 2017". As per the RGI's MCCD report, six children in Odisha died from malnutrition-related diseases like kwashiorkor, nutritional marasmus and other similar disease conditions. The India Health of Nation and States – 2017 (IHNS-17) report had also rated child and maternal malnutrition, as the number one risk factor in driving most of the deaths and disabilities in the state.[1]

Context

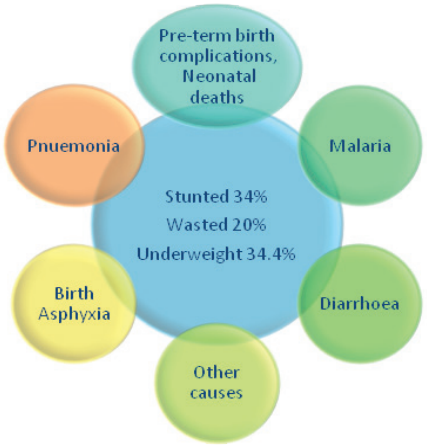
Odisha, with a population of 41.9 million in 2011, is one of the poorest states in India. According to the SDG India Index Baseline Report of 2018, 32.59% (13.85 million) population in Odisha are below poverty line as of 2011-12 as against the national average of 21.92%.[2]

The rationale for investing in nutrition is globally well recognized both as a critical developmental imperative, as well as crucial for the fulfillment of human rights especially of the most vulnerable such as children, girls and women. Reduction of malnutrition among children has been accorded high priority in global, national and local

1 https://www.asianage.com/india/all-india/090919/malnutrition-snuffs-out-lives-of-children-women-in-odisha.html
2 SDG India Index Report of 2018 https://www.niti.gov.in/sdg-india

development agenda. The World Health Assembly (WHA) set six commendable targets for stunting, wasting, overweight, anaemia, low birth weight and exclusive breast feeding to improve the state of maternal and child health.

It is the most effective means for poverty reduction and economic development with high economic return. Nutritional balance is *central to the achievement of Sustainable Development Goals (SDGs)* targets to end hunger, achieve food security and improve nutrition. Current trends show that India faces a significant risk of falling far short of the SDG target of Hunger Eradication by 2030. Odisha has one of the highest proportions of malnutrition among children and high child and maternal mortality, one of the major reason being poor nutritional status among its population.



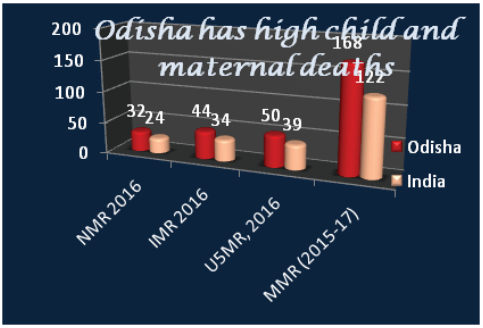


Fig. 2: Child mortality rates and Maternal mortality ratio

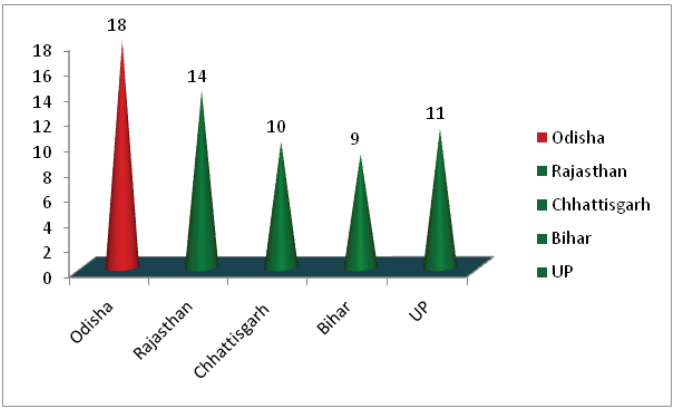


Fig. 3: Comparision of LBW babies in some States, 2017-18

State's Nutritional Health Status: Battling Endemic Malnutrition

As per February 2016 data, as presented by Women and Child Development Minister Usha Devi

- ◊ 8, 39,285 newborn babies (22.17 per cent) are found under weight (less than 2.5 kg)
- ◊ Malkangiri district tops in the list having 36.27 per cent of underweight newborns, followed by Nabarangpur (35.25 per cent), Rayagada (33.36 per cent) and Koraput (35.78 per cent)
- ◊ The percentage is 30.74 in Kalahandi, 29.64 in Nuapada and 29.10 in Sundargarh district.
- ◊ Other districts that register over 20 per cent underweight newborns include Sambalpur, Mayurbhanj, Keonjhar, Jajpur, Jharsuguda, Ganjam, Gajapati, Kandhamal, Deogarh, Balangir, Bargarh and Baleswar.
- ◊ Jagatsinghpur district recorded the lowest of 3.27 per cent underweight newborn babies.

Children in Odisha suffer from some of the highest levels of stunting, wasting and underweight in the world

Odisha has the highest proportion (18.2) of LBW babies (less than 2500 grams) among new born as per the latest Niti Ayog's Health Index Report, 2019

(Box 2). As per CNNS survey of 2018, 29 percent of children are underweight as well as stunted. *The fact that around 46% children (severe + moderate) are stunted shows that the children in the state are suffering from long term undernutrition.*

Anaemia is a major public health problem in Odisha and is one of the states with high proportion of anemia among children and women. CNNS 2016-18 found 30% children (1-4 years) and 13% (aged 5-9 years) having iron deficiency. 20% adolescents were found iron deficient. About half (51%) of women in Odisha have anaemia.

Key Strategies to Tackle Undernutrition by the State / Government Interventions

Nutrition and Health Interventions - To improve nutritional intake and reduction in disease burden

Table 1: List of key government interventions

For Children under 6 years	
Promotion of breast feeding	MAA (Mother's Absolute Affection) in 2016 – To revitalize efforts towards promotion, protection and support of breastfeeding practices through health systems and community support Breastfeeding is also promoted through home visits by FLWs, and promoted through various methods on VHNDs/Mamata diwas
Timely introduction of complementary food	Campaigns like *Annaprasanna* Nutrition counseling by FLWs
Provision of supplementary nutrition to school children	Mid Day Meal Program Malati Devi Prak Vidyalaya Poshak Yojana
Integrated Child Development Scheme	Supplementary nutrition / Take home ration (The state now provides chatua, a THR made of wheat, peanuts, Bengal gram and sugar.) Non-formal pre-school education Immunization Health check-up which includes growth monitoring Nutrition and health education which includes breast feeding practices, FP etc Referral to NRC (Nutrition Rehabilitation centres)

Mamata Diwas/ Village Health Sanitation and Nutrition Day:	Organized every Tuesday / Friday at village Anganwadi Centers. Counseling on nutrition, childhood illnesses and health Referral to NRC
Reducing anemia	National Iron+Initiative launched in 2013 - Iron supplements for children - Children 6-59 months
Reduction in Childhood illnesses	Vitamin A Prophylaxis Program (From 9 months every 6 months upto 5 years) Deworming of children every 6 months (12-59 months of age) Zinc supplementation during diarrhea Distribution of mosquito nets to reduce incidence of malaria
Treatment of severe and acute malnutrition	Pushtikar Diwas is organized on every 15th day of the month at PHCs and CHCs to assess, diagnose, and treat children with severe / acute undernutrition Districts conduct vulnerability assessment of the families having SAM children and link them with the development schemes of the various Departments.
Establishment of NRCs	For treatment of SAM (Severe Acute Malnutrition) children
Crèches in Particularly Vulnerable Tribal Groups (PVTG)	These were established for children from 6 months to 3 years set up in PVTG and hard to reach areas to prevent under nutrition in five districts of Rayagada, Kalahandi, Koraput, Malkangiri and Nabarangpur (30 in each district).

For Adolescent girls	
Reduction in anemia	Weekly Iron and Folic Acid Supplementation (WIFS) in 2000 - provides weekly IFA supplements to adolescents 12 by 12 initiative launched in 2007 – aims to make sure every child in India achieves a healthy hemoglobin level within 12 years National Iron+ Initiative Program (NIPI) - supplementary nutrition to increase protein intake
Deworming	National Deworming Day (Twice a year)
ICDS	THR/Hot cooked meal for 10-14 years Health check-up and referral services Nutrition and health education Counseling/ARSH
For Pregnant and Lactating mothers	
Reduction in anemia	Distribution of 100 IFA tablets during pregnancy National Iron+ Initiative Program (NIPI) - to address supplementation interventions and supplementary nutrition to increase protein intake

Calcium supplementation	Pregnant and lactating women for six months[3]
ICDS	Supplementary nutrition / Take home ration Nutrition and Health Education
Immunization	TT immunization for pregnant women
Deworming	Deworming of pregnant women
Health care provision	ANC and PNC through home visits and at health care facilities FP services SAMMURNA scheme – to reduce MMR and IMR

Indirect Interventions – To improve underlying determinants of nutrition[3]

Table 2: List of key government interventions

Micronutrient supplementation	• National Iodine deficiency disorder control program – to provide iodized salt and banning non-iodized salt
Fortification of food	• Fortification of rice and distributed through Mid day meal scheme and PDS • Fortification: of oil and milk
Food security	• Implemented National Food Security Act in in 2014, providing subsidized food grains to almost two thirds of the population • Mobile vans were used to ensure PDS commodities reached remote areas • Antodaya Anna Yojana and Annapurna scheme. • Aahar kendras in selected urban areas
Women empowerment	• SUDAKYA – to improve enrolment of girl students • Mission Shakti launched on 2001
Improvement in drinking water provision	• Universal Coverage of Water Supply Scheme • Implementation of *rural* piped *water supply* projects
Improvement in sanitation	• Swaccha Bharat Mission • Construction of individual household toilets • Shakti varta program in high burden districts

3 National Guidelines for Calcium Supplementation http://www.nrhmhp.gov.in/sites/default/files/files/NG_calcium.pdf

Livelihood options	• National Rural Employment Guarantee Act - guarantees rural households 100 days of unskilled manual work a year at a given wage, has the potential to improve food consumption • Deendayal Antoday Yojana National Urban Livlihood Mission (DAY-NULM) for urban areas • Odisha Tribal Empowerment and Livelohood Program (OTELP) • JEEVIKA
Maternity benefits	• MAMATA scheme - conditional cash transfer of ₹5000 to pregnant and lactating women
Safegaurd against health shocks induced poverty	• Biju Swasthya Kalyan Yojana, a Health Assurance scheme • Other health insurance schemes
Support to farmers to improve dietary diversity	• KALIA (Krushak Assistance for Livelihood and Income Augmentation) scheme 2018 • Agriculture Production Cluster Project, 2018 in tribal districts • Promotion of nutria-gardens
Improvement in living conditions	• 'JAGA Mission' (Odisha Liveable Habitat Mission) • Biju Pucca Ghar Yojana
Poverty elimination	• KBK districts are part of Transformation of Aspirational Districts program • Jan Dhan Yojna
Better governance	• Community monitoring – establishment of Mother's and Jaanch committees at village level • Joint monitoring system between various depts. At district level • Joint planning for various community intervention days like VHND/pushtikar diwas • Establishment of Multi-sectoral Nutrition Council in 2010 • Initiation of the concept of Nutrition Budgeting

THE STATE HAS THE POLICIES AND PROGRAMS IN PLACE TO TACKLE MALNUTRITION IN ODISHA.

Causes of Undernutrition and Evidence on Coverage of Key Interventions

Immediate determinants of undernutrition

Figure 4 reveals that

Poor ICYF and immunization practices

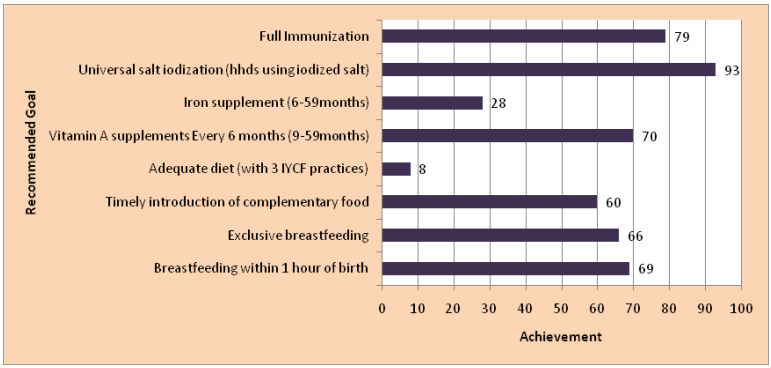


Fig 4: Determinants of Malnutrition among Under 5 Children in Odisha: Child feeding practices, Micronutrient supplementation and Immunization, NFHS 2015-16

- More than thirty percent of newborn are not breastfed within 1 hour (Fig 4).
- 34% gap in exclusive breastfeeding.
- According to RSOC, 20 percent babies were given pre-lacteal feed[4], which needs to be addressed as there are chances of contamination and have lesser immunological values.
- Poor implementation of U5 iron supplementation program
- More than 90% children do not receive adequate diet.
- More than 20% children do not receive full array of immunization.

4 Practice of feeding a baby with some food like honey, ghee, goat milk etc, before the initiation of breastfeeding.

Poor nutritional intervention (diet and diversity) in the first 1000 days:

- More than 80% of U2 children do not receive minimum acceptable diet inspite of an array of nutritional supplementary programs.
- Around 90% children do not consume iron-rich food and this coupled with poor implementation of iron-supplementation program (Fig 10) for children in the state, it is not surprising that anemia is a major health problem in the state.

Poor coverage of ICDS services

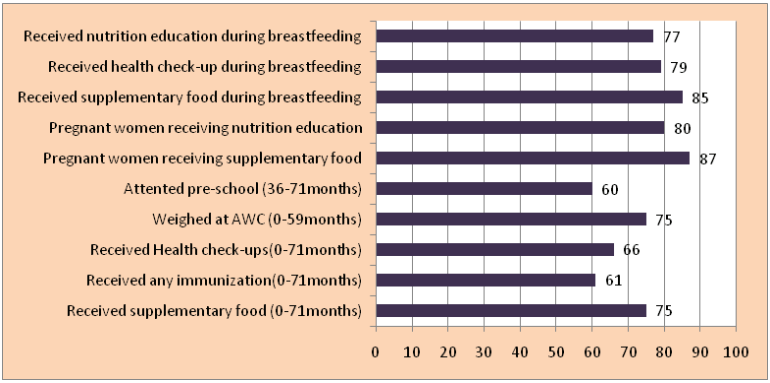


Fig 5: Nutrition and Health care intervention for children from ICDS, in Odisha, 2015-16

- The ICDS programme, which has been in operation for more than 30 years, has not been able to reduce malnutrition to acceptable levels in the state (see Figure 5).
  - ◊ Approximately 25% mothers did not receive counseling for breastfeeding which is a very discouraging factor as it might reduce the healthy practice of early initiation and exclusive breastfeeding in the state.
  - ◊ Large proportion of U5 children were not weighed (25%) and did not receive health check-up (34%).
  - ◊ Large gaps exist in distribution of supplementary food distribution, especially U5 children.
- Poor infrastructure impacts service delivery like lack of premises and availability of water impact food preparation and hygiene.

- According to RSOC survey 2013-14, women were not convinced about the need of AWC intervention in improving their own and child's growth. Perception about poor quality of ICDS services, attitude of AWC workers and access to AWC also hindered utilization of services provided at AWC. [5]

Box 3: Poor infrastructure of ICDS

- Only 38% AWCs have their own building.
- 18% of AWCs do not have weighing scales and 16% have defunct scales
- Non-availability of learning material ranges from 36% to as high as 72%.
- Only 54% have functional water facilities
- Vacancy of supervisors

Source: Nutritional Operational Plan, Odisha 2013

Poor nutritional and health care interventions during pregnancy

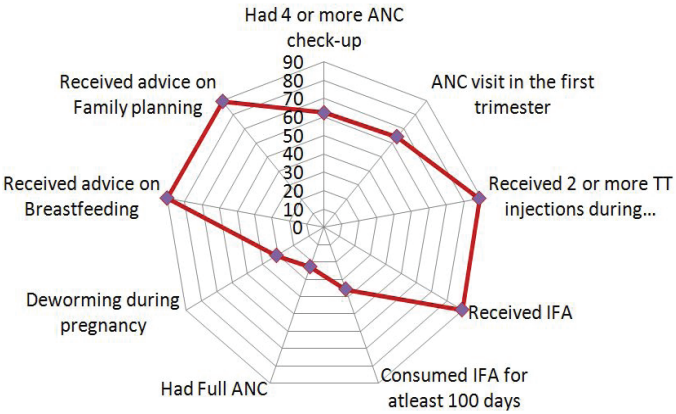


Fig 5: Care during Pregnancy, NFHS 2015-16

- Although 62% women in Odisha reported having 4 or more ANC visit during their last pregnancy (Fig 6), but there exist large intra-state differences, with Bhadrak reporting only 35% and Keonjhar 40%. As per RSOC, significantly more proportion of women from urban areas (67%) received 4 or more ANC check-ups as compared to rural women (47%). [6]

5 RSOC, P-246
6 RSOC, P-126

- Moreover, in rural areas pregnant women rely mostly on home visits due to the issue of inaccessibility to health care facilities, so it is very important that outreach workers visit each and every home of the beneficiary. The home visitations by the healthcare workers are necessary to provide individual and family counseling on issues of diet, rest, use of iodized salt as part of ANC, on issues of birth planning and safe/institutional delivery.
- Full ANC - the state reported a dismal figure of only 23% women receiving full ANC, an important component which influences maternal and child health and nutritional outcomes. District figures are quite dismal with Baleshwar 9%, Bhadrak 13%, Gajapati 12%, Ganjam 10%.
- Although 90% pregnant women reported receiving Iron supplementation, only 36% consumed it for mandatory 100 days.
- Only 30% pregnant women received deworming tablets.
- ANC care seems to be limited to only advice on breastfeeding and family planning and administration of TT injections ignoring other important aspects

Very poor coverage/access to health care

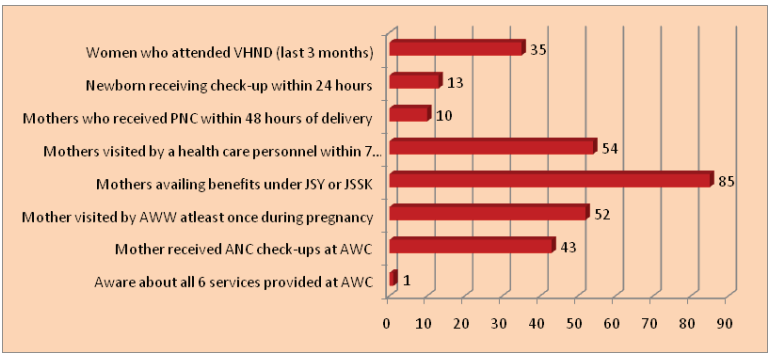


Fig 7: Mother and Child care interventions in Odisha, RSOC 2013-14

- Only 35% mothers of children under 2 years in the state attended VHND and this has implications for receiving timely care and services for acute health and nutritional conditions (Fig. 7).

Only 1% mothers were aware about all services that are being provided at AWC

- Only 13% newborn and 10% mothers received health care visit with 2 days of delivery. Odisha having high IMR and MMR, this is a matter of grave concern.

High disease burden

- Five percent of the children in the state suffered from diarrhea in 2 weeks.[7]
- Increase in TB cases: New TB cases notified in 2017 in Odisha posted a whopping around 61 per cent jump over 2016.[8] TB makes malnutrition worse, and malnutrition makes TB worse. Food insecurity and malnutrition in people who are in close contact of a patient with active TB, increases their risk of developing TB.
- Malaria: Compared to 2018, there was more number of malaria cases were reported from High burden districts. Although since 2016, Odisha had successfully reduced malaria cases, but recent increase is threatening to undo the state's successful efforts.[9] Studies suggest malaria may increase the incidence and severity of undernutrition, while undernutrition may increase the risk of malaria infection. [10]

Underlying Determinants of Malnutrition

Poor status of women

- Around 8% girls in the state were married before the age of 18 years, 24% married girls became pregnant before 18.[11] , although recent trends show that there is a decreasing trend in the age at marriage, first pregnancy and first live-birth with increase in the age, in both urban and rural areas suggests an increasing trend in all the three with time period.

7 Odisha NFHS 4 Report
8 https://www.dailypioneer.com/2018/state-editions/tb-now-number-one-killer-in-odisha.html
9 https://www.news18.com/news/india/odisha-saw-a-3-fold-rise-in-malaria-cases-in-july-health-workers-blame-complacency-of-officials-2285795.html
10 https://academic.oup.com/cid/article/67/7/1027/4924398
11 RSOC, P-84 & 290

- Fourteen percent women in the state has unmet need for family planning, with districts of Bhadrak, Baleshwar and Kendujhar having unmet need of more than 20%.

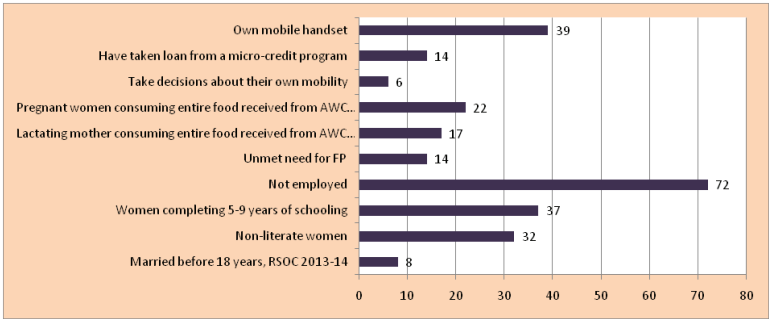


Fig 8: Status of women in Odisha, 2015-16

- With 72% women not in gainful employment means some amount of economic hardship, which result in poverty and subsequent chronic malnutrition.
- Even those women who are employed there is high concentration of females as self-employed workers (those in the informal sector) or casual labourers[12] which highlights that majority of female workers are devoid of employment benefits like maternity benefits or breastfeeding breaks.

Poor implementation of Mamata Scheme/ lack of decision making ability

- A three district study (Jagatsinghpur, Keonjhar and Kalahandi) reveals that only less than 50% beneficiaries had a Mamata card and less than 60% were enrolled in the scheme.
- Usually those who had a card received the cash in their account, but *unfortunately not using them for the purpose of enhancing their nutritional and health status, majority households saved it for the future or for the health care of the child only*.

12 Odisha Economic Survey 2018-19, P-23.

Poor drinking water and sanitation facilities[13]

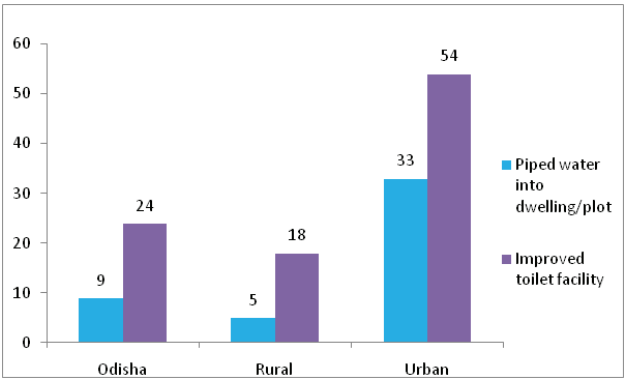


Fig 8: Access to piped water and toilet facility, NFHS 2015-16

- Only 9% households in Odisha (only 5% in rural areas) have piped water into their dwelling, the implication being there would be a tendency to restrict water usage for frequent hand washing when one has to bring/carry water from a distance.
- Sanitation: Only 24% households have access to improved toilet facilities. However in recent years there has been major emphasis in building individual toilets under the *Swacch Bharat Abhiyan.*

Poor socio-economic conditions

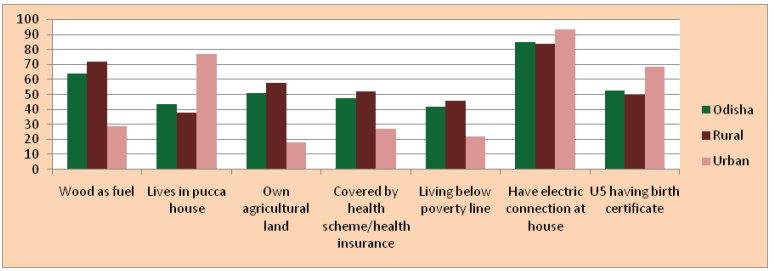


Fig 9: Poor socio-economic conditions in Odisha, 2015-16

13 Improved toilet facility includes f lush/pour flush to—piped sewer system, flush/pour flush to septic tank, flush/pour flush to—pit latrine, ventilated improved pit latrine (VIP), pit latrine with slab, composting toilet and toilet not shared with any other household. RSOC P-64

- Only 50% households in rural areas own agricultural land.
- Majority of the population in the state live in poor living conditions

Large scale poverty and food insecurity

- More than 30% of the population in the state lives below poverty line.[14]
- Majority of the tribal population in the state live in forest and inaccessible areas for livelihood and are therefore unable to access health and nutrition services.[15] Food insecurity and non availability of adequate food throughout the year is a pervasive problem in these communities where poverty is a strong underlying determinant.
- Odisha also faces frequent drought coupled with migration, poor economy and lack of application of location-specific scientific knowledge in the fields, which reduces agricultural productivity.
- The high burden districts are also those which falls under the 'severely insecure' and 'extremely insecure' category as per the Food Security Atlas of Rural Orissa.[16]

Progress to date – not good enough, especially the state of underlying determinants in Odisha, and could hold back progress in nutrition

What Needs to be done to end Hunger and Malnutrition by 2030

The data reflects that the performance of Odisha in terms of health and nutrition is better in comparison to national figures. Odisha's investments, especially in recent years, in the health, ICDS and PDS programs have yielded significant dividends in terms of program coverage and have helped re-orientate nutrition programs and shifts in immediate determinants of nutrition. However, it is now time that Odisha invests in long-term developmental activities that ensure sustainable human well-being beyond short-term relief measures.

14 Niti Ayog SDG Baseline Report 2018
15 Nutrition Operation Plan 2013, P-12.
16 https://documents.wfp.org/stellent/groups/public/documents/ena/wfp267951.pdf?_ga=1.225688538.1313249433.1486404767.

Advocacy Plan

Threat	Call for Action
Immediate determinants of malnutrition	
High prevalence of low birth and IMR	• Proper implementation of existing guidelines for newborn care • Establishment of a 'continuum of care' as advocated by WHO between home and health care facility and importance of immediate PNC (home visits) for all new born
Poor ICYF practices	• Focusing on the thousand-day window of opportunity and promoting health-ICDS synergy • Focused intensive campaign and programs on ICYF practices through proper role clarification of FLWs • Government support to improve complementary feeding (both quality and quantity) • Livelihood programs like MNREGA to include maternity benefit provisions like breastfeeding breaks and paid leaves during pregnancy and lactation • Improve quality of SNP to ensure dietary diversity and food intake
Correct identification of the nutritional status	• Proper training of AWW/AW helper for taking proper measurement of height and length especially of child below 2 years. • Diagnostic tests need to be done on all children referred to *Pushtikar diwas.*
High prevalence of anemia among children, adolescents and women	• Distribution of IFA needs to be given to all anemic child, adolescents and women after proper testing through regular health camps at AWCs • As ensuring biweekly supervised consumption by ASHA is not feasible, it is better to make the care givers understand the necessity of it for proper growth to ensure compliance (acceptability issues) and also counseling for proper intake method (eg gap of atleast 2 hours between Iron supplements and calcium). • Ensuring continuous supply of iron supplements • Strategies need to be worked out to reach to the remote areas of the state.
Poor coverage of programs like micronutrient supplements, immunization and deworming	• Ensure 100 percent implementation of all micronutrient supplementary program by addressing current bottlenecks • Supply side also needs to be improved to ensure that. • Use of technology to ensure next dosage and capacity building for the same • Better conduction of Mamata diwas (VHND)

Poor and inadequate diet among children, adolescents and women	• Formulate strategies to increase coverage of the direct nutrition interventions which are already part of the program. • Improving supply, quantity and quality of THR through elimination of private contractors and proper supervision by civil society and PRI members. • Establishment of adequate testing facilities of THR in the state • Further strengthening of PDS • Price control of essential foods like fruits, poultry, fish, etc • Improved food processing • Youth friendly programs to improve adolescent nutrition • Demystify beliefs related to diet diversity • Creation of food consumption database at district level based on local food diversity and traditional food system
Poor coverage of ICDS services	• Improve infrastructure of ICDS (building, water and sanitation facilities, etc) • Equipping the AWCs with supplies (medicines, weighing machines, IEC materials, utensils, LPG gas, etc) • All vacancies of all posts should be filled and all AWCs should be provided with adequate number of workers. • Capacity building of AWWs and AWHs specifically on communication, mobilization and IT skills and Supervisor training to improve perception of beneficiaries about ICDS services • Need of improvement in the quality of training and AWTC (Anganwadi Training Centres) to be strengthened with equipment and quality trainers. • The enhancement of workers/helpers' monthly honorarium needs consideration. It is also necessary that the AWC workers should not be deployed in other works. • Doctors should visit AWCs regularly. • AWCs should maintain complete health records of all the children enrolled with them. At present, AWCs are required to maintain around 30 registers which is considered too many. Hence, review should be carried out to reduce/minimize their number. • The monitoring and supervision should be done by the Block and District level Officers regularly.
Very poor coverage and access to health care	• Focused efforts are needed on closing implementation gaps and building evidence, revisiting program designs, and establishing feedback mechanisms to inform policy and programmatic decisions. • Augmenting public service delivery capabilities by filing up vacant posts, knowledge and skill upgradation • All protocols/guidelines related to ANC/PNC[5] needs to be followed and monitored.

High disease burden	• Improve preventive measures for diarrhea, TB, malaria, etc • Improve curative measures at PHCs especially for ARI
Underlying determinants of malnutrition	
Poor skills of health functionaries	• Clear delineation of roles of FLWs as per the 2013 Framework and also incorporation of recent development and changes in program priority or ICT if applicable • Skill and capacity of FLWs needs to be upgraded keeping IMNCI, IYCF, and the treatment of the minor ailments • Improve communication and mobilizing skills • More ongoing capacity building is required than long duration classroom trainings • Ensuring supportive supervision • Regular capacity building of officials of district SDG cell.
Poor status of women	• Proper implementation of all schemes aimed at improving status of girls and women (programs mentioned earlier) • Addressing patriarchy through education system, through perspective building of GP members, FLWs, SHG members etc, otherwise programs like THR or MAMATA scheme will never achieve what it intends to do – ensure proper nutrition to women, as she will always *'eat last and eat least'* and will save the money for household needs. • Age at marriage and age at pregnancy needs to increase for all girls in the state. • Livelihood schemes need to address the issue of women's unemployment
Poor WASH practices	• Proper implementation of Shakti Varta Plus program • Ensuring safe drinking water through the piped water projects and formulation of area specific strategies in drought affected areas/ districts for uninterrupted water supply. • Formulate effective strategies for 'behaviour change' to end OFD
Large scale poverty and food insecurity	• GPs and district officials to ensure proper implementation of all national and state poverty reduction schemes • The state needs to come out with a comprehensive mechanism with regard to implementation of Food security act which details the grievance redressal mechanism, fixing accountability at different levels, food security allowance and a robust social audit process to enhance transparency. • Need to identify bottlenecks in linking Aadhar with PDS so as to ensure that there are no exclusion errors • Strategies to ensure that tribals living in forest areas are covered under poverty alleviation and food security schemes

Poor MIS and accountability mechanism	• Need to generate real-time data on status of nutrition of children, adolescents and young mothers and use that data effectively for implementation (prompt remedial action) and policy tool. *2018 Global Nutrition Report* shows how investing in data can help inform the nutrition response. • Building capacity of stakeholders to use it to make evidence-based decisions. • Establishing an independent mechanism to ascertain the accuracy of the data entered, especially that relating to the distribution of supplementary nutrition and growth monitoring. The ICDS-CAS literature indicates an overwhelming emphasis on monitoring at higher levels and not enough details on how exactly the AWW will be assisted in her important tasks by technology. • Establishing accountability mechanism. For example, ICDS MP₹are supposed to send electronically every month to the Ministry of WCD, but many times they are not sent on time and are not available in the government websites and therefore is unable to guide administrative policy and praxis. • Continue to strengthen and empower social accountability mechanisms such as Mother's committee, Jaanch Committee, RKS and GKS, and raise public awareness of entitlements and the means for public monitoring of health and nutrition outcomes and services. and presentation of the findings in Jan sanvads (public dialogues)
Lack of convergence at microlevel	• Need to identify strategy on how to converge efforts and money at village and household level to ensure proper services/entitlements of the intervention programs • Develop 'District Nutrition Plan of Action'. • Need for convergence in the activities of the health department and the ICDS right from the registration of pregnancy onwards, moving through childbirth and infancy till the child reaches the age of five. • For example, effective action under the ICDS to tackle child malnutrition requires reaching out to every child, monitoring her/his growth pattern systematically on a monthly basis from birth to the age of five, and ensuring attention from both the ICDS and the public health machinery at the sub-district level and below to their nutrition and health needs. • Monthly joint action plans of FLWs with role clarification • Appointment of a 'Nodal Officer' at district level to ensure overall implementation of 'District Nutrition Plan of Action'

Lack of SMART Targets in state plans and policies	• Odisha State Nutrition Mission need to set time bound target for all the 6 goals. (At present it has time bound target for U5 stunting and U5 wasting only and not for LBW, U5 overweight, Anemia in women of reproductive age and exclusive breastfeeding) • Targets set are not SMART targets *i.e.*, how and who are not mentioned in order to achieve those targets • Taking help of WHO tools to help making SMART targets to track and address malnutrition ◊ WHO Nutrition Targets Tracking Tool ◊ The Health Accounts Production Tool
Inadequate budgetary support	• A study by the Centre for Budget and Governance Accountability and UNICEF for financial year (FY) 2015-16 reveals that budget resource gaps for the supplementary nutrition programme (SNP) for 6 month to 6 year children and pregnant women/breastfeeding mothers were as much as 50 per cent for Odisha. • Increase investment in agriculture to ensure crop diversity. • WHO *OneHealth To*ol can be used to assess required financial and human resources for implementing selected nutrition interventions
Lack of political commitment	• Nutrition budget is a good beginning in viewing NUTRITION AS A DEVELOPMENT INDICATOR and can be used in reviewing all programs through nutrition lens. • Need for regular reviews and an insistence on bureaucratic accountability to ensure cross-sector coordination to achieve national and state targets on SDG • Develop instruments to track resources invested in nutrition-sensitive and nutrition-specific interventions. • Develop strategies to overcome the challenge of competition for resources and unnecessary duplication among international implementing agencies by developing coordinating mechanism. • Regulation of the private sector as a potential contributor to improved infant and young child nutrition
Inadequate evidence-based research	• Formative study to assess how the ICDS-CAS system has worked in practice and whether it has enabled those at the field and supervisory levels to get a firm grip on the actual malnutrition situation at the anganwadi level, enabling early remedial action. • Assessment of the Model Crèches in five high burden districts • Need-gap analysis: Evaluation of the safety net programs in reducing malnutrition • Studies required to assess whether interventions like Shakti Varta, MAMATA are making a positive contribution (causal associations) to improve IYCF practices.

Improvement in underlying determinants can address 80% of undernutrition. Lets act ….. NOW……have a long way to go

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Role Delineation of Frontline Workers https://icds-wcd.nic.in/icdsimg/Role07114.pdf

Global Nutrition Report: From Promise to Impact Pg 29

The tool displays a country's updated, comparable data on five of the six global nutrition target indicators (low birth weight is not yet included). It is an interactive tool, featuring for each of the indicators status at baseline, recent trends, and required progress to reach set targets for 2025. This tool is also meant to provide benchmarks to track target achievements, identify gaps, and trigger action.

This tool (WHO 2016v) tracks expenditures on nutrition-specific and nutrition-sensitive actions. The tool may help in setting relevant and achievable nutrition outcome targets as well as setting SMART (specific, measurable, achievable, relevant, and time bound) spending targets that take into account financing gaps in relation to the scaling up of nutrition interventions.

https://www.thehinducentre.com/incoming/article26397862.ece/binary/WP-1.pdf

Chapter 3

The Lives of Delhi's Women Waste Pickers during the Shadow Pandemic (COVID-19)

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Abstract: The emergence and outbreak of COVID-19 virus lead the Government around the globe to take drastic measures. Imposing the lockdown as a measure to combat the novel coronavirus disease in India has come as an exogenous shock for a major part of society. Undoubtedly, the pandemic has affected both men and women associated with various sectors. But, the statistics and reports shows an invisible and an unbalanced affect of the pandemic on the lives and livelihoods of the waste pickers, especially the women waste pickers. Normal norms like washing hands and maintaining hygiene still remain a luxury for many waste pickers. The shadow pandemic has landed them in a situation of conflict where they continue to struggle with reduced income and biased behaviour. Therefor, this study aims to gain a deeper insight on the impact of COVID-19 followed by the lockdown on women workers employed by informal sector in the Capital. And for the same, a small round of telephonic and face to face interview was conducted reflecting the challenges and hardships faced by the women waste pickers during and after the lockdown in Delhi.

Keywords: Women Waste Workers, COVID-19, Delhi, Informal Sector.

Introduction

The Solid Waste Management, 2016 defines Waste Pickers as the "people or group of people informally engaged in collection and recovery of reusable and recyclable solid waste from the source of waste generation the streets, bins, material recovery facilities, processing, and waste disposal facilities for sale to recyclers directly or through intermediaries to earn their livelihood (sic)". [Rule 3(1) (58)][1]. This section of the society along with waste recyclers, kabadiwalas, and junk or scrap dealers constitute the bottom-most layer of the waste recycling process in a city. Ranking the lowest on the scale of the urban private occupation, yet around 1.5 million to 4 million people opt for this occupation across India[2].

The Solid Waste Management Rules (2016)[3] explicitly offered a wide range of options to the urban municipalities for appropriate waste management systems according to the local conditions. Believing the privatization of garbage collection to be more cheaper and efficient, the system of doorstep garbage collection, partly or fully, to local and multinational operators, is the most popular contacted out system. The process may seem cheaper and more efficient but the study by Chintan (2018), found that the privatization of waste collection has led to job loss and a fall in incomes of around 50% of waste pickers[4]. Further, the spread of the deadly disease COVID-19 followed by the nationwide lockdown has come as another threat to the lives and livelihood of the waste pickers in the capital. Imposing of the lockdown around the capital made major parts of the city to shut down which resulted in a loss of employment of around 86% of waste pickers. The fears of contracting the disease and the police patrolling made the workers sit inside their houses preventing them from going to door-to-door collection. The reports also reflected upon the struggle of the waste pickers to maintain the most basic safety guidelines to prevent the disease. The lack of financial help from the government and loss of employment and income significantly exacerbated the stress caused by highly unpaid work leading to difficulty in accessing essential resources. The extended lockdown has further pushed the

women waste workers and their families into the situation of poverty, social instability, biased behaviorand high morbidity[5].

Even though the lockdown was lifted on May 25, 2020, the fear to fight with it still continues. While everyone is trying to bounce back on personal and professional terms, the situation and time is far from normal. Thus, this study was designed keeping in view the Delhi Waste Pickers, especially the Women Waste Pickers. It aims to understand and analyze the impact of the pandemic followed by the lockdown on the women waste pickers of Delhi. It aims to highlight the instances from their lives to gain a better understanding of the ways and mechanisms they adopted to not just only deal with the pandemic but also the loss of employment, the biased behavior by society, increased unpaid work, etc.

Approach and Data

The study is designed to keep in mind the emergence of waste management workers in Delhi during Lockdown. The qualitative data for the study was collected through face-to-face and telephonic surveys with 30 women waste management workers. A questionnaire comprising of 10 questions was designed to get the viewpoints of respondents in the same direction. The sample collected was a mixture of convenience and snowball sampling techniques, and the results are not representative of the state in question or the country.

The purpose of the study was made clear to all the respondents before hand followed by a prior consent from all the respondents. The participation was voluntary in nature with strong anonymity being maintained during the research. No question was designed or asked in a way to hurt the sentiments or be discriminatory against any person based on caste, religion, race, gender, sexual orientation.

The work is purely based on a methodological commitment to highlighting the voices and hardships faced by marginalized women. The research in this short exploratory study highlights the challenges bought by COVID19 in the lives and livelihoods of women waste pickers in the Capital.

Waste Workers in Delhi

In India, the bottom most layer of the waste recycling pyramid is captured by the waste pickers. Along with the waste pickers come the other actors in the complex chain such as the waste recyclers and junk or scrap dealers. These other actors in the city constitute the informal recycling sector.

Delhi is home to 200,000 waste pickers. The majority of whom are migrants from rural areas. These people relocate to big cities in hope of service and employment but oftenend up being engaged in the informal recycling sector as a survival strategy [6]. The duty of a waste picker is to collect waste from different sources, which can be a household, office, shops, streets, transfer section, or a landfill. Ones the waste is collected the first segregation takes place between the non-recyclable and the recyclable material. The first category of material is disposed of at the transfer station and the second category of material again gets loaded in the tricycle for further segregation. This recyclable material collected is then taken to the waste collector community wherein the material gets segregated to a minimum of 5 to more than 15 categories. The segregated material is then weighed and sold to a junk or a scrap dealer. This material is then stored by the junk dealer until a minimum quality is reached after which the material is sold to a bigger junk dealer. The segregation and the selling process continue till the material reaches the final recycling industry. Thus, looking from the service perspective, this structure is often described as the pyramid of employment. The waste collectors at the bottom, the junk dealers and the segregation at the middle, and the top recycling industry at the top[7].

Further, the women waste workers in the field are involved in either segregation of the waste at the godownsas daily wage earners or segregate the waste bought by the male members of the family at home as unpaid labor. Some women workers also go out to collect the waste with their husbands but the majority of segregation work resides with the women workers.

Also, women waste pickers on an average walks for 8-10 km for daily work to collect, carry, segregate and sell 15-20 kgs (approx.) recyclable material. Therefore, women waste pickers undertake the most hazardous and risk-oriented aspect of urban waste management.

Not only this, but they are also poorly remunerated (₹ 50-150) for everyday occupational health threats and stigmas they face (Wittmer, 2021)[8].Intersecting marginalized identities of gender, caste, and class are also associated in this livelihood with the ritual and symbolic pollutions of waste and untouchability that further articulate the stigmatization of women waste pickers (Gill 2010[9]; Reddy 2018[10]). Although waste picking is a hazardous and stigmatized livelihood, it remains an important strategy for women workers, most of whom have little formal education and no capital to invest It is within this context of precarity, marginalization, and hazards that the Covid-19 lockdown unfolds.

This information puts lights on women being marginalised in the whole process of waste management While their task involves tedious and risk oriented work, still they are paid less than their male counterparts. This is due to the gender role perception of believing that the men works faster and help in loading and unloading of material. Therefore, the present study involves the women workers mainly involved in the segregation work prior to the pandemic.

Living through the Pandemic

The outbreak of Novel Coronavirus followed by the nationwide lockdown had a drastic affect on the lives and livelihoods of those associated with informal waste management. The basic precautionary measures like washing hands, using hand sanitisers, wearing mask, social distancing remained a luxury for many waste pickers in the capital. The Pandemic came as an exogenous shock for the income and savings of these workers. In order to survive and continue in the harsh battle, some switched their jobs while others continued to struggle with reduced income. The time when everyone was locked inside their home, even the pandemic could not help with the constant evictions and relocation drives.

The husband of *Rama Devi*, a waste picker from Delhi, collects the waste in the morning which is further segregated by her at home. According to Rama Devi, her husband has been unable to go out to collect waste since the beginning of the COVID-19 pandemic.

"Sister, we haven't been able to work since lockdown. Initially we managed with few of our savings, but now we are left on our own to survive with no support and earnings. Forget about basic amenities like maintaining hygiene and education for our children, right now I don't know how we are supposed to survive in such conditions".

Similarly *Poonam Kumari*, a resident of Mangolpuri said that both men and women were engaged in the work prior to the lockdown. Majority of the work especially the second round of segregation whether at home or on-site residing with the women. Women were supposed to segregate the waste into 87 categories

inside their respective houses and sell it further. This used to take up to 18 hours of labour every day and yet women belong to the marginalized section of the society who are yet not regarded as workers. The houses where they work are filled with foul smells posing severe risk hazards and vulnerabilities to their health. The conditions are an invitation to acute illness and deadly accidents. The majority of women in this work have weak eyes and suffer from fungal infections and allergies. Such working environment also is a house to many ailments like tuberculosis and chronic respiratory diseases. And Viruses like COIVD-19 which is directly related to the respiratory illness makes it even more difficult for women to work and survive in such conditions.

Women in every household are the ones who are directly linked to the household chores. They experience multiple responsibilities on their shoulders. From maintaining the house in limited income to taking care of children, providing food to maintaining the cleanliness and hygiene of the place.

"Such responsibilities and duties have landed us in a difficult situation, where we are unable to find the solutions on how to run the household with declining income" said Rachna Lal, a resident of Nandnagri. When asked about how they manage their daily basic needs of food, Pooja Singh in the situation of acute hunger during lockdown, we used to stand in the line of ration for three four hours, but was unable to get some ration for house. The small amount I got was further distributed among the neighbours who were bed ridden and old.

Since the Pandemic, most of the workers were unable to go out an collect waste due to imposed restrictions. Even if someone wants to work, they cannot as the main source of selling dry waste and recyclables to scrap dealers in the junk shops have been shut down due to the ongoing crises in the country.

The lack of work and employment have created a situation of absolute hunger and deprivation for many waste pickers, said Usha Anand from Vijay Vihar. Few of the people from our community

have also faced police harassment for stepping out of the homes for work.

A recent study highlighted the hardship faced by the women waste pickers in the city during the lockdown. According to the study the respondents not only faced challenges in going out to collect the waste due to police patrolling the streets and lack of protective equipment but also faced racial discrimination of biased behaviour from the people in the name of maintaining social distancing. These workers were amongst the ones who were exposed to most dangerous environment including used masks PPE kits and all the hospital untreated waste without any protective gears.

"Who are we? Asked one of the respondent after listening questions. We are not just the waste pickers, we make 2-3 lakh of the city's population and play a very important role in providing a waste free city to its citizens. How are we supposed to survive such chronic disease in such conditions? We are so helpless that we are still ready to work in such condition but shutting down of the godowns and scrap shops have further made the process of selling and sorting recyclables impossible", said Ria a resident of Seemapuri.

The study revealed respondents facing severe shortage of money and food. The lockdown have further impacted on their access to essential medicines and healthcare services. Following the impact of the pandemic on the lives and livelihood of these workers, the respondents were found to be in a state of stepping out for work, without prioritising their safety and health protection.

"We are ready to step out of our homes and work for the wellbeing of the people of the society but no one understands the hardships we face. The lack of support and equipment is further combined with biased behaviour of people towards us. Whom are we supposed to talk to or go to in situation like these? We have survived a little with the government support, but for how much time will it continue? At last we have to step out in the landfill exposed with all kinds of used and untreated hospital waste. This environment is a risk to us and to

our lives. But we will work. We will work for us, for the people and for the nation", said Leelavati, from Bhalswa Village.

Women already used to face challenges like being unpaid workers working in a hazardous environment. The virus has further elaborated on the hardships they face. It has not only affected their daily working routine but men being at home has also resulted in the increase of abuse against women. The increased calls for domestic violence amongst women in the wake of COVID-19 has been the most common problem of the nation. COVID-19 has proved to be a parallel pandemic for women in the city.

Some of us wants to leave and move ahead. But how? We are left with nothing, not even the money for food. They say wash your hands to maintain hygiene, but with what? Atleast together, we are able to survive, even in such horrible conditions.

These workers often lives in the unrecognised area of the city with no basic amenities. They are required to fight harder to fight such pandemic. According to the respondenrs not every person they meet is same. There are some people in the society who has helped them. Some with food and others with money.

"Here we are, keeping the localities of the capital spotless for years," says Preeti, waste waste picker in New Delhi. Don't you think we have the right to ask for help now? How are we supposed to keep our children safe? Everyone should know that in such times of acute danger in the environment if we do not show up one day, the disease may become even worse for everyone".

Even after the lockdown was lifted on May 25, 2020, the fear of pandemic still continues. Like every employee, the waste workers are also trying to restore their employment but the situation now is far from being normal[11]. The waste workers like others have also started going back to their work but now theconditions are far more dangerous than pre-pandemic. The working area now is even more infectious without protective equipment.

"Meet us, we are the waste pickers of the capital: we are the frontline warriors against the virus. We are the ones who manage

the city waste for everyone to be safe. And we do this by exposing ourselves to diseases and infections. If I compare our pre pandemic lives with today. Its far more difficult to work now. Both men and women are facing difficulties. But women being the marginalised section are facing more hardships than men. Apart from the mental trauma, we are expected to work day and night to earn livelihood for our children and adults. We have forgotten ourselves and are working day and night to manage the house, pay off debts with little or no earning.", says Poonam Rani, a resident of Seemapuri.

The women have returned to roadside and house to house waste picking work as before. The news is good but they have to rely on their self-independent protective strategies to be safe. Without having the access to protective equipment in highly contagious environment have resulted in lack of access to sanitation and hygiene facilities for women Wittmer, 2021[12].

It will be good to have this lockdown lifted— it is such a difficult situation— there is no income! But our work will be of a very different nature now, you can't touch anything, you can't go anywhere. Our work is dependent on both! It will be good to go back to work, but it will more difficult after this virus. (60-year old woman working with waste for 17 years; April-May 2020)

Further, women already faced challenges associated with privatisation of the waste collection in thecity Dias & Samson, 2016[13]; Kornberg , 2020[14]. And lockdown gave rise to the private workers collaboration with the municipality terming them to be the essential workers instead of the regular waste pickers Datta, 2019[15] and GOI, 2020[16]. With the new normal stepping in with the virus, it is anticipated that the consequences bought by the pandemic will last longer for the women waste pickers. They will have to work in the harshest condition to earn a livelihood for their family.

Strategy to Combat the Situation

The city people and the government should put head to the needs of people associated with waste management. Working in open landfills

and conditions exposed to harmful bacteria's and germs was already very challenging, and the spread of the virus has made it even more difficult to work and earn livelihood in such conditions. Everyone should understand the importance of waste management and the repercussions if it is not done on time by these front line warriors. The only thing they are asking is to get recognised and a normal treatment from the government and the people of the society.

The role of all the people associated with the process of waste management should be recognized and acknowledged by the government and the people of the society.

These workers should be included in the protection and insurance schemes as devised by the government for the front-line warriors.

The government should work to ensure provision of protective equipment like masks, gloves and boots, as well as sanitation products (soap and sanitisers).

Living in some of the poorest slums of Delhi, waste pickers also need support for income and food security. An immediate cash transfer will help them recover from the economic impact of the lockdown on their lives.

Finally, the government should work to ensure that waste pickers have access to regular health check-ups and essential medicines.

Conclusion

"*Without the sense of caring, there can be no sense of community*"

- Anthony J D'Angelo

It is essential that the policymakers of the country understand the importance and the requirements of the women waste pickers. The people of the country need to understand the importance of every profession. Every human has some basic requirements of housing and food and safety. Not the luxurious one but atleast the basic requirements related to maintaining hygiene, food, housing and basic protective equipments should be provided to the workers who work in such drastic and unprotective conditions. Housing and livelihood are interlinked for many women workers; decent housing, therefore,

needs to be treated as priority to secure women participation in the waste sector.

The pandemic further has clearly highlighted the vulnerability of people who are engaged in providing the most essential services to the community. Therefore, there is an urgent need to protect and safeguard their rights and livelihood. For marginalized workers suchas women waste pickers to be protected, cope, and recover from such crises, there is a need for their work(inside and outside the home) to be recognized as essential, to prioritize an ethic of justice in urbangovernance, and build lives and dignifiedlivelihoods on an unshakeable foundation of substantive andexperienced rights to work, access the city, exercise agency, and pursue wellbeing.

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Chapter –4

Role of Students Socio-economic status on Online Learning and Open Book Examination in the Higher Education: Evidences from India during COVID-19 Outbreak

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Abstract: Novel coronavirus disease emerged as a health pandemic, forced to close all the educational institutions which disrupt the traditional learning mechanism. To cope with this issue most of the higher education in India adopt online learning and evaluation processes. The study mainly focused to examine the students' perceptions about online learning, the role of the socio-economic status of students in adopting the new paradigm. Further, the study provides an overview of the students' perceptions regarding online assignments based on open book examinations. The study found that online learning is moderately effective compare to traditional learning. The low economic status act as a bottleneck in the successes of online learning. It is inverse relation with the access of necessary equipment. It also causes the student preference to blended learning. Hassle-free learning and open book examination provide a wider scope to the student for developing their mental and cognitive ability. The SWOT analysis also provides a critical outlook of online learning and categorically reflects the future scope of online education in the Indian context.

Keywords: Online learning, socio-economic status, blended learning, open book examination, SWOT analysis

Introduction

From the end of 2019, the world is fighting against a health disaster called COVID-19 (Cenimo, 2021). On 11 March 2020, World Health Organization (WHO) declared COVID a global pandemic (Cenimo, 2021). The novel coronavirus is 'highly transmissible' and infectious, which significantly hampered humans' everyday lives and forced them to restricts their daily activities (Hu *et al.* 2021; Tandon, 2020). The year-long pandemic situation very drastically affected the normal way of living, movements, and interactions between people worldwide (Tandon, 2020).

Under the compulsion of COVID-19 infectious nature, the Government of India has closed all the educational institutions since March 2020 (Hebbar, March 24, 2020). The closure of educational institutions threatens the traditional classroom learning process between teacher-students. Traditional classroom learning provides a greater level of physical interaction between teachers with the group of students in a classroom of an education institution (Kaushik, 25 August 2020). The nationwide closure of all educational institutions hampers the traditional method of institutional learnings, especially in higher education, vocational and technical courses (United Nations, 2020). The worldwide spreading of infectious COVID-19 is drastically mismanaged by the regular system of education across the world. Around 94 percent of the student's community is extensively suffering from the current pandemic; most of them are belong to low and middle-wealth countries (United Nations, August 2020). In this newly emerged extraordinary situation, most countries adopted remote learning mechanisms through Radio, Television (TV), and digital platforms (United Nations, August 2020). UNICEF Data (September 2020) shows that around 90 percent of the countries have facilitated Online learning methods.

However, about 463 million students across the world of different wealth backgrounds cannot access those digital education methods due to a lack of electronic gadgets and non-familiar with technology (UNICEF Data, September 2020). The Organisation for Economic

Co-operation and Development (OECD) reported that most member countries adopted and applied digital and modern technological methods to eliminate learning difficulties due to the nationwide closure of educational institutions and the physical mobility of the students and teachers (Schleicher, 2020). The popular methods include a dedicated online dashboard for sharing study materials and doubt clearing, learning through Television (TV), Radio, and Remote Learning through digital platforms with a special support system for students and parents (Schleicher, 2020). Online learning-enabled opportunities of learning through an electronic medium at own place (Tamm, 2020; Dull & Arora, 2017). However, the infrastructure of Indian educational institutions has not ready to completely shift from the paradigm of classroom teaching towards online learning. Nevertheless, the process has started due to the emergence of COVID-19 and the nationwide closure of the institution. After the announcement of nationwide lockdown, educational institutions try to adopt online learning methods with their limited infrastructure. A successful and quality online learning outcomes need a well-equipped classroom that includes a digital blackboard, e-library with access to central libraries, projectors, Wi-Fi hotspots, and proper ventilation and lighting facility (Digital Learning Network, June 21, 2020). However, the Indian Express, in an article, stated that the majority of the institution and the students are not well equipped to shift in digital mode (Kalra, 4 May 2020). It also revealed that lack of content in regional language also acts as trouble in acquiring online learning (Kalra, May 4, 2020). Here, the main concern is the quality of content and the adaptive capacity among the students with a newly emerged learning environment. Both the teachers and students are facing issues in this new system. The teachers are not well trained to handle the different digital applications available for online teaching. On the other hand, the student community is not well equipped to attend remote teaching. The success of online learning outcomes mainly depends on the 'level of digital access and efficiency' (Muthuprasad *et al.*, 2021). The issue has critically concerning in those subjects where practical is necessary. It is a very difficult task

for both the teacher and students to teach and understand the practical classes on online platforms. Further, the pandemic severely affects the traditional evaluation process. However, the majority of higher education institutions adopt the assignments based on Open Book Examination. But the process is not able to critically evaluate the student's ability and performance. It generalizes the performance of the students.

In the Indian context, another concerning issue is the low level of the socio-economic background of the majority student community. The estimation of the World Data Lab shows that, as of 2021, around 12.2 percent of the Indian population live in extreme poverty among the global population. Save The Children Fund reported that due to pandemics and limited access to the internet, 320 million students had been severely affected (cited by Sunil, 24 July 2020). The students are not well equipped to attend online classes; their parents cannot arrange electronic gadgets and internet connections due to the economic downturn (Mani, 18 May 2020; Sunil, 2020, July 24).

Therefore, the primary objective of the study is to analyze the perceptions of students of higher education students belong to different socio-economic backgrounds in order to the effectiveness, bottlenecks, and benefits of online learning. The study tried to examine student's preference of a mode of learning. Thus, the study, along the line of the collected data, analyzed the association of effectiveness of online learning, preference of a mode of learning with the respondent's social, economic, and demographic attributes.

Material and Methodology

Study site and Participants

In the year 2020, after the shout-down of all the higher educational institutions in India, the authors have decided to conduct a cross-sectional study to examine the perceptions of higher education students of the online learning environment. For The study, the authors have been selected the students studying in different colleges and universities in West Bengal, India. West Bengal lies in

the eastern part of India. Geographically West Bengal lies between 85°50'E to 89° 50' E longitude, and 21° 25'N and 27° 13'N latitude. West Bengal is the fourteenth largest state in India, covering an area of 88,752 sq. km (Sen, n.d.). For the study of participants, authors exclusively consider the students who studied any course in Undergraduate, Postgraduate, M.Phil, and P.hD. Thus, the target population of this study comprises respondents 18 years and above residing in West Bengal.

The Survey Instrument and Data Collection

For data collection purposes, using an online survey (Google Form) form. The survey questionnaire began with questions regarding the social, economic, and demographic background of the respondents. Then, several questions were involved to assess the student perceptions of online learning, the effectiveness of online learning versus offline learning, feeling during online classes, preference of a mode of learning, advantages, and problems of online classes. In the end, one open-ended question has been asked to the respondents to share their opinion and provide suggestions regarding online learning environments.

Sampling Method and Sample

The study used a non-probability sampling technique that is *Snowball Sampling*. Snowball sampling is widely used in qualitative research design. In snowball sampling at the initial phase, the researcher selects potential participants and builds a network of respondents (Dusek *et al.*, 2015). However, in the sampling technique scrutinize the potentiality and quality of the participant are limited (Dusek *et al.*, 2015).

For the study, initially, a Google form link was sent to the ten participants through email and Whatsapp. The ten participants circulated the same in the later stage. The researchers disabled the link after 15 days. Finally, the researchers collected 80 responses from the target population. After summarization, the responses of MPhil, and Ph.D. are considered in a single category named as *others* due to fewer responses.

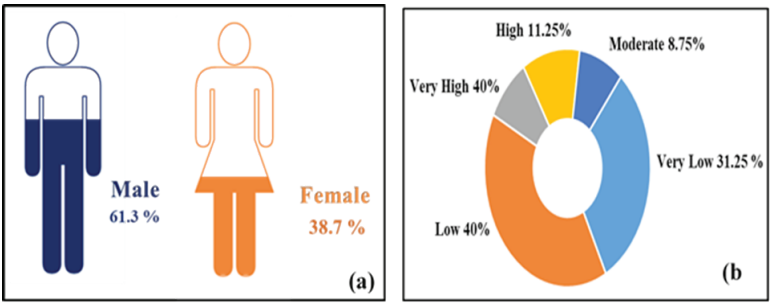


Fig. 1: Sample distribution: (a) Gender wise distribution of sample. (b) Economic status wise sample distribution

Tools and Techniques

In order to analyze the collected data, authors applied both descriptive statistics (Mean Standard Deviation, frequencies and percentages) and inferential statistics through Chi-square (X^2), Fisher's exact test, Cramer's V. The results also represent graphically for better insight. Chi-square is a well-accepted inferential tool to measure the association of continuous and categorical variables (Gliner, *et al.*, 2002; Kim, 2017). However, the Chi-square test is less effective when 20% of cells have expected frequencies <5 (Kim, 2017). To avoid discrepancies in results, the authors also computed Fisher's exact test, which useful for a small sample size. The following formula used to calculate the Chi-square test of Independence.

$$E_{nij} = \frac{\sum X_j \times \sum X_i}{N}$$

$$X^2 = \sum \frac{(O_{nij} - E_{nij})^2}{E_{nij}}$$

X^2 = Chi-square

E_{ij} = Expected count of *n* cell of column *i* and row *j*

O_{nij} = Observed count of *n* cell of column *i* and row *j*

ΣX_j = Sum of row *j*

ΣX_i = Sum of column *i*

N = Total number of observation

To overcome the limitation of the chi-squared test, Fisher's exact test has been implied. This test work on hypergeometric distribution (Hoffman, 2015). Cramer s V is used to measuring the degree of association between employed variables. For all statistics, the authors used SPSS statistical package for the Social Science version 23 and Microsoft Excel for Windows.

Results and Discussions

Social, Economic, and Demographic Characteristics

Here, demographic variables include Gender, Age, Place of Residence, and socio-economic variables include Religion, Caste, Marital Status, and Economic Status (Table 1). The economic status of respondents was calculated based on the monthly family income. Table 1 and Fig. 1a indicate 22.5 percent more male respondents (61.3 percent) have participated in the survey than female respondents (38.8 percent). The majority of the respondents belong to very low (31.3 percent) and low (40 percent) economic backgrounds (Fig. 1b). The mean age of the respondents was 23 years; 55 respondents age were under 22-25 years.

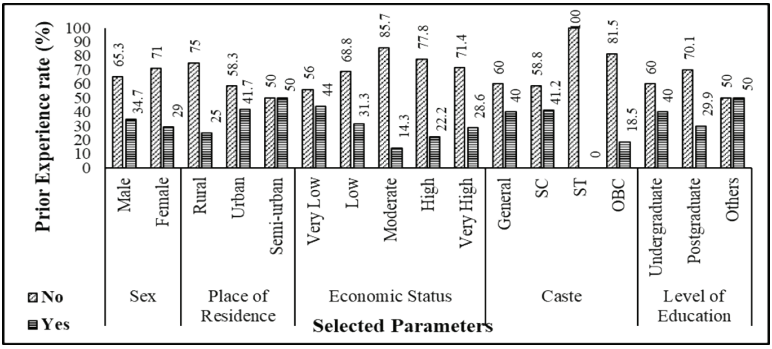


Fig. 2: Prior experience of online classes based on social, economic and demographic characteristics

The variable place of residence shows that 48 respondents (60 percent) belong to a rural background, 24 respondents (30 percent) and 8 respondents (10 percent) respondents belonged to urban and semi-urban areas respectively (Table 1).

Table 1: Social, economic and demographic attributes of the respondents (N=80)

Demographic & Socio-Economic Characteristics	Frequency	Demographic & Socio-Economic Characteristics	Frequency
Gender		Place of Resident	
Male	49 (61.3)	*Rural*	48 (60)
Female	31 (38.7)	*Urban*	24 (30)
Marital Status		*Semi-urban*	8 (10)
Married	5 (6.3)	Caste	
Unmarried	75 (93.8)	*General*	16 (40)
Age		*Scheduled Caste*	8 (20)
21	17 (21.25)	*Scheduled Tribe*	1 (2.5)
21-25	55 (68.75)	*Other Backward Class (OBC)*	15 (37.5)
25	8 (10)	Religion	
Economic Status		*Hindu*	32 (80)
Very Low (<5000)	25 (31.25)	*Islam*	7 (17.5)
Low (5001-10000)	32 (40)	*Other*	1 (2.5)
Moderate (10001-20000)	7 (8.75)		
High (20001-40000)	9 (11.25)		
Very High (>40000)	7 (8.75)		

Source: Online Survey, January, 2021

Prior Experience: Online Learning

Table 2 indicates a summary of student's perception about their previous experience attending any online classes and their course of a tendency to attend the class conducted by their institution. A major proportion (67.5 percent) of participants responded that they do not have any prior experience attending online learning mode. In comparison, only 26 (32.5 percent) participants out of 80 have prior online class experience (Table 2). The study founds a high disparity (35 percent) between the students who have prior experience to attend any kind of online learning activities and those students who have

no prior experience. Henceforth, prior experience act as a barrier to adopts the new paradigm shift. In this context, respondents said that initially, they have to fear that, how to join the class, how to unmute the speaker and video, and also faced problems to asked their doubts during the class. Among the respondents, 34.7 percent of male students attend online classes, and only 29 percent of female students have prior experience (Fig. 2). The response has varied irrespective of gender, place of residence, economic status, level of education, and caste (Fig. 2). It highlights that most participants' lives in the rural areas which caused a lack of effective use of online mode for their educational purpose.

Table 2: Prior experience of online learning and attendance during online class (N=80)

Questions	Response	Count	Percentage
Have you had any such experience to take online/digital mode of education before this pandemic situation?	Yes	26	32.5
	No	54	67.5
Can you attend all the Online classes which are Conducting by your institution?	Yes	59	73.8
	No	21	26.2

Source: Online Survey, January, 2021

However, the experience barrier has minimal impact on students belonging to urban and semi-urban areas. The National Statistical Office (NSO) 75th round survey report entitled 'Household Social Consumption: Education' revealed that only 4.4 percent rural household have own computer and 14.9 percent rural household have the access to the internet. In contrast, the scenario is far better for the urban areas, where 23.4 percent of households have computers and 42 percent of households have an internet connection (The National Statistical Office, 2020). The students of urban areas have a high opportunity and tendency to use sophisticated modern technology. They have more access to the necessary infrastructure, equipment, and high-speed internet. Further, in rural areas, only 29.4 percent of males and 17.6 percent of the female population under the age of 15-29 years can operate a computer (The National Statistical Office, 2020). Whereas, 60.6 percent of males and 50.9 percent of females

in the urban areas can use computers (The National Statistical Office, 2020). Urban-rural discrimination is also huge in the internet penetration across India (Sharma, 2020). The Telecom Regulatory Authority of India (TRAI) published a report in April 2021 showing that the total internet subscribers in India are 795.18 million, where only 34.60 percent of subscribers are from rural backgrounds per 100 population (TRAI, April 27, 2021). The rural-urban divide in broadband subscription is 69.38 (TRAI, April 27, 2021).

Table 2 indicates that 73.8 percent of students sincerely attend all the online classes conducted by their institutions. The survey summary has revealed a very interesting fact that female students have more sincere in attending online classes compare to their male counterparts. Among the female respondents, 80.69 percent of respondents said they regularly attend all online classes conducted by their respective departments. It indicates that female students have a greater conception of syllabi, knowledge gathering, and future outcomes.

Table 3: Level of effectiveness of Online Learning versus Offline Class (N=80)

N=80, Mean 3.591.59		Responses	Frequency	Percent	Mean
Online mode of education is more effective than Offline education	Ineffective	Very Much Ineffective	10	12.5	2.110.81
		Moderately Ineffective	12	15.0	
		Slightly Ineffective	15	18.75	
	Effective	Slightly Effective	17	21.25	4.80.76
		Moderately Effective	17	21.25	
		Very Much Effective	9	11.25	

Source: Online Survey, January, 2021

The results supported the outcomes of the study conducted by Khaleel (2017). Khaleel (2017) conducted a cross-sectional study to examine that the girls' students are more efficient in academic activities compare to the boys' students. The results indicate girls

are more interested in non-technical academic activities and skills, whereas the boys are more attached to acquire technical knowledge (Khaleel, 2017). However, the keen interest in technology act as stimuli for male respondents, where 69.38 percent of male students among the male respondents regularly join in the online class. The outcome also supports the argument made by Khaleel (2017).

Students Perception: Effectiveness of Online Learning versus Offline Class

This section of the study will examine respondent's feelings, conscience, and choices about the mode of education. This section will also examine the association with different factors in students' perception of the effectiveness of online education.

Table 3 shows students' perceptions of the effectiveness of online learning over offline classes. Among the respondents, 43 (53.75 percent) perceived that online learning is more effective than offline learning (Fig. 3a). However, 47 (58.75 percent) respondents have not agreed with this statement. The perceived offline classes have provided more potential outcomes than online classes. For assessing the level of effectiveness, responses were collected on a six scale- three from effectiveness and three from ineffectiveness (Table 3). Among all responses, 21.25 percent, 21.25 percent, and 11.25 percent perceived online classes slightly, moderately, and very much effective compare to the offline class. Whereas, the majority of the respondents among the effective responses perceived online lasses moderately and slightly effective. Only 9 respondents found online classes very much effective. Fig. 3a and 3b highlight the gender-based differential of perception on the effectiveness and ineffectiveness of online learning.

However, the perception is given during pandemics and closure of institutions where online classes emerge as an effective way for both teachers and students to complete the necessary syllabi. In the later part of the study, the researcher will discuss the various bottlenecks faced by students during an online class.

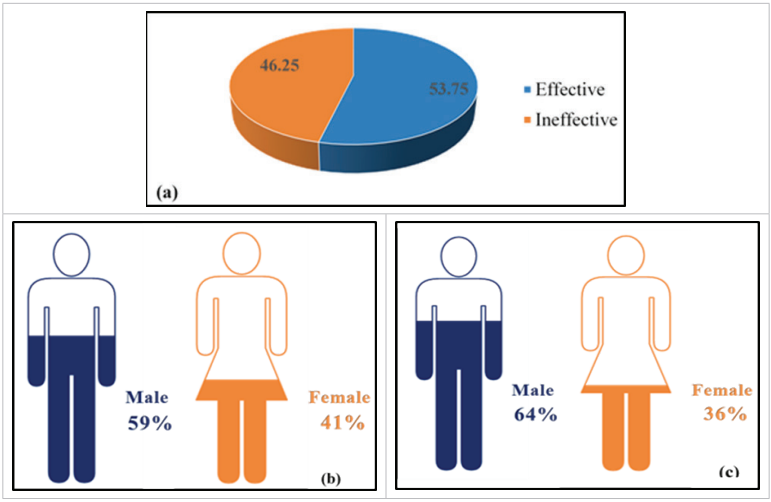


Fig. 3: (a) Proportion of students' perception regarding effectiveness and ineffectiveness of online learning. (b) Gender wise proportion of students' perception regarding effectiveness of online learning. (c) Gender wise proportion of students' perception regarding ineffectiveness of online learning

Table 4: Students perceptions of equipment necessary for online learning (N=80)

Questions	Response	Count	Percentage
Are you well equipped for receiving online education provided by your institution?	Yes	42	52.5
	No	38	47.5
Is Your educational institution well equipped and ready to teach you in online mode?	Yes	32	40.0
	No	13	16.2
	May be	35	43.8

Source: Online Survey, January, 2021

Online Learning: Students well Equipped for the Paradigm Shift

The paradigm shift is a course of transformation from an established system to the new one. The term *paradigm shift* was first used by Thomas Kuhn in his book, *The Structure of Scientific Revolution,* defines "*paradigm shifts arise when the dominant paradigm under which normal science operates is rendered incompatible with new phenomena, facilitating the adoption of a new theory or paradigm*" (Michelson, May 5, 2020). Since 2019, the Coronavirus pandemic

forced the people to alter their usual way of living and reframe the normal working system of society (Michelson, May 5, 2020). Due to the pandemic, all educational institutions changed their teaching-learning mechanism and shifted from physical classroom to virtual classroom. It is also noted as a major paradigm shift of the existing education system which hard to adopt for institutions, teachers, and students (Baruwa *et al.*, 2021).

Attending online classes needs a well-equipped technological environment for both teachers and students. This section of the study examines the condition of students in terms of availability of necessary equipment, namely, personal computer, laptop, smartphones, and high-speed internet connectivity.

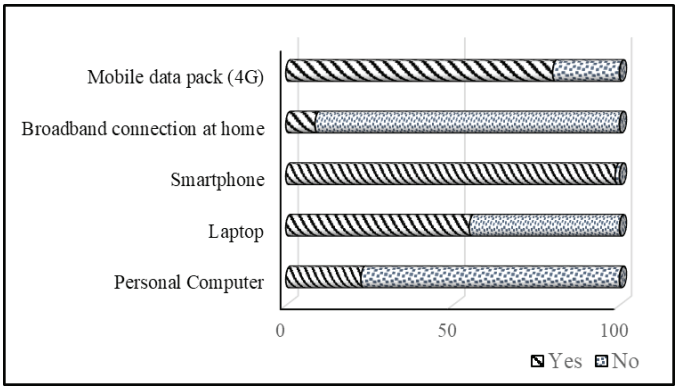


Fig. 4: Availability of necessary equipment for online learning

Among the responses, more than half (52.5 percent) of respondents said they are well equipped for availing of online classes (Table 4). In contrast, the concerning issue is that a major proportion (47.5 percent) of students said they could not be able to access necessary technical devices. It indicates that a major proportion of students either discontinue or irregular in attending the online class. The study also revealed that less access to high-speed internet is a significant bottleneck for most of the students to pursue the class. Among the respondents, a majority have not access high-speed internet (Fig. 4). Internet is a primary need for attending online classes by using a

different application. A question was asked to know the student opinion, whether their institution is well equipped and ready to teach online. Here, most of the students have given a positive response that their institution can conduct the class.

Table 5: Pearson Chi Squared test of Association between students economic status and necessary requirements for online learning

Variables		Necessary requirements for e-learning from students end			
		Personal computers	Laptops	Broadband (Wi-Fi)	Mobile Data (4G)
Economic status	*df*	*4*	*4*	*4*	*4*
	X^2	16.575*	13.043*	16.179*	4.619
	Cramer's v	.455*	.404*	.450*	.240

X^2 =Pearson Chi squared; *df* Degree of freedom; *Asymptotic Significance (P<0.05).

Availability of Technical Equipment

Fig. 4 showing the scenario of available necessary equipment. The respondents have smartphones (98.76 percent), laptops (55 percent), and desktops (22.5 percent). When the question asked on the internet connection, 80 percent of respondents informed about the use of a mobile data pack to attend the online class. The majority of students preferred smartphones for online learning due to the unavailability of other devices, flexibility, and comfortable to use in any place. The findings are supported by the study conducted by Muthuprasad *et al.* (2021). The study of Muthuprasad *et al.* (2021) finds that most students in the agricultural field use smartphones and laptops for online classes. The authors also suggest that the application needs a noticeable user interface and compatible with all devices (Muthuprasad *et al.*, 2021).

In this part, the author employed a chi-square test of association to reveal the association between respondent's economic status and necessary equipment for an online class (personal computers, laptops, Wi-Fi, and smartphones). The result (Table 5) revealed that availability of personal computer ($X^2 = 16.575$, $p = 0.002$), laptop ($X^2 = 13.043$, $p = 0.011$) and broadband (($X^2 = 16.179$, $p = 0.003$) is statistically significant association with the respondents economic status. Ahuja

& Bera (2021) also noted that online education was significantly influenced by the economic background of the user (students). They found the relationship between poverty and broadband adaption has inversely proportional, which means if poverty increases the adaption of broadband is automatically falls (Ahuja & Bala, 2021). The result indicates that high cost is the main barrier to availing of the necessary equipment. However, the smartphone is not significantly related to economic status. So, irrespective of economic status smartphone is a crucial device to attend an online class. Also, the smartphone is a major link between students and online classes.

Table 6: Students perception of Teacher-Students Interaction and Doubt clearing during online class (N=80)

Question	Response	Count	Percentage
What score will you give for *doubt clearing* during online classes?	Very Low (1)	9	11.4
	Low (2)	17	21.5
	Moderate (3)	31	39.2
	High (4)	12	15.2
	Very High (5)	10	12.7
What score will you give to the *'Teacher-Student'* interactions during Online classes?	Very Low (1)	10	12.7
	Low (2)	12	15.2
	Moderate (3)	31	39.2
	High (4)	15	19.0
	Very High (5)	5	13.9

Source: Online Survey, January, 2021

Teacher-Students Interaction

Teacher-students interaction is an essential input for making better learning outcomes (Ahmad *et al.*, 2017). The study of Ahmed *et al.* (2017) found that teacher-student relations positively associated with comfort learning. It helps students to make their learning better. However, the results were satisfied in the classroom environment. Aydin (2013) conceptualize the background and necessary approach of student-teacher interaction in online learning. In the present study, the researchers use a five-point Likert scale to examine the perceptions of students about teacher and student interaction during

an online class. Score 1 represents very low interaction, to score 5 represents very high interaction (Table 6).

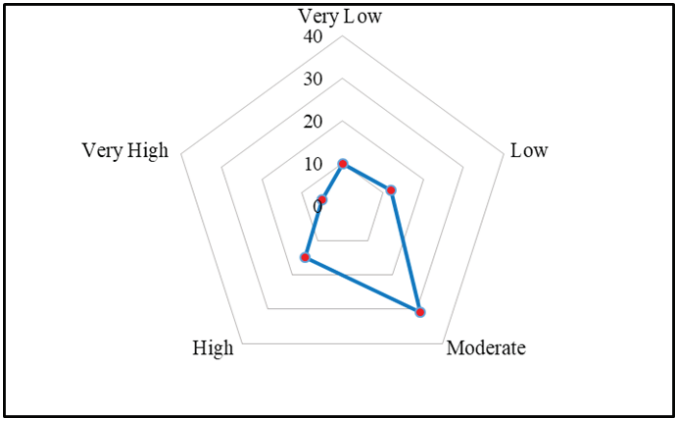


Fig. 5: Teacher-Students Interaction

Among the respondents, 12.7 percent perceived that during online class, the scope of student-teacher interaction was very low, while 13.9 percent responded in line with very high interaction. The majority of the respondents (39.2 percent) perceived a moderate level of interaction between teachers and students during online classes (Table 6 and Fig. 5). The reason for the low scope of interaction is the sudden change of mode of the teaching-learning process. In the pre-COVID era, students are familiar with the environment of the physical classroom. Nevertheless, in this online learning mode, they need more time to habituate to the new environment. A teacher is also a significant stakeholder in this interaction. So, their role is to provide sufficient scope for the students to familiar with the new paradigm shift. Despite this, online learning has effective potential in teacher-student interaction and comfortable learning. Teachers and students both are new to the environment of remote learning, which creates certain initial limitations. Further, lacking necessary infrastructure in the institutions and limited equipment to the students work as an additional major setback for better learning outcomes (Table 4). The findings of the study coherence with the findings of Abbasi

et al., 2020. Abbasi *et al.*, 2020 also found limited student-teacher interaction in the e-learning mechanism. The current situation forced educational institutions to drop the traditional educational practices and adopt the practice of e-learning (Naik *et al.*, 2021). It creates major drawbacks to the natural communication between students and teachers. Due to the adaption of e-learning laboratory-oriented courses are hard to teach (Naik *et al.*, 2021).

Scope of Doubt Clearing

Table 6 shows that among all respondents, 21.5 % of students said online learning has a very low potential to clear their queries. Although, the majority (39.2 percent) of students perceived online medium has a medium level of doubt clearing role (Table 6). In higher education, conceptual clarification is essential, and queries on several topics are usual for a student. The study of Muthu Prasad *et al.* (2021) finds that posting queries in the online application and live chat plays a significant role in addressing a student's doubt. However, an online mode is challenging for a teacher to clarify and respond to all the queries through an online medium (Table 8).

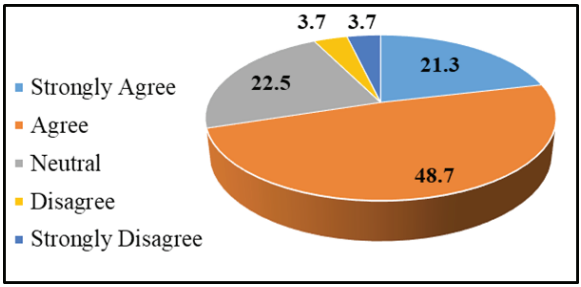


Fig. 6: Fear of Learning Loss due to pandemic and shifting of teaching practices from physical classroom to online mode

Fear of Learning Loss in Pandemic

Fig. 6 shows around 48.7 percent of respondents agreed they fear learning loss due to pandemic and online class. Around 21.3 percent strongly agreed with the question. The majority of students in higher education consents that pandemics and online learning hamper their

future academic achievement. Whereas only 3.7 percent of the student said they disagree with the question about learning loss (Fig. 6).

Feeling of Students during Online Class

Fig. 7 indicates that 35 percent of respondents said they feel less concentration throughout the online class. In comparison, 33.8 percent of respondents feel satisfied with this new mode of learning. The result also indicates that 15 percent of students have faced difficulty with understanding the class. Only 2.5 percent responded feel online class is same as offline class. The majority of the students also said online learning is satisfactory. The mixed responses from the student indicate that they faced difficulties in online classes, but due to the COVID-19 pandemic maintaining social distance is necessary. However, in this unusual situation, online learning provides a healthier platform for continuing the study.

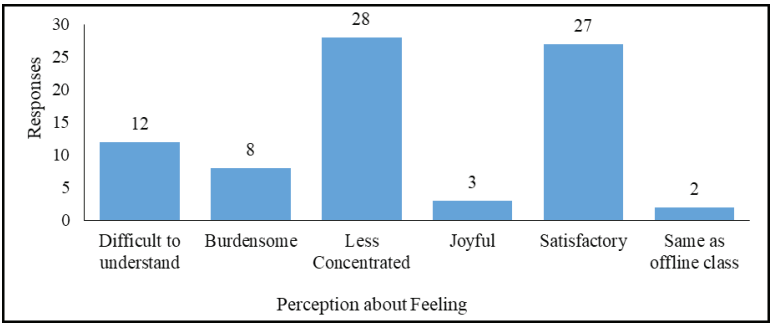


Fig. 7: Students' perceptions regarding their felling during online class

Preference of Learning Mode after Pandemic

The effect of the novel coronavirus is prolonged, which influences the normal process of classroom learning. In this long period, it is obvious that most students are familiar with online learning modes. With this in mind, researchers frame a question, *which mode of learning would you prefer after the pandemic?* Surprisingly, 52.5 percent of the respondents prefer offline mode (Fig. 8a). Only 7.5 percent of the respondents choose the online mode. However, 32 respondents (40 percent) prefer the hybrid mode (offline + online)

of learning. The economic status of the students variably influenced by the preference of a mode of learning (Fig. 8b and 8c). It indicates that most of the students who belong to low and very low economic backgrounds opted for offline or blended modes of learning. But also the student who belongs from a better economic background prefer to choose the same mode of learning after the pandemic. Students gradually habituated to the online learning environment. Although they still consider classroom learning is necessary. Classroom learning in an institution provides them a customized learning environment which is not possible at home. Consequently, online classes help the student to revise their syllabus and solve instant queries. A respondent opined that '*our study is enhanced when the offline classes have recorded and later provided to us for revision*.'

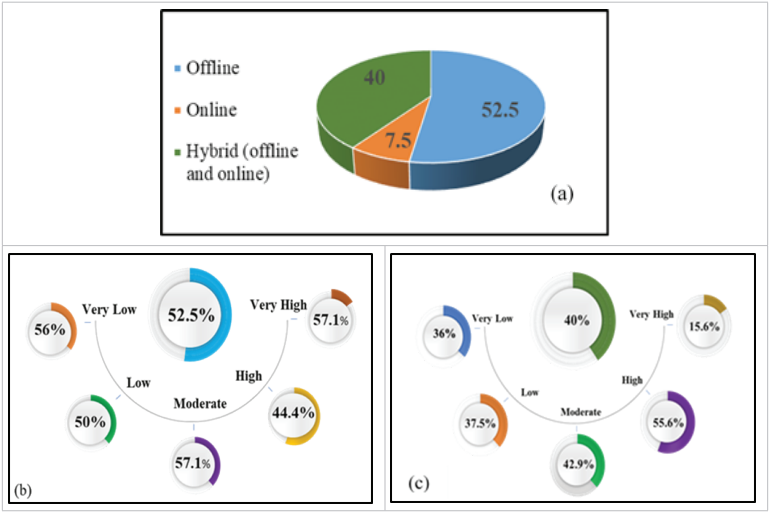


Fig. 8: (a) Students' perceptions regarding their preferred mode of learning after pandemic. (b) Economic status wise students' perceptions regarding their preference of offline learning after pandemic. (c) Economic status wise students' perceptions regarding their preference of hybrid learning after pandemic

Table 7: Pearson Chi Square test for the association, Fisher's exact test and Spearman correlation between different variables and preferred mode of learning

Variables		Gender	Place of residence	Caste	Level of education	Economic status	Well equipped	Prior experience
Preferred mode of learning	df	**2**	**4**	**6**	**4**	**8**	**2**	**2**
	X^2	.574	10.246**	12.894*	9.696*	3.788	10.421**	1.964
	Fisher's Exact Test	.629	10.407**	13.767**	9.072**	2.675	10.176**	2.111
	Spearman correlation	.076	.296	-.311	.207	.059	.327	.122

X^2 =Pearson Chi squared; *df* Degree of freedoml; *Asymptotic Significance (P<0.05); ** Exact significance

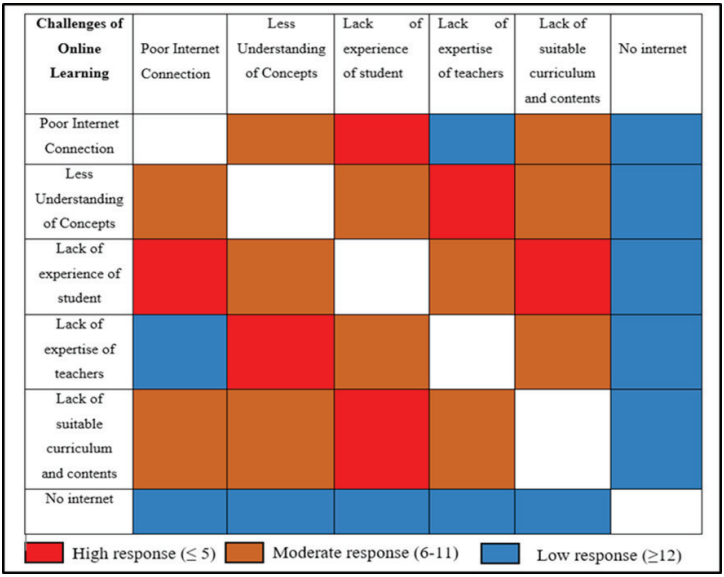
Further, the researchers examine the role of gender, place of residence, economic status, level of education, prior experience of online learning, and well equipped for an online class on the student perception of the preference of the mode of learning after the pandemic. Here researcher uses Chi-square and Fisher's exact test to test the association of the above-mentioned variables (Table 7). The results revealed that the place of residence, caste, level of education, and well-equipped condition of the students has a significant statistical association with the preference of the mode of learning. However, other employed variables (like gender, economic status, and prior experience) have not significant association with the students' perceptions. It does not mean that those variables have any impacts on student perceptions.

Table 8: Different challenges faced by the student community in attending the online class

Challenges of Online Learning	Responses (%)
Poor Internet Connection	38.09
Less Understanding of Concepts	18.37
Lack of experience of student in online learning	15.65
Lack of expertise of teachers in online learning	7.48
Lack of suitable curriculum and contents	14.97
No internet during online class	5.44

There is not enough evidence to state that gender, economic status, and prior experience of online learning are a significant

association with the test variable. The result also supported the prior arguments that economic status does not have any significance on the students' choice of mode of learning. The results highlight the mixed responses about the effectiveness of online classes in terms of the employed variables with limited responses.



Source: Online Survey, January, 2021

Fig. 9: The Fig. indicates a matrix of challenges faced by students during an online class. It prepares based on the occurrence frequency of responses given by students.

Challenges of Online Learning

Table 8 and Fig. 9 shows that the majority of respondents said poor internet connection is a significant issue to attending the online class. Low understanding, less experience of students with digital interface and lack of suitable curriculum possess second, third and fourth rank as per the responses obtained from students. About 14 respondents said less experience of teachers in digital learning also prevents to effectively conducting the class. The result validates the observation of Muthuprasad *et al.* (2021). Further, lack of direct

interaction with teachers, poor learning environment, and high cost of data packs identified as bottlenecks for online learning (Muthuprasad, 2021).

The study examines that for smooth learning with digital mode, needs to build a better network of the internet (Mishra *et al.*, 2020) across the region (irrespective of rural, urban and semi-urban areas) and give minimum necessary equipment to the students. For that case, the institution bears the cost of the internet (fully or partially). The institution also conducted a training session for teachers. Because intense training of teachers is a prerequisite for conducting successful and effective online learning. Well-structured and concise course modules, regular quiz, and queries solving are essential during an online class. Mishra *et al.* (2020) found that excellent domain knowledge, high proficiency in the online application with excellent communication skills, and motivational attachment with students are necessary for a teacher to provide effective online learning outcomes.

Benefits of Online Learning

Due to the COVID pandemic, online learning is beneficial for both students and teachers to continue the course (Mishra *et al.*, 2020). Among the respondents, 53.8 percent agreed that online learning effectively reduced the chances of transmission of COVID and other infectious diseases (Table 9). About 25 percent of respondents said online learning is cost-effective (12.5 percent), and the scope of recording the class (12.5 percent) help them to revise complex concepts with more ease. The home learning environment is another major benefit of online classes (Table 9). However, few students agreed that online class is less time-consuming. The online learning environment provides an opportunity for low and very low economic status student to reduce the cost of education which help them to survive in the pandemic situation. Fig. 10 depicts the selected opinions of respondents regarding e-learning.

Table 9: Benefits of online learning

Benefits	Responses (%)
Cost-effective	12.5
Low chance of transmission of COVID & other infectious diseases	53.8
Scope of Class Recording	12.5
Less time consuming	5.0
Easy learning in own environment	8.8

Source: Online Survey, January, 2021

Teaching-learning in a Virtual Space: Strength, Weakness, Opportunities and Threats (SWOT)

SWOT denotes Strengths, Weaknesses, Opportunities, and Threats which provide a critical base to understand the present scenario and future possibilities of an issue and provided several ways forward. The following Table 10 provide a glimpse of SWOT of the online learning,

Strength

Online learning provides a virtual medium for the student community to reduce the cost of educational expenditure. The virtual platform also provides an effective solution to save time, which is an obvious need for offline classes. In house learning eliminate the cost like transportation cost. However, the study found that the long duration class reduced the productivity of a student (Abbasi *et al.*, 2020; Chaturvedi *et al.*, 2021; Muthuprasad *et al.*, 2021). Hence, short duration and regular intervals in a class possibly increase the productivity and concentration of the student (Muthuprasad *et al.*, 2021). Also, enhance the capacity to understand the lecture, enhance the learning outcomes.

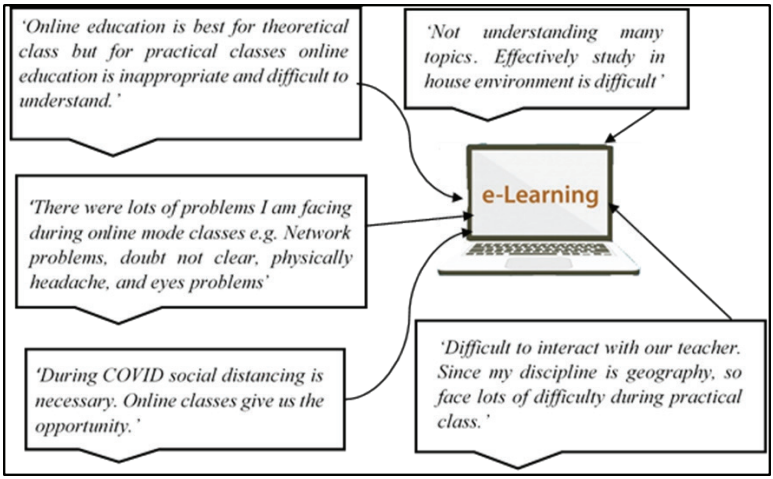


Fig. 10: Selected responses of the student of online learning

Weakness

In the Indian context, sudden from classroom learning to online learning has amplified few weaknesses, that as lack of high-speed internet. Even, the low penetration of the internet across the nation is also acting as a significant weakness to adopt the new paradigm. Further, the wide rural-urban digital divide also acts as a bottleneck. Lack of necessary equipment, low financial backgrounds affects the majority of student in attending the online class. Ozuorcum & Tabak (2012) noted that online learning reduced the certain kind of interaction between the student-teachers and student-student. It affects cognitive behavior and reduced learning outcomes.

Opportunities

The motivation of students and teachers is a major opportunity for adopting the virtual learning medium. This means the main motivation is to complete the syllabus and course. In addition, during the pandemic, it provides an effective solution to maintain social engagement, face-to-face interactive contact. Here, face-to-face denotes the opportunities of live streaming where both teach

and students see each other. It also minimizes the risk of exposure to novel coronavirus. Online mediums have the opportunity to conduct their class in a time-flexible schedule, which is hardly possible in a physical classroom.

Table 10: Strength, Weakness, Opportunities, and Threats (SWOT) of online learning: In the perspective of Students, Teachers and Institutions

Strengths	**Weaknesses**
• Cost effective due to the absence of the cost of transport, hostel and foods. • Time saving • It helps to correlate both student and teachers with the upgraded technologies • Blended mode of learning is strengthen the future learning process. • Adjustable timing and possibility of instant feedback • Record the class for future reference • Access the class from anywhere	• Lack of penetration of high speed internet across the nation • Lack of assimilation of students-teachers with the online learning platform • Long duration class tends to boring and interrupt in the understanding and concentration • Lack of necessary equipment • Incompatibility of hardware and software
Opportunities	**Threats**
• Online learning provide an interactive platform of distant learning and complete the syllabus • Flexibility of time for study schedule • Provide a healthier and pro-active medium of study • User friendly • Opportunity of reuse the content for any other online courses • Widening the opportunities of student participation from different parts • Easy home learning environment • Broadened the scope of distance learning	• Possibilities of high dropout due to lack of necessary equipment • Urban-rural digital divide • Low speed of internet, especially in rural areas • Lack of quality content which is useful for online class • High initial cost • Most of the learning platforms (ex. Google meet, Zoom) needs paid subscription which provide extra financial stress for the institution • Investment in education is stagnant to upgrade the infrastructure to provide quality class in virtual mode

Source: Online Survey, January 2021, January, 2020; Abbasi *et al.*, 2020; Cook, 2017; Gupta & Sharma, 2020; Hande, 2014

Threats

The initial cost of foundation the infrastructure, new technology, human resource training is very costlier. However, in the long term, the maintenance is cheap compare to the traditional mode (Cook, 2017). Likewise, on short-term basis e-learning provide a solution but in the long-term, it does not meet the requirement of the complex system and requirement of higher education (Inceu *et al.*, 2013). Less opportunity of cognitive satisfaction is also acts as major threats for successfully run their e-learning mechanism (Levy, 2017). Lower satisfied students possibly drop their study which broadened the learning gap (Levy, 2017).

Assessment of Student Performance: Online Assignments based Open Book Examination

In this year-long pandemic situation, evaluation of student's performance widened the challenge of the educational institutions. To cope with these challenges the University Grants Commission (the highest regulating body of higher education in India) formed two expert committees which suggest guidelines to conduct the examinations and prepare a feasible academic calendar during COVID-19 (Baral, May 1, 2020). The expert committee of UGC opined to conduct an online examination and to reduce the exam time in order to accommodate the academic loss (Baral, May 1, 2020; Chowdhury, September 19, 2020). In this context, most of the universities and colleges adopted the new mode of assessment, which is assignments-based online Open Book Examination (OBE). University of Newcastle (December 15, 2020) defines an Open book examination as a system of academic assessment, where a student has the freedom to consult books, notes, materials, and other necessary resources. Eurboonyaun *et al.*, (2020) noted that open book assignments-based examination had provided more significant results compared to the traditional examination. The mean score of student is more in the OBE (Eurboonyaun *et al.* 2020).

Table 11: Perception about Open Book Examination: Prior experience, post experience and difficulty level

Questions and Responses	Count	Percentage
Prior experience of Open book examination		
yes	73	91.25
no	7	8.75
Post experience of Open book examination		
very good	8	10.00
good	17	21.25
neither good, nor bad	43	53.75
bad	8	10.00
very bad	4	5.00
Level of difficulty of Open book examination		
very difficult	5	6.25
somewhat difficult	22	27.5
slightly difficult	26	32.5
slightly easy	13	16.25
somewhat easy	7	8.75
very easy	7	8.75

Source: Online Survey, January 2021

In this section, researchers examine the perceptions of students in an open book examination conducted by their institutions during the COVID-19 pandemic. Table 11 shows that 91.25 percentage of respondents do not have any experience attending any online examination. The sudden change of the existing examination system majorly affects their cognitive performance. Likewise, the respondents said that most of the institutions were not arranged any mock examination which helps the students to cope with this new form of the assessment process. The majority of students (32.9 percent) perceived that they agreed with the OBE during this health emergency (Fig. 11), because it is necessary to complete the course for future studies. While 30.3 percent of respondents are neutral, 15.8 percent of respondents disagree and 9.2 percent of respondents strongly disagree in the assignments-based open book examination. The study found that more than half of the students (53.9 percent) said that their experience in an open book examination is the same as the traditional closed book examination. Likewise, 21.9 percent of

respondents perceived that their experience is good in the new mode of assessment.

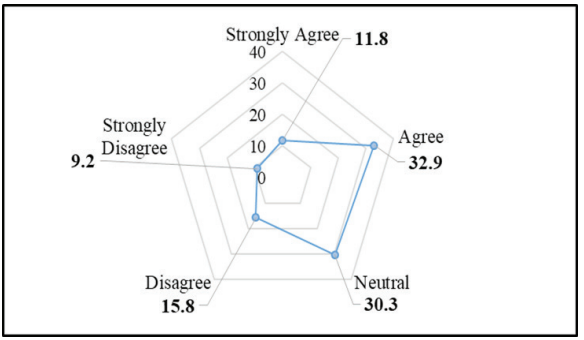


Fig. 11: Level of students consent (agree) regarding the Open Book Examination

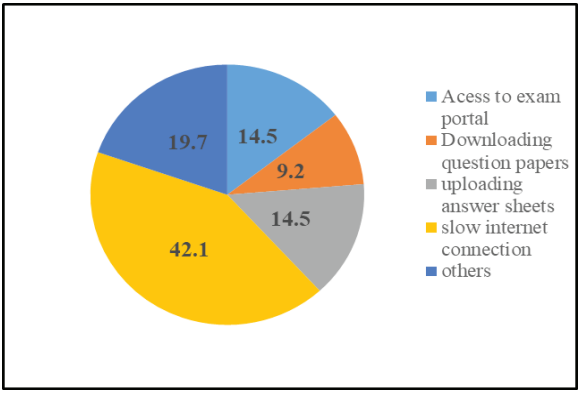


Fig. 12: Bottlenecks of Open Book Examination

Bottlenecks and Way forward of Online Assignment based Open Book Examination

During the COVID-19 pandemic, online assignment-based OBE has emerged as a solution to continuing the evolution process in higher education in India. However, OBE is not generally practiced in the traditional educational mechanism in India. So, student's community does not accommodate this mode of assessment. In this context, the study found that 6.25 percent of the respondent facing very much

difficulty, 27.5 percent and 32.5 percent of respondents opined that they faced somewhat difficult and slightly difficult respectively (Table 11). Likewise, Fig. 12 shows that online class OBE also faced the same problem of slow internet connectivity which emerged as a major bottleneck in the success of OBE. Further, the access to the exam portal (14.5 percent) and uploading answer sheets (14.5 percent) noted as major problems in successfully arranged the online assignment-based OBE. The work of Guangul (2020) found that the lack of proper infrastructure and ambiguity in academic integrity from the students' end was a major challenge in effectively arranged the remote assessment.

Table 12: Initiatives for promoting online learning

Sl. No.	E-learning Courses	Description and Link
1	UG/PG MOOCs	UGC has launched Massive Open Online Courses (MOOC) through the SWAYAM online platform to continue the non-technical courses of Undergraduate and Postgraduate students. It offers quality teaching-learning resources accessed 24. http://cec.nic.in/cec/cecmoocs
2	SWAYAM Online Portal	It provides a web-based interactive learning environment for young students. Launched by then, MHRD offers 4024 courses. https://swayam.gov.in/
3	E-PG Pathshala	It provides an initiative e-content included 23000 learning modules (e-text and video) around 70 postgraduates discipline (Jena, 2020). https://epgp.inflibnet.ac.in/
4	Shodhganga	The Sodhganga is a web-based Indian thesis repository. From here, research scholars accessed unlimited thesis and dissertation. https://shodhganga.inflibnet.ac.in/
5	E-Shodh Sindhu	The platform covering around 15000 peer-reviewed journals, synopsis and factual database. It helps the scholarly community to run the research work smoothly. https://ess.inflibnet.ac.in/
6	CEC-UGC YouTube Channel	The platform created by Consortium for Educational Communication (CEC) for free access to web-based quality content. https://www.youtube.com/user/cecedusat

Open book assessment has needed more attention from the instructor. Here, instructors have the scope to frame the question in a manner that needs to solve critical thinking and problem-solving

ability (Sarkar, 2021). The study of Sarkar (2020) found that majority of students faced difficulty in solving the problems, asked in an Open book assessment. The Open book examination is not easy, because the evaluating criteria are framed in a way that is hard to solve through and book or any pre-arranged materials (Hedge, May 30, 2021).

Strategies to cope with the New Paradigm

As per the present findings, the authors recommended the following suggestions in order to enhance the quality outcome of online learning,

(1) It is necessary to provide a high-speed broadband connection to all students and bear the cost of a limited data pack by the institution or by the government.

(2) The government should provide low-priced necessary equipment (like computers, laptops, and tablets) to needy students.

(3) The institution needs to prepare a contemporary and feasible curriculum for each discipline dedicatedly for online learning.

(4) Regular quizzes, mock tests, and flexible short-duration classes will be more effective online learning. In this context, a frame of the concise syllabus is necessary. Because traditional syllabus creates enormous pressure both teacher and student to complete course on time.

(5) The government needs to arrange a faculty development program for the teachers to efficiently handle the online learning applications and better communicate with students on the online learning platform.

(6) The teachers' community needs to be more analytical during framing the questions for OBE, which critically assesses the verbal and non-verbal problem-solving ability of the students.

(7) A regulatory body needs to set that regularly monitor online learning progress and provide a quality suggestions for improving the same.

In this context, The Ministry of Education (MoE), formerly the Ministry of Human Resource Development (MHRD) and the University Grant Commission (UGC), the apex body of Indian

higher education were taken different initiatives for continuing the learning process during the pandemic (Table 12). These initiatives is widely promoted the scope of e-learning, preparedness about the online mode of education, reduced the urban-rural learning disparity and promoting inclusive learning opportunities.

Limitations

Due to time constraints, the study is conducted on a small sample that only includes the students and excluded the teachers and other stakeholders. The study only provides students' perceptions and behavior about online learning, which partially indicates the applicability of online learning in higher education.

Concluding Remarks

The main aim of the study is to analyze student's perception of online learning during the closure of educational institutions and also to know their choice of mode of learning after the opening of institutions. The findings of the present study provide a comprehensive outlook of online learning and its relation with social, economic, and demographic attributes. The study also examines the contextual perspective of open-book examination, which appeared as a solution to eliminating the fear of lacking the evaluation process.

Forced the educational institutions to drop the traditional educational practices and adopt the practice of e-learning (Naik *et al.*, 2021). It creates major drawbacks to the natural communication between students and teachers. Due to the adaption of e-learning laboratory-oriented courses are hard to teach (Naik *et al.*, 2021). Majorly research scholars suffering because they need to access the lab and library to continue their research work. But in the current scenario, the research work is mainly stuck of which further delays their academic achievement (Marar, May 5, 2020; Press Trust of India, September 28, 2020). But in the current scenario, the research work is mainly stuck of which further delays their academic achievement (Marar, May 5, 2020; Press Trust of India, September 28, 2020). Anxiety, stress, obesity, mood sewing and loneliness is

now a common health issue for students due to travel restriction and longtime closure of educational institution (Chaturvedi *et al.*, 2021). The majority of students are not satisfied with their time utilization. They opined that high use of social networking sights, which hamper the regular process of self-study (Chaturvedi *et al.*, 2021).

Likewise, the wider appearance of online learning tendency is accelerating the propensity of the digital divide in knowledge drive. For instance, The Hindu on 11 June 2020 reported that due to the downturn of economic conditions and fear to adopt the technology, fear of missing online classes a girl in Kerala to commit suicide (Naha, June 11, 2020). Further, the high exposure with digital devices maximizes the chance of data breaches, exposed to the virus, malware, and cyber threats (Ahuja & Bala, 2021). Time spent in online classes increased the attraction of digital devices irrespective of age group. However, the children between the ages group 7-17 are majorly spent their time is an online platform (Chaturvedi *et al.*, 2021). It increases the addictive tendency of the digital device which further hampers their performance. Traditional face-to-face learning is best to conduct the practical class. However, it is very difficult for a teacher to complete a practical syllabus through an online platform. Also, the lack of an application-based curriculum demoralized the interest of students (Oyedotun, 2020)

The study demonstrates that the majority of the students perceived online learning as not a practical option to bypass traditional face-to-face classroom learning. However, most students opined that the hybrid model of learning (blending of online and offline learning) is more effective than face-to-face learning. In the Indian context, most students have not to access internet connectivity and the necessary types of equipment for online learning. The high cost of necessary equipment's and logistic supports increased the financial burden for both the institution and parents. The study revealed that complete shifting towards online mode needs to enhance the efficiency of both students and teachers in the long term. However, the economic status of the students is a significant setback to the adaptation of online

learning. However, the study findings indicate that the quality learning outcome of offline learning to be comparable with online learning. Students perceived that quality and effective online learning needs a well-structured study module that provides theoretical knowledge. However, in this pandemic situation, online learning is an effective option to continue the study, and gradually both students and teachers are habituated with this new learning mode. The current scenario significantly hampers traditional educational practices but increases the future possibilities of digital learning. It widened the scope of penetration of online learning. The online learning environment needs to be innovative encouraging ways of teaching but the majority of teachers are facing issues in providing innovative approaches on an online platform (Baah-Duodu, 2020).

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Chapter 5

Trends in Covid-19 in India and its states

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Abstract: Epidemic is widespread occurrence of any infectious disease of any particular or geographical area but Pandemic is a situation where an epidemic spreads worldwide means diseases can outbreak across continents. Recently spread Novel Corona virus has never been encountered before. Based on current available information, coronaviruses (COVID-19) may be transmitted from person to person either through droplets or contacts. It has become global concern as it is highly contagious and our country is high density country. Emergence of COVID-19, world is suffered from health as well as economic crisis. "In a span of last four months, the SENSEX is three year low in emerging economies, and unemployment has reached the peak. The medical know-how on treatment of COVID-19 is limited. No vaccine exists to treat the deadly virus and the use of hydroxychloroquine and plasma therapy seems to be effective in some cases."[5] In our analysis, data retrieved from WHO (India situation report), https://www.covid19india.org/, worldometer (https://www.worldmeters.info), Business Report (https://www.business-standard.com/article/current-affairs/coronavirus-test-are-india-others-testing enough-know-statewise-corona-tests-status-update-120071400172_1.html), covid19india.org (MoHFW). This study presents the analysis of Recovery rate, Recovery-death ratio, Case Fatality Rate (CFR) among Indian states and India also.

Keywords: COVID-19, 6 Continents, South-East Asia, India, Recovery rate (RR), Recovery-death ratio, Case Fatality Rate (CFR)

Introduction

History of previous epidemic (guided by WHO): As per WHO, there are several epidemic and pandemic diseases over last 68 years like

Rift Valley fever (1931), Chikungunya (1952), Cholera, Marburg virus disease (1967), Crimean-Congo haemorrhagic fever (1969), Influenza, Lassa fever (1969), Monkeypox (1970), Smallpox (1979), Hendra virus infection (1994), Nipah virus infection (1999), SARS (2003), Ebola virus disease (2014-16), Meningitis (2014), MERS-Cov (2019), Plague (14th Century), Tularaemia, Yellow fever, Zika virus disease (2015-16).

Presently another type of coronavirus are been discovered as Novel Coronavirus (COVID-19) is particularly identified as Severe Acute Respiratory Syndrome Coronavirus (SARSCOV-2). Coronaviruses consist of large family of viruses which may cause illness or fever in human body as well as in animal. Previously in humans, 2 types of coronaviruses already exist named as MERS (Middle East Respiratory Syndrome) and SARS (Severe Acute Respiratory Syndrome) that can cause respiratory infection from common cold to more severe disease.

In Wuhan City, Hubei Province, China, was first time reported to World Health Organization (WHO) on 31st December 2019. On 7th January 2020, it was confirmed by Chinese authorities, and on 12th Jan 2020, WHO confirmed it. On 11th March WHO declares COVID-19 as Pandemic.

In India, it is found that in Kerala, more rigorous implementation of screening process, going beyond guidelines issued by the Ministry, disbursement of highest amount on public health expenditure among all the major states in India and better-quality of economic and educational status of the state population are one of the reasons why Kerala is performed better than other states (Vibhute *et al.*). A close relation exists between HDI values and infection, death rates among these states, is observed by Gupta *et al.* They revealed that states with higher HDI value reports low rate of death and infection (Kerala, Tamil Nadu) and vice-versa. States with Mid-HDI values (Maharashtra, Gujarat, West Bengal) witnessed large and rapid increase of COVID-19 cases. There is another study which reveals that in the absence of any control measures it is expected that two to

three persons are infected by one person, and around three per cent of the population are at the risk of death within one-and-a-half months from the onset of disease COVID-19 in a generalized population. Paper on COVID-19 reveals an alarming issue that observed Case Fatality Rate in India increased from 1.9 (as of 15 March 2020) to 3.6 (as of 12 April 2020) and reduced slightly to 3.2% (as of 20 April 2020) to total confirmed cases. State-level variations are prominent; mostly Tamil Nadu, Maharashtra, and Madhya Pradesh are most affected states with higher levels of CFR as against Kerala and Tamil Nadu with significantly higher levels of recovery rates. (Dhillon *et al.*,2020)

As on 14th July 213 countries and territories around the world is affected by this deadly virus. In Asia COVID-19 has engulfed all 49 countries and there have been 71,535 reported deaths, with 841,459 Active Cases, 4788 New Cases out of 3,019,837 Total Cases (worldometer). Most common symptoms of COVID-19 are fever, dry cough, and tiredness, aches and pains, nasal congestion, headache, conjunctivitis, sore throat, diarrhea, loss of taste or smell or a rash on skin or discoloration of fingers or toes. These symptoms are usually mild and begin gradually. Some people become infected but only have very mild symptoms or asymptomatic mostly.

Objective of the Study

1. Aim of this paper is try to compare the condition of 6 continents on the basis of % of death cases, % of recovered and % active cases of COVID-19 as well as which are most affected countries around the world as on 16-July.
2. Attempt has been made to understand trend of Case-fatality ratio (CFR), Recovery Rate (RR), Recovery-death ratio, testing trend with confirmed cases in India from beginning of Lockdown phase to mid of July and the major states of India.

For convenience this paper shared in III sections. Section I deals with Indian scenario of COVID-19 for last 5 months. In Section II, attempt has been made to visualize World health condition because of this Pandemic. In section III, Recovery rate, Fatality rate,

Recovery-death ratio have been estimated to understand adverse health condition of India's and its major affected states.

Section I

Indian Prominence of COVID-19

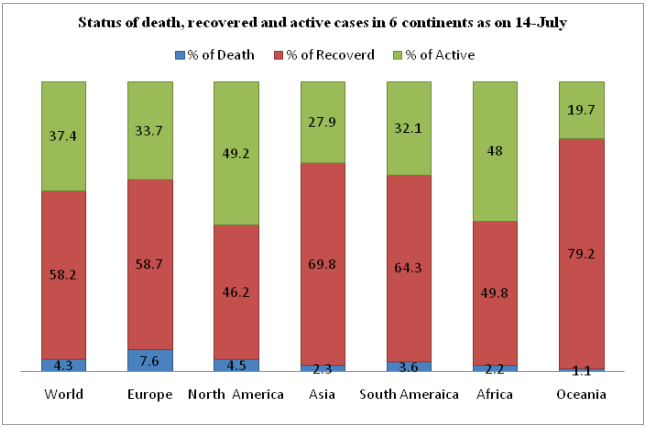
On 30th January 2020, a laboratory confirmed case of COVID-19 was reported in Kerala. The State has lifted the state calamity status on 7th February in a high-level meeting chaired by the Chief Secretary.[2] To tackle the pandemic situation in India, on 24th March 2020 Hon'ble Prime Minister of India ordered a 21-day lockdown (Janata Curfew) till 14th April, 2020 to disrupt the chain of coronavirus transmission, followed by, continuing nationwide Pandemic lockdown till 25th May 2020. PM commended people to maintain social or physical distancing in order to combat this pandemic at an individual level. WHO recommends physical distance means keeping at least 1-metre distance from others. This lockdown is announced when the number of confirmed positive cases in India was approximately 500. Apart from this Quarantine, self -isolation is necessary for limiting the exposure of this virus. Quarantine means restricting activities or separating people who are not ill themselves but may have been exposed to COVID-19. Whereas Isolation means separating people who are ill with symptoms of COVID-19 and may be infectious to prevent the spread of the disease. The containment zones have been identified and classified into three zones, these are red zone (at least one case was detected in last 14 days), orange zone (no case reported in last 14 days) and green zone (no case reported in last 28 days) that restrict the movement.

Now after two months complete lockdown, India entered second phase of three phases unlock plan announced by Union Ministry of home affairs. After unlock all services and activities are allowed except hotspot region (contaminated area), usage of Arogya Setu aap is to be focused also. As maximum number of COVID-19 cases are reported in the states of Maharashtra and Tamil Nadu, so they announced their extended lockdown up to 31st July 2020 despite of

country has entered in unlock 2.0. As populous country like India, this lockdown hit hardly on migrant workers, vendors, small shopkeepers, poor people and almost shaken their livelihood.

Section II

How rapidly a virus can spread is estimated by its Reproductive number (Ro or r-zero or R-nought). It is also known as Transmission Rate which measures the average number of people to which a single infected person can transmit the virus. WHO's estimation was for COVID-19 Ro (on Jan. 23) to be between 1.4 and 2.5. Ro of common flu is 1.3 and 2.0 was Ro of SARS (https://www.worldometers.info) .



Source: Obtained from Worldometers.info

All over the world % of death, recovered and active cases are 4.3, 58.2, 37.4 respectively as per wordometer on 14th July, 20. Active cases are highly prominent in North America followed by Africa. Recovery rates are not satisfactory in North America as 1881512 cases are recovered out of 4075594 cases. Percentages of death rate is very low in Oceania, Afrecia and Asia but this rate is pretty high in Europe which is much higher than world death rate. Among 6 continents, recovery rate is high in Asia after Oceania and also in contary percentage of active cases are also low. So we can conclude that upto 14th July, 20 performance of Asia in case of COVID-19 Pandemic is good in comapre to other continents.

Taking global view, We now try to explore the the trend pattern of Case-fatality rate, recovery rate of South-East Asia, more specifically India and most affected states in India.

As per Ministry of Health and Family Welfare (MoHFW), India reported out of 968876 cases, death toll reaches 2.57% and 63.25% of Indian Population is being cured on 16th July. Along with India most affected countries around the world are US, Brazil, Russia, Peru, Chile, Mexico, South Africa, Spain, UK.(Business Report 2020)

S.No	Country	Cases	Deaths
1	USA	3616747	140140
2	Brazil	1970909	75523
3	India	970169	24929
4	Russia	746369	11770
5	Peru	337724	12417
6	Chile	321205	7186
7	Mexico	317635	36906
8	South Africa	311049	4453
9	Spain	304574	28413
10	UK	291911	45053

Source: Business Report 2020

Incubation period means the time for the exposure to the development of symptoms and simultaneously it is very essential to estimate effective days of quarantine.

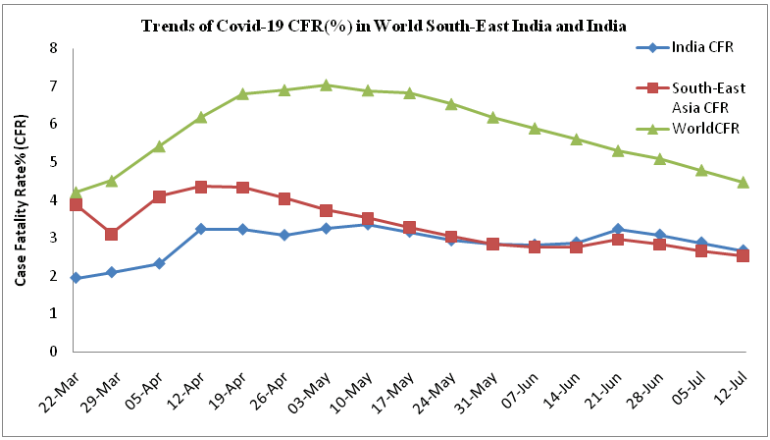
Comparison with other Virus

Virus	Incubation Period
Novel Coronavirus (COVID-19)	2-14 or 0-24 days *
SARS	2-7 days, as long as 10 days
MERS	5 days (range: 2-14)
Swine Flu	1-4 days, as long as 7 days
Seasonal Flu	2 days (1-4 range)

Source: worldometers.info (https://www.worldometers.info/coronavirus/coronavirus-incubation-period/)

At present India occupies third-worst-hit which has a population over four times higher than US has conducted 12412664 tests in total or 8991 tests per 1 million whereas US arranged 132992 tests per 1 million of its population (Business Report 2020). CFR defines as a

ratio of total deaths to total infected/ confirmed cases (Dhillon *et al.*, 2020).



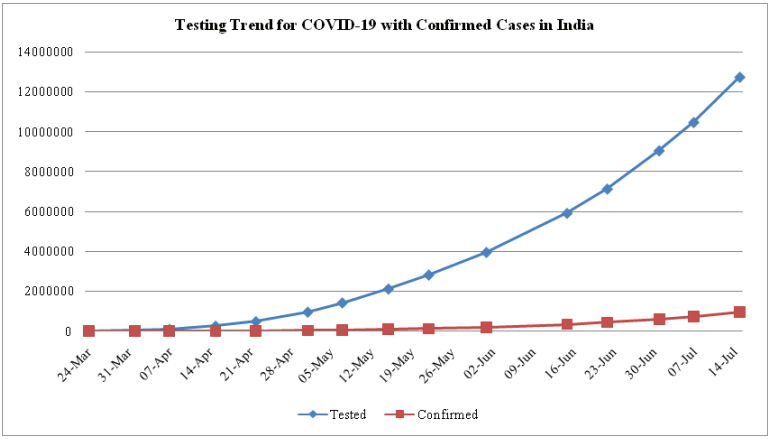
Source: WHO (India Situation Report), CFR is based on Author's own calculation

By considering mild and asymptomatic cases which have less chances of dying, CFR gives low value. (Vincent *et al.*, 2020). Therefore extensive testing and screening process are very important to find out COVID-19 infected symptomatic as well as asymptomatic people. During the outbreak of COVID-19, CFR has been continuously increasing in the most affected countries namely Belgium, Italy, UK, Germany, USA, and Iran. Italy continued to be top upto 14th April, after that 1st have been jointly occupied by Belgium and UK, Iran has successfully flattened its curve in late March, 2020 while bottom position occupied by Germany though it increases constantly at a lower rate. (Dhillon *et al.*).

Apart from affected countries around the world we are now try to figure out trend pattern of CFR in India with comparison of South-East Asia. Until 10th May India has maintained lower position. After that it has been increasing but with lower rate. From 7th June onwards CFR of India is little bit higher than CFR of South-East Asia. World trend suggest that an increase in CFR from 22-March to 31-May 2020 and after that CFR curve flattened till 12-July, 2020.

Section III

As per WHO report dated on 12-July, 2020 "WHO continues to support ICMR in increasing the testing capacity of the country supplementing with 5.4lakh PCR kits. Overall, India has tested 1,15,87,153 samples with test rate of 8,449 tests per million population and test positivity rate (cumulative) of 7.3%, day-wise test positivity is 10.2% of samples tested".

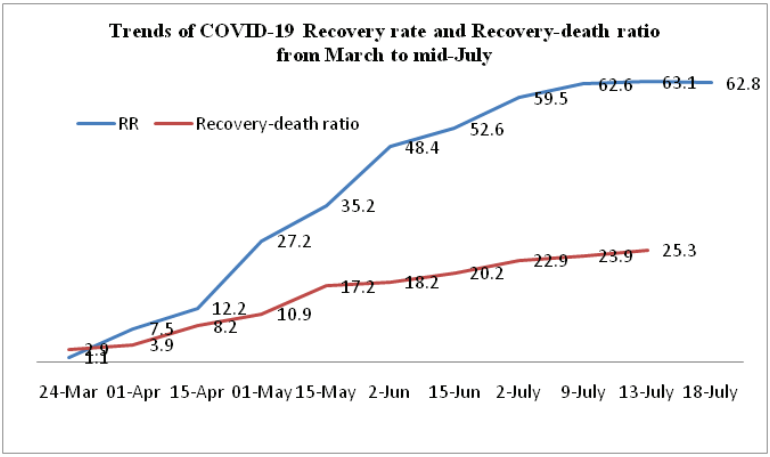


Source: Confirmed Worldometer, Tested https://twitter.com/PTI_News/status/1245308976440340482Press Trust of India

Through 'Test, Trace, Treat' strategy, India has operationalized now more than 1100 COVID testing labs which was just just 1 lab on 23rd January, 52 on 8th March, 160 on 23rd march identified by the Indian Council of Medical Research (ICMR). As on 19th April 2020, total number of the sample tested, India marked at 10th among 63 infected countries (Our World Data). Testing is very much important to understand the extent of Corona virus. Above picture clearly reveals that there is a continuous increase of sample testes in India. Testing status of India for last month (15-June to 15-July,2020) increased to 12739490 from 5921069. In this duration confirmed cases raise from 343070 to 970169.

Numbers of confirmed cases are increasing day by day as there is a continuous increase in sample tested for COVID-19 in India. 24th

March it was only 571 but after 2 month of compete lockdown as India switched in Unlock 2.0 number of confirmed cases increased drastically from 85856 on 15-May to 124760 on 22-May that is in one week after lockdown increased number of confirmed cases are 38,904.

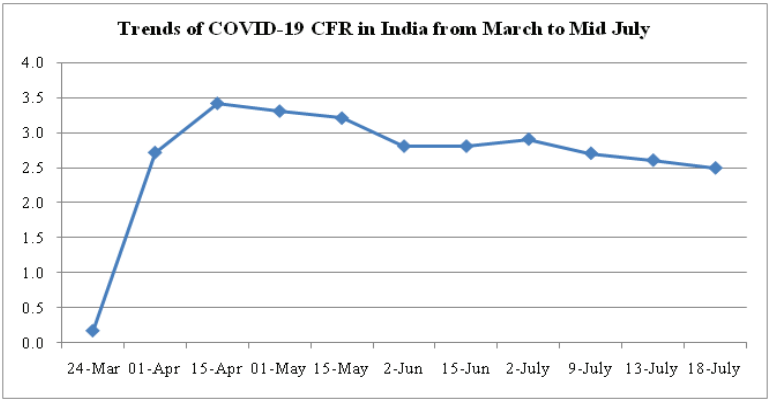


Source: Worldometer, RR based on author's own calculation

The recovery rate (RR) is defined as the ratio of the total number of recovered cases to the total number of confirmed cases (Dhillon *et al.*). Recovery-death ratio is the number of patients recovered per death. It is a good indication of chance of recovery from the disease (Mohanty *et al.*).Recovery rate and Recovery-death ratio are not used in same manner. A study by Mohanty find out that India's recovery rate (28.9) is lower than countries such as Brazil (40.3), Turkey (60.03), Iran (80.23), Canada (44.09), Germany (82.9) on 7th May,20. By author's calculation India's Recovery rate was 28.9% and Recovery-death rate was 8.58% on 7-May 2020.

Trend analysis on Indian data as shown in above figure reveals that RR in India continues to steadily improve. Progress on RR is shown by from 1.1% (24th March'20) to 62.8% (18th July'20) but the rate of increment is not increasing throughout from the beginning of lockdown phase I to Unlock 2.0. From 9th July to 18th July % of RR remains almost same. An increase of 15% Recovery rate is observed

from 15-April, 20 to 1-May,20. In the month of July rate of recovery is more or less remain same. From April to mid-July, Recovery-death ratio has been substantially increasing from 2.9 on 1st April to 25.3 on 18th July, 20. On the other side over time, Recovery-death ratio has shown improvement but in lower pace. It clearly suggest that number of recoveries are rising as per one death is slow which means fatality rates are also increased.

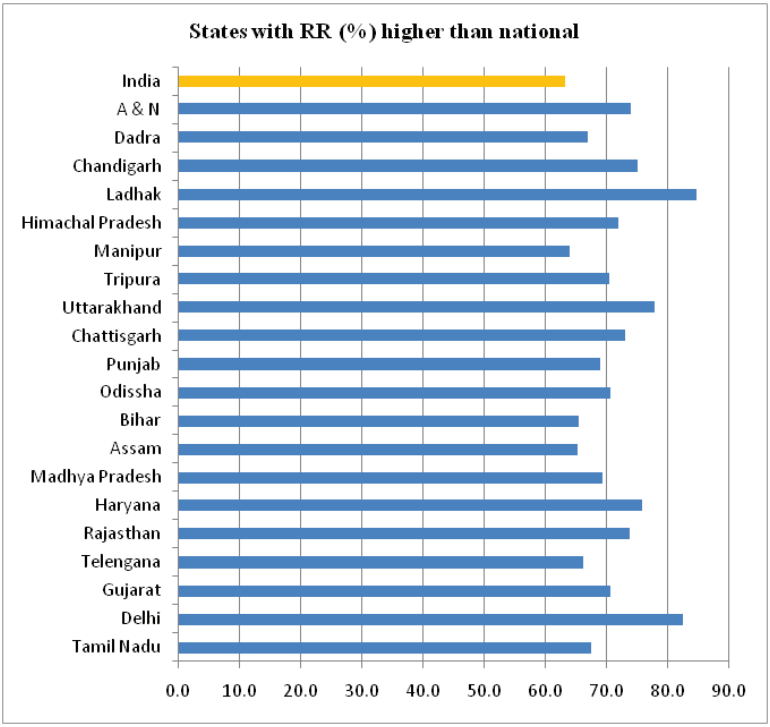


Source: Worldometer, CFR based on author's own calculation

In early stages of this Pandemic, CFR is to be estimated which was around 2% announced by WHO[11]. CFR for SARS and MERS was 10% and 34% respectively. Fatality rate changes as virus change their process of mutation (Worldometer). Unlike other countries, India is able to control the spread of deadly COVID-19 to some extent which is captured by low fatality rate. But case of under-reporting, miss-reporting, less number of test, missing data of co-morbidity are responsible for lower CFR in India. By author's calculation India's CFR was 3.37% on 7-May 2020 (Dhillon *et al.*).

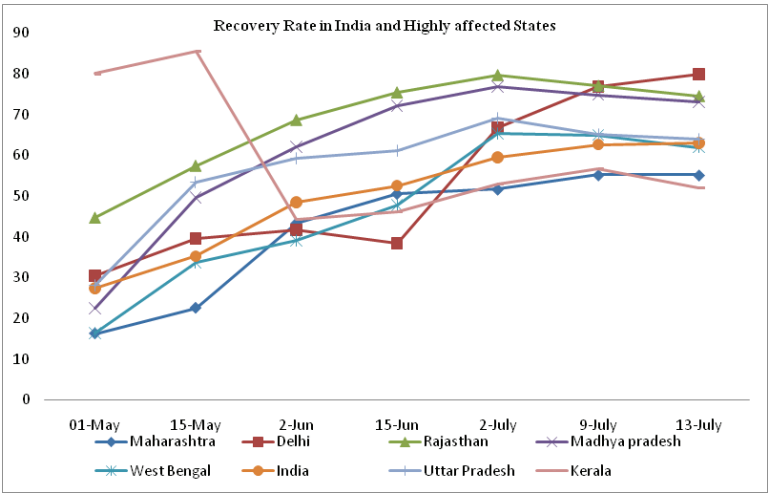
India reported 2.5% of deaths of total 1077864 cases on 18th July. In the span of one week (24th March'20 to 1st April'20) starting period of 1st Lockdown, fatality rate of COVID-19 jumps up from 0.2% to 2.7% as number of confirmed cases rises from 657 to 2545. Highest CFR was on 15th April 3.5%. In July'20 CFR is throughout same or very slightly diminishing.

Report on 16-July,20 National Recovery Rate amongst COVID-19 to 63.2% Which was 60.8% on 5-July. Over a week National RR raises by 2.5%. On 5th July'20 there are 697846 confirmed cases and 424894 are more recovered patients in COVID-19. On 16-July,20 out of 1001464 confirmed cases 633585 are noted as recovery cases. There are 20 State/UTs with a Recovery Rate of more than the National average (63.2%).



Day by day COVID-19 patients are rises. Numbers of active and death cases are dynamically increasing. At the early days of Pandemic Recovery rate of India was just 10-11%. Author points out that RR has a significant negative relation with higher population living in slum, higher population living below poverty line and higher number of middle aged population whereas RR is improved with urbanization, good medical infrastructures like health expenditure,

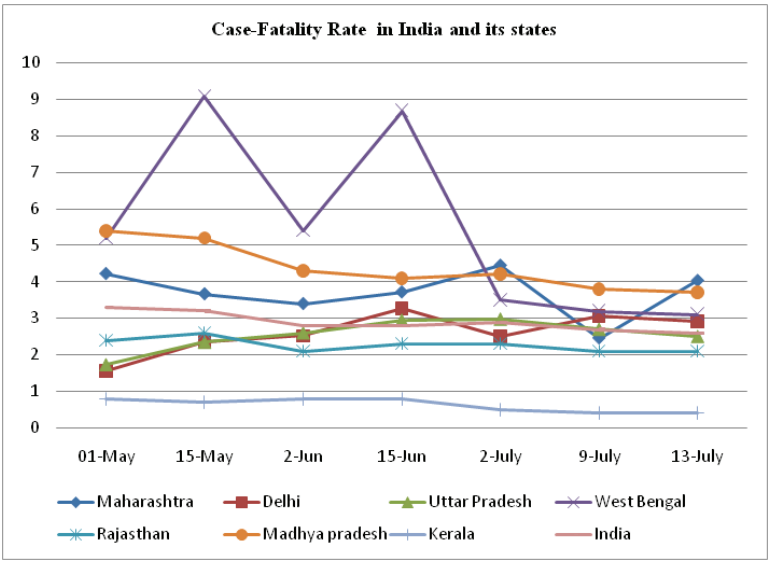
no of health workers available per 10000 population (Chattopadhyay *et al.*).



Source: World meter (https://www.worldmeters.info), RR is based on Author's own calculation

State level variation is vast among major states of India. Among most affected states Recovery rate varies from 64% in Uttar Pradesh to 61.9% in West Bengal, 52% in Kerala, 80% in Delhi on 13th July. But this situation is totally opposite at the beginning phase of Lockdown, 1st May'20 reported Recovery rate 16% in Maharashtra, very high RR in Kerala (80%), 30% in Delhi, 16.4% in West Bengal.

The state of Kerala where epidemic started, reached recovery rate 85% on 15-May but thereafter there is sharp downfall from 85% to 44% on 2-June and then gradually increased up to 9th July and falls afterwards. Among these states overall recovery rate from beginning of lockdown to 13th July is satisfactory in Rajasthan. But in the month of July highest RR is achieved by Delhi and bottom position is now engaged by Kerala, though it marked at top position at Unlock phase I.



Source: World meter (https://www.worldmeters.info), CFR is based on Author's own calculation

From the above figure it is evident that, on 1-May, 2020 India observed CFR 3.3% and 2.6% by 13-July, 2020. Very unfortunate situation arises for West Bengal, Maharashtra and Madhya Pradesh. In these states CFR is very high from national CFR throughout. On 15th May'2020 CFR reaches peak for West Bengal. It flattened till 2-June and again it continued to be top with 8.7%. Over all rates are mostly less or similar with India's CFR for Uttar Pradesh. Kerala has maintained bottom place throughout from the beginning of nation-wise complete lockdown followed by Rajasthan. In the month of July CFR of Kerala starts falling with lower rate. From mid of July'20 States of Delhi showed an increment beyond India's CFR.

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Chapter 6

An Analysis of Determinants of Agricultural Exports of BRICS: A Fixed Effect Panel Approach

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Abstract: This paper seeks to analyse the significance of the determinants of agricultural exportsin BRICS countries using a fixed effect panel data predictive model. Considering a time span of 27 years (1990-2016), the study has taken out three determinants for agri-exports as explanatory variables *viz* tariff, exchange rate and world GDP. The results using fixed effect panel data method shows that all the explanatory variables are statistically highly significant in explaining agricultural exports of BRICS as a group while tariff is insignificant when tested for country-level analysis.

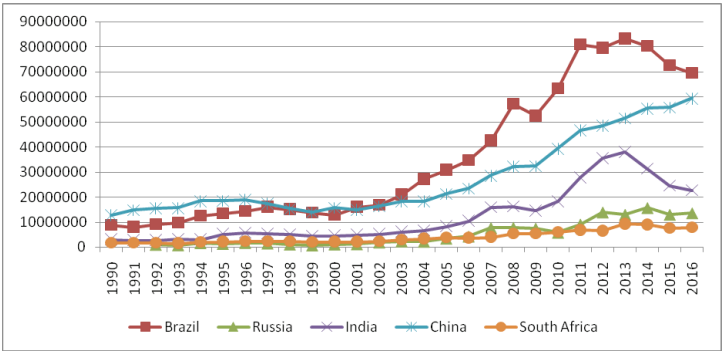
Keywords: Agricultural export, export determinants, fixed effect model, BRICS JEL classification: F14, O13, Q17

Introduction

BRICS is the acronym coined for five major emerging economies – Brazil, Russia, India, China and South Africa. Four out of five members are in the top 10 of the world by population (excluding South Africa, stands at 24th). The BRICS members are known for their significant influence on regional as well as global economic affairs. As of 2018, BRICS have a combined GDP (in terms of PPP of their national currencies) of US$ 40.55 trillion (32% of World's GDP in terms of PPP) and an estimated US$ 4.46 trillion in combined foreign exchange reserves. The BRICS report 2012 supposed that

the higher growth of these economies are due to perhaps India and Brazil's heavy dependence on domestic demand, strong external surplus of China and Russia, and abundant surplus resources of South Africa that are yet to be used.

The BRICS' agriculture sector has been tremendously growing over the years since its formation. It owns almost one third of the world's farmland. According to BRICS Agricultural Report 2017, the gross agricultural product of the five members has kept on increasing and contributes a greater share to the rest of the world. Most of the agricultural commodities like cereal, sugar, fruit and vegetables, meat, milk, oilseeds etc. are traded by BRICS and followed a trend of rapid growth. Widespread economic globalisation and integration further stimulated agricultural trade to a great extent. With some remarkable features like heavy domestic demand, abundant surplus resources, strong external surplus etc., BRICS countries are gaining significant importance in global agricultural trade. However, there are some pivotal determinants of trade that force the sector to expand. These are marked as tariff, GDP per capita, share of agriculture to total GDP, exchange rate, foreign exchange reserves etc. A static panel regression analysis has been done for 27 time periods (1990-2016) to examine whether these factors are statistically significant to explain the growth of trade affairs of BRICS with respect to the rest of the world and a time series linear regression analysis is done for each country separately to examine the same at country level.



Source: FAOSTAT

Figure 1: Value of agricultural exports in BRICS (US$ million)

Literature Review

BRICS bloc is comprised of diversified economic set-up that exhibits a mixture of both agri-based and industry-based club of regions. They are totally different countries with different histories, political and economic systems, needs, opportunities and futures. BRICS countries are endowed with rich agricultural resources with a large agricultural population. According to BRICS Innovation Competitiveness Report 2017, all the five countries are in the list of top 10 in agricultural production index. But still they are lagging behind in the aspects of R&D, modern infrastructure, quality of education etc. Mishra *et al.* (2015) investigated India-BRICS trade flows using a gravity model during 1990-2010 and found that a positive relation exists between per capita GNP of the nation and its trade volume. Kundu (2015)concentrated on the bilateral trade balance of Bangladesh with BRICS through a static panel gravity data analysis during 1991-2013 and found significant effects of all of the factors (relative GDP, relative GNI per capita, real exchange rate, import weighted distance) on the concerned bilateral trade balance. Nayyer Rahman (2016) investigated the role of the World Trade Organisation (WTO) in promoting the merchandise trade of BRICS during 1995-2014 using a gravity model, concluding that the WTO accession positively impacted on enhancing trade flows in BRICS economies. Rasoulinezhad and Jabalameli (2018a) examined the trade integration patterns for BRICS members using the 2014-UN Regional Groups and the gravity-panel data over the period of 2001-2015. The results found a dissimilar integration trade patterns in manufactured products and raw materials, among the BRICS members, particularly Russia. Rasoulinezhad and Jabalameli (2018b) also analysed and compared the similarities in foreign trade patterns of BRICS and other five United Nations regional groups from 2001-2015 using fixed effect, random effect and fully modified ordinary least squares (FMOLS) based on gravity model of international trade. They found that Russia has a dissimilar trade pattern and the other members follow the Linder hypothesis. Maryam & Mittal (2019)

examined the trade flows between India and BRICS using three different sets of methodologies *viz* bilateral revealed comparative advantage index (BRCA), trade complementarity index (TCI) and gravity modelling for period 2001-2015 and concluded that India holds a comparative advantage predominantly in agricultural and allied products followed by manufacturing and man-made products.

There are numerous literatures found studying overall trade integration pattern on BRICS but no such literature is found on agri-trade in particular. Therefore our attempt is to fill this gap by examining the effect of some determinants of agri-trade.

Research Methodology

An empirical analysis can be developed using different types of data, namely, time-series, cross-sectional and panel or longitudinal data. The present study is based on panel data which is a combination of both time-series and cross-sectional data. In words, it can be defined as data that is derived from a number of observations over time on a number of cross-sectional units like individuals, firms, households, countries etc. When all individuals are observed in all time periods, it is called a balanced panel and when all individuals are not observed in all time periods then it is called an unbalanced panel. Panel data analysis is considered to be superior to both time-series and cross-sectional while estimating a model.

Symbolically, panel data variables are represented by subscript *it*, where subscript *t* represents time-series variables and subscript *i* represents cross-sectional variables. Thus, using the symbolic representations, the proposed model for this research can be defined as

$$Y_{it} = \alpha + \sum_{j=1}^{k} \beta X_{it} + e_{it}, \quad i = 1, 2, \ldots, n; \quad t = 1, 2, \ldots, T \quad \ldots (1)$$

Where Y denotes dependent variable, X denotes the independent or explanatory variables, *t* denotes time-series dimension, *i* is the cross-sectional dimension and e is a random error term. Thus equation (1) follows a panel data framework.

Panel Data Models

Panel data models are divided into static panel data models and dynamic panel data models. The significant difference between the two is that the latter describes the case where a lag of dependent variable is used as regressor. This particular study centres on static panel data models. A typical static panel data model can be expressed as:

$$Y_{it} = \alpha + \sum_{j=1}^{k} \beta X_{it} + e_{it}$$

where, j= 1, 2,…., k (regressors); *i* = 1, 2,…., n (cross-sectional units); *t* = 1, 2,…., T (time-series units); Y is the dependent variable, X denotes the independent or explanatory variables, subscripts *t*and *i* denote time-series dimension and cross-sectional dimension respectively, and e_{it} is the composite random error term of the model. This e*it* may have two specific effects, namely, individual specific effect and time specific effect. This can be expressed as:

$$e_{it} = \mu_i + \nu_{it} \text{ (individual-specific)} \quad \ldots.(2)$$

$$e_{it} = \lambda_t + \nu_{it} \quad \text{(time-specific)} \quad \ldots.(3)$$

If only one set of specific effects is addressed and analysed in the regression, it is called one-way error component model (equation 2 and 3) and if both (individual and time) specific effects are addressed then it is called two-way error component model. Equation (4) can be termed as two-way error component model where μ_i and λ_t represent the unobserved individual and time-specific effects respectively:

$$e_{it} = \mu_i + \lambda_t + \nu_{it} \quad \ldots. (4)$$

Static panel data models are estimated by mainly two methods *viz.* fixed effects and random effects provided that their respective assumptions satisfy sufficient requirements of the estimates of the model. In our study, both the fixed-effects and random-effects regressions were run and then Hausman test is used to test the random-effects model against the fixed-effects model. Hausman test statistics show that fixed effects model fits this particular study.

Fixed effects model

The fixed effects model represents the observed quantities in terms of explanatory variables and or non-random quantities. It assumes that the parameters are fixed and can be estimated. These models also control for time-invariant variables with time-invariant effects.

Model specification

In this research, a panel data predictive model is used. Multiple linear regression models are employed using agricultural exports as dependent variables and tariff, exchange rate and world GDPas the independent or explanatory variables:

$$\ln EX_{it} = \beta_0 + \beta_1 \ln ER_{it} + \beta_2 \ln WT_{it} + \beta_3 \ln WGDP_{it} + \mu_i + \nu_{it} \quad ... (5)$$

Where,

EX= agricultural exports

ER = PPP adjusted exchange rate

WT = average tariff rate of partner countries

WGDP = world GDP

β_i and γ_i = unknown parameters to be estimated

μ_i = cross-country fixed effect

ν_{it} = idiosyncratic error term

Data Analysis and Results Discussion

The value of agricultural export data for this study is collected from FAOSTAT database along with all other explanatory variables from World Bank databank. To examine the effect of agri-export determinants among BRICS countries, we regressed agri-exports on tariff, exchange rate and world GDP. Simple average of tariff rate of each country's export partners is considered as partner country tariff rate while world GDP is calculated by subtracting respective country's GDP to get rid of the problem of multicollinearity, e.g, for Brazil, WGDP is calculated by subtracting Brazil's GDP from world GDP and so on.

Table 1: Description of variables used

Variable name	Unit	Source
Agricultural export (EX)	US$ million	FAOSTAT
Partner country tariff (PT)	Applied, weighted mean, primary products	WDI (World Bank databank)
PPP adjusted exchange rate (ER)	Price level ratio of PPP conversion factor to market exchange rate (%)	WDI (World Bank databank)
World GDP (WGDP)	Constant 2010 US$	WDI (World Bank databank)

This section presents the empirical results of our model with the objective to assess the impact of some world development indicators *viz,* partner country tariff rate, world GDP and PPP adjusted exchange rate, on variables on agricultural. Estimates are computed using the fixed effect static panel data model after justifying the basic assumptions of fixed effect model.

Table 2 summarizes the statistics of all the variables used for agri-exports and table 2 describes the summary of the model computed using fixed effects static panel model. The panel regression model for agri-exports is thus fitted as:

$$\ln EX_{it} = - 27.865 - 0.218 \ln WT_{it} + 0.61 \ln ER_{it} + 2.565 \ln WGDP_{it} + \mu_i \quad (7)$$

where μ_i represents the countries' fixed effects.

Table 2: Descriptive Statistics of Variables (data in logarithms)

	Agri-Exports value	World average tariff	World GDP	Exchange rate
Mean	6.955804	0.650311	13.72163	-0.395145
Median	6.985585	0.711807	13.72114	-0.376751
Maximum	7.920121	1.426945	13.88835	-0.056011
Minimum	5.757541	0.088136	13.56541	-0.669586
Std. Dev.	0.524859	0.294420	0.094813	0.148455
Skewness	-0.138448	-0.145846	-0.045586	-0.036350
Kurtosis	2.217681	2.471883	1.735627	1.985020
Jarque-Bera	3.816517	2.017122	8.905192	5.738228
Probability of J-B	0.148339	0.364744	0.011648	0.056749
Observations	133	133	133	133

Table 3 provides the fixed effect (within) estimates of a (unbalanced) panel of five cross-sections (BRICS) and 27 time periods (1990-2016). It is evident from table 3 that, all the explanatory variables have their expected signs and are statistically significant at 1% level. Positive and significant ER implies that increase (decrease) in exchange rate leads to depreciation (appreciation) of domestic currency which ultimately increase (decrease) the value of agricultural exports. Similarly, positively significant WGDP implies that as world GDP increases (decreases), the value of agricultural exports goes on increasing (decreasing). Accordingly, negatively significant tariff rate implies that, a low level of tariff is beneficial for agricultural exports from the region and vice-versa. This implies that for BRICS as a bloc, tariff rate, exchange rate and world GDP significantly impact agricultural exports from the region.

To assess the impact of tariff rate, exchange rate and world GDP on agricultural exports on a disaggregate level we have done country-level regression analysis. The cross-sectional estimates (table 4) of the analysis show that except partner country tariff (TF), exchange rate (ER) and world GDP (WGDP) are statistically significant (at 1% level) in explaining agricultural exports of each of the five countries. Only in case of China, WGDP is insignificant and tariff shows a positive relationship with agricultural exports contradicting its theoretical base. This might be due to heavy demand for agricultural products from the rest of the world.

Table 3: Fixed effects panel estimation results

Dependent variable: EX			R-squarred:	
Method: Fixed-effects (within) regression			Within: 0.8817	
Cross-sections included: 5; Periods included: 27 (1990-2016)			between: 0.1229	
			Overall: 0.2488	
Total panel (unbalanced) observations: 133			Prob> F : 0.000	
Variable	**Coefficient**	**Standard error**	**t-statistic**	**p-value**
Constant	-27.86572	2.433464	-11.45	0.000
ln WT	-0.2182621	0.690639	-3.16	0.002
lnER	0.6103741	0.1239512	4.92	0.000
ln WGDP	2.565632	0.1749474	14.67	0.000

Hausman test of H_0: Random Effects versus H_1: Fixed Effects; $\chi^2(3) = 12.53$; prob > $\chi^2 = 0.0058$

Table 4: Cross-sectional estimates of the explanatory variables

	C	lnWT	ln ER	ln WGDP	Obs	R-sq	Prob>F
Brazil	-32.533	-0.061	0.548***	2.292***	27	0.9767	0.0000
	(2.536)	(.056)	(.102)	(.183)			
Russia	-49.709	-0.041	1.249***	4.128***	25	0.9594	0.0000
	(7.433)	(.222)	(.271)	(.537)			
India	-34.935	-0.093	1.598***	3.124***	27	0.9417	0.0000
	(5.535)	(.215)	(.563)	(.402)			
China	-0.853	0.168	1.634***	0.640	27	0.9225	0.0000
	(4.717)	(.105)	(.255)	(.335)			
South Africa	-23.752	-0.108	0.451***	2.219***	27	0.9521	0.0000
	(2.813)	(.083)	(.2.813)	(.204)			

Notes: Corresponding standard errors are given in parenthesis

*** implies significant at 1% level.

Conclusion

This study investigates the effect of trade indicators on agricultural exports of BRICS nations using fixed effects model over a period of 27 years. The variables considered for this study are agri-exports of each of BRICS nations, partner country tariff, PPP adjusted exchange rate and World GDP. Results show that all the explanatory variables are effective in determining agricultural exports from BRICS to the rest of the world. From the coefficients, ER shows higher impact on agri-exports. However, for each of the countries, simple regression results show that ER and WGDP are statistically significant (at 1% level) in explaining respective country's agricultural exports, except partner country tariff. It simply implies that import tariff of partner countries do not affect agri-exports of these countries. Again, WGDP is not significant in explaining agri-exports of China. To conclude, exchange rate appreciation and GDP growth of rest of the world are substantial to escalate agri-exports from BRICS. Partner country tariff on imports has also significant impact in determining agri-exports of BRICS as a blocbut insignificant at country level.

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Chapter 7

COVID-19 Pandemic Crisis on Migrant Labours: A Geographical Study in Sitai Block, Coochbehar District, West Bengal

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Abstract: Out-migration is a major problem in West Bengal as well as in Coochbehar. Due to less availability of working opportunities, the village peoples have to migrate other regions as a migrant's worker for searching work. Sitai block where agrarian social low-income economy dominates, out-migration is an inevitable fact. In the study region, the literacy rate, livelihood status, economic empowerment is very low. But due to this pandemic, their economic livelihood status was damaged significantly as the whole country was lock-down in an unprecedented way. The study explains about out-migration pattern, the impact of a Covid-19 on migrant workers, the lockdown scenario, and the unspeakable harsh situation of the migrant's laborer during the lockdown. But, in this article; the authors try to describe the impact of COVID-19 and their discrete problems during the COVID-19 lock-down. The Governmental initiative and its impact on migrant workers' livelihoods also have been discussed. Data has been collected from various sources. Census data, International and National institutions' available data on the internet as well as primary survey, 2021 data has been used. The data is presented by various cartograms, tables, by using statistics to create a more meaningful study. The system which is running from very priorly, i.e. agrarian social system damaging the rural economy and also impacting the cultivators as well as villagers life very harshly. Implementations of governmental schemes and their failure indicate that the system (Governmental initiatives) does not work properly at grassroots levels. The small entrepreneurship industries, agro-based industries should be promoted primly to maintain and stable the condition of the migrant workers' livelihood as well as villagers' livelihoods in Sitai Block.

Keywords: Lock-down, out-migrants, migrant worker, COVID-19, recession.

Introduction

In the late of 20th century and 1st two decade of the 21st century, globalization, urbanization, and environmental changes are important characteristics of globe. As a result of the prior facts, communicable syndrome outbreaks and epidemics have become global threats necessitating a coordinated response (Enton Pak *et. al*). The Corona virus (COVID-19) is a result of SARS-CoV-2 virus, which is a highly infectious disease (WHO). The WHO (World Health Organization) "On 31 December 2019, was alerted and learned about instances of pneumonia of unknown etiology in Wuhan City, China," according to the website. Chinese officials detected and accepted a novel corona virus as the source, and it was given the temporary designation "2019-nCoV'' on January 7, 2020. The Corona viruses (CoV) are a large group of viruses. The symptoms of corona viruses are ranging from the common cold to more serious illnesses. It is a strain of virus that hasn't been seen before formerly known in the past to individuals (WHO). On February 11, the World Health Organization (WHO) stated that the new corona virus disease will be named as COVID-19. India's first new corona virus patient was reported in Thrissur district from Kerala on January 30, 2020. The patient was studying in Wuhan University in China. At the same time, more than 7500 cases documented in 20 countries around the world (Business Standard, 2021). COVID-19 has becoming a global pandemic and public health disaster with significant impact on the world economic and financial markets. Disruptions in the transportation, service and manufacturing industries, reduced income, increased unemployment are among the worst affected phenomena of the global implications of the corona virus. Despite the enormous number of deaths across continents, most governments overestimated the risks of rapid COVID-19 spread. Many governments have implemented mitigation measures, even though it is a difficult subject. The Corona virus epidemics are unlikely to go away anytime soon and for this, pro-active worldwide steps are needed to save lives as well as defend economic development (Enton Pak *et. al*). The enormous amount

of predictions and research on the corona virus has been done but the proper mitigation strategies to counter the covid-19 has failed (Enton Pak *et. al*). As a matter of fact, enormous amount of deaths and economic loss had to suffer globally. The Impact of COVID-19 affected globally as well as micro-regions.

India's Response

Prime Minister Narendra Modi of India instituted a 21-day mandatory lockdown beginning March 24, 2020, and encouraged Indians to practice social segregation and hand hygiene by washing their hands frequently (Business Standard, 2021). Prime Minister Narendra Modi acknowledged it wasn't a curfew, but given the circumstances, it was close to one. As a result of the announcement, on March 25, a mass migrant movement began (Business Standard, 2021). Because of the spread of the corona virus, all types of transportation networks had to disarm, worsening the situation across the country. The entire country witnessed a large-scale migration of the urban poor as they sought refuge in rural areas. As the situation worsened, a series of lockdowns were implemented across India (Business Standard, 2021). The current concern is not only for human well-being but also for the global economy, which is obviously collapsing. According to the World Bank's Global Economic Prospects for 2020, the economic fluctuations in developing and rising countries will likely be more persistent and severe. The prospects also make an analysis on weaker healthcare system, fragile industrial and economic policy as well as political instability in the different parts of the globe. Many economists refer to this as a black swan occurrence because it is both a health and an economic and humanitarian problem. Because of its infectious nature, practically every country preferred a lockdown to prevent it from spreading. With the prevailing situations, India declared a one-day "Janata Curfew" on March 22, 2020. News outlet, The Hindu stated on March 23, 2020 that India was put on absolute lockdown for 21 days, which was then prolonged to an additional 19 days, and then it was stretched further with slight relaxations based on the

current scenario around the country. Many exemptions are granted to continue economic activity after June 1, 2020; although, some states sealed their borders based on the severity of the health crisis in that state. Except for a few select categories, all the economic activities remained closed, but an extraordinary loss has already happened, and the economy has been severely rocked (Ranjan Aneja and Vaishali Ahuja, 2020).

Background

In the scenario when India was facing macro-economic issues, Dev and Dasgupta stated that, " In 2019 India's GDP growth rates were 4.7 percent which was the lowest since 2013 (as indicated by official statistics) in pre-covid era including high unemployment rate, a decline in core sector industrial output-the worst in 14 years, stagnancy in private sector investment, and a decline in consumption expenditure for the first time in seven years". India has the largest informal sector of the globe and in this sector, 90% of the working population engaged which accelerated the overall GDP growth of the country (more than 45 percent). Due to demonetization in 2016 and GST in 2017, the country has already been rocked by two big shocks (or changes). Even developed and most industrialized countries like the United States, Europeans countries specially Italy, France and the United Kingdom have not adequately prepared to deal with this pandemic. The COVID-19 pandemic had a devastating impact on both developed and developing countries in all the aspects of country's sustainability. According to the World Economic Situation and Prospects as of mid-2021, this global crisis has significantly increases the poverty and inequality around countries and it is anticipated to "leave long-lasting scars on labor markets while reversing advances on poverty and income disparity in many economies." The prior situation could be applied to India and the situations become worsened and complicated. In accordance with the prevailing situation of the world, The link between migration and health has been discovered to be multifaceted and bidirectional. An individual's health situation as well as surrounding situations may influence their desire to

migrate, yet such relocation may have an impact on their health very harshly (Ginsburg et al., 2018). The COVID-19 epidemic in India is anticipated to spread due to the country's urban-rural population structure and the dynamic component of migration. The pandemic-induced economic crisis wreaked havoc across India, affecting every state and union territory.In this situations, an accounts on corona cases of West Bengal are listed in the below table.

Table 1: Corona cases in West Bengal.

Vaccine Source: 103,553,157	
• Samples Tested	21,391,872
• Recovery rate	98.14%
• Recovered	1,638,485
• Mortality Rate	1.21%
• Deceased	19764
• Active cases	10,710
• Positive percentage	7.66%
• Positive cases	1,638,485
• Per million population	14,609

Source: Health and Family Welfare Department as of 31 December 2021.

Table 2: COVID-19 pandemic situation in the districts.

COVID-19 pandemic in West Bengal by the district.			
District	Total cases	Recoveries	Deaths
Total	15,34,360	15,05,808	18,240
Cooch Behar	27,874	27,229	95

Source: Coochbehar.nic.in as s of 2021-08-09.

The table 1and 2 indicates the serious damages done by this pandemic where 19764 people died. Besides this, the fear of the corona will not go immediately. In a district where so many people died, the impact of Covid-19 would be affected everywhere even for a small region like Block. As of 7/1/2022, no covid-19 patients have been reported (http://coochbehar.nic.in). Being fully a village area with rural area: 151.25 sq. km, urban area: 0.00 sq. km. and with 96, 335 populations, it is worthy to study the region in the dark effect of the pandemic.

Who are the Migrants?

According to the International Labour Organization (ILO), a "migrant worker" is defined as if a person who regularly a migrates from one country to another (or has migrated from one country to another) with the intention of being employed other than on his account admitted as a migrant. During the COVID-19 outbreak, Indian migrant workers encountered numerous challenges and had to exprienced pathetic and harsh situation. In this catastrophic pandemic crisis, companies and workplaces were forced to close due to the country's lockdown, leaving millions of migrant workers without jobs, food shortages, and uncertainty about their future (Slater, Joanna; Masih, Niha, 28 March 2020). Thousands of the migrants workers went hungry during the event of pathetic pandemic migration. Even by bicycle, peddles crossed thousand miles irrespective of gender and health problem. The masses of people were started migrate to reach their home and stay with their families. Hence, the Great individuals, welfare organizations as well as federal and state government started to monitor and maintain the situation (Sengupta, 2020). Majority of the migrant workers engaged in the manufacturing and construction industries and worked as a daily wage labourer. Because many of them work in the informal sector, they are frequently denied proper healthcare, nutrition, housing, and sanitation by the authorities (Jha, Mohammad, 2020). They are generally from rural areas, however, they reside in cities for most of the year due to jobs. Many of them had no savings and were forced to stay in factory dorms owing to the lock-down. Even though the Inter-State Migrant Workmen Act of 1979 existed, there was no central registry for migrant laborers (Srivastava, Roli; Nagaraj, Anuradha, 2020). During the lockdown, 198 migrant laborers perished as a result of traffic accidents (Sharma, 2020). The table below depicts the population distribution in Coochbehar District by gender for various groups of workers and non-workers. The table 4 indicates how different occupational groups impact the region significantly. Among the occupational group, 95,078 people did not identify themselves as above mentioned any other group.

Table 4: Applicants on the Live-Register of Employment Exchanges for 5 years (2008 to 2012) in Cooch Behar by Main Occupational Group.

Occupational Group				*(all in numbers)*	
Year	2008	2009	2010	2011	2012
• Industrial Supervisory	2,398	2,489	2,593	2,698	2,806
• Unskilled	35,938	36,079	37,003	37,966	38,940
• Domestic	785	978	1,044	1,290	1,484
• Educational	5,720	6,047	6,316	6,618	6,930
• Clerical	55,422	55,242	56,132	57,068	58,012
• Skilled & Semi-skilled	2,302	26,624	27,017	27,445	27,882
• Others	90,592	91,706	92,782	93,888	95,078
• All Groups :	2,17,157	2,19,165	2,22,887	2,26,933	2,31,132

Source: Employment Exchange of Cooch Behar, 2015.

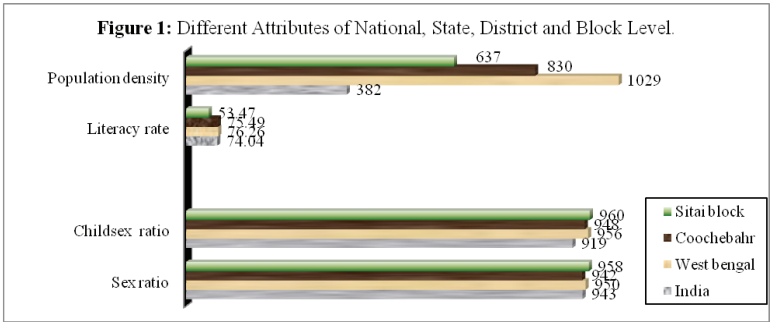
This could not be identified because these people might belong any group which might be a floating population, migrants labor or simply they are just normal people. As the other group belongs to the maximum number of people, there should be a large number of migrant labor hiding inside the group. Point to be admitted that this data from 2012 might be fluctuating with the maximum anomaly. The hiding number of migrant labor may increase or decreased from this group.

Location of the Study Area

The location of the study area i.e. lies in Cooch Behar District located between 25°57’47” & 26°36’20” North Latitude; between 88°47’44” & 89°54’35” East Longitude. The District Headquarters lies between 26°19’86’’N Latitude and 89°23’53”E Longitude. Sitai block is located in the adjacent border area of Bangladesh with coordinates 26.060556N 89.318333E. It is one of the 12 Blocks of Coochbehar district and it has 5 Gram Panchayats as well as 53 villages with a total Population of 1,10,333 (Census, 2011). The figure 1 shows different attributes of sitai block. To understand the grassroots problems of the study area, one should be understood about the existing status of the area. In the case of Population density, the Sitai block exists above the national level with 637/ sq2 km but below State and district level. The literacy rate is lower than national,

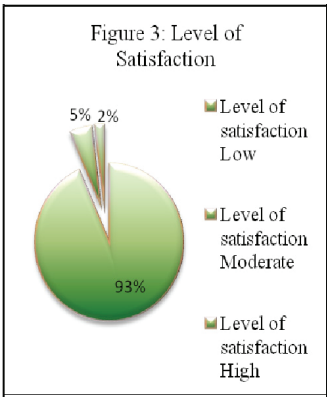
state, and district levels. But it is noticeable that the child sex ratio is highest with 960 girls per 100 boys in the study area than national, state, and district levels. With 958 females per 1000 males, the sex ratio is now higher than at the national, state, and district levels. However, according to the latest National Family Health Survey (NFHS 2019-2021) India has 1,020 females every 1,000 males, it is to be concerned about the fact that the region's literacy rate is the lowest.

Figure 1: Different Attributes of National, State, District and Block Level.

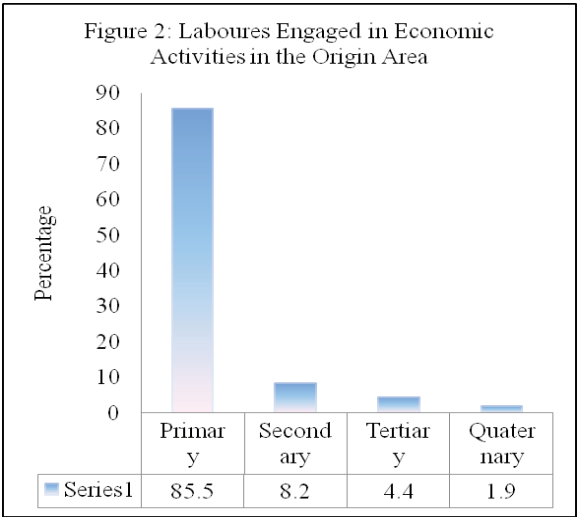


Source: Primary Data, 2021.

As a result of this aspect, higher-education candidates may be hard to come by in this area. There is a possibility that the region's low literacy rate is true. It is owing to a predominantly agrarian economy, in which children are required to labor to reduce production costs, or because the study region is near to a border area, in which infrastructural development determines the study area's development. The federal government ignores the infrastructural development near the border area due to strategic interest of the nation. The core view of this plan is for countering the neighboring country during battle time where acces to the transport network would have been hampered the enemies, the study region i.e Sitai block also not exceptional on this account. This



orthodox strategic viewpoint ignores the developmental strategy near the adjacent border area. But the present federal government by the central institution like BRO (Border Road Organization) changing the orthodoxy viewpoint with their developmental as well as strategic improvement.



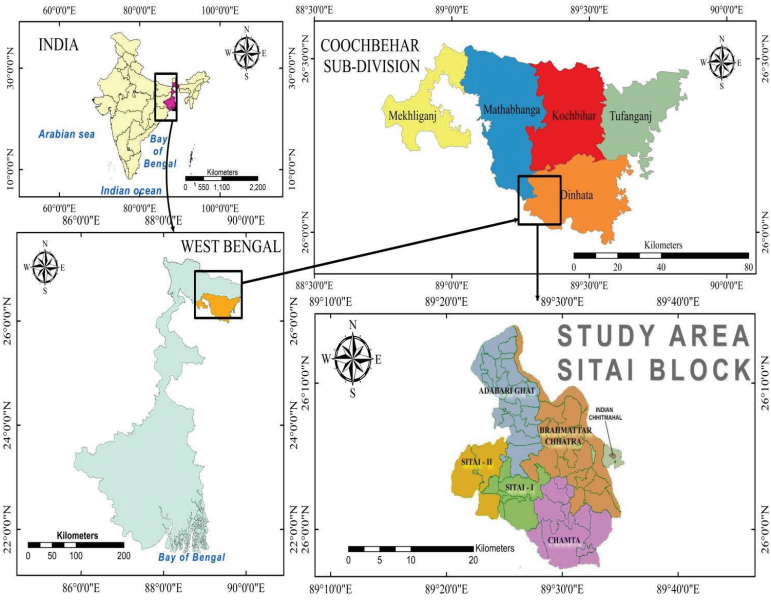
Source: primary Data, 2021.

As a result, persons in the research region are becoming increasingly vulnerable, resulting in an increase in labor out-migration. This vulnerable population of rural laborers can also be seen in West Bengal's Coochbehar region. Every year, a huge number of rural laborers from Cooch Behar district travel to different states in India in quest of work, including Rajasthan, Haryana, Delhi, Maharashtra, Tamilnadu, Bihar, and Arunachal Pradesh, as well as other West Bengal districts (Sarkar, 2012). Land lords' monopolistic power, low and uncertain wages, the seasonal nature of agriculture and lack of employment opportunities, rising commodity prices, and rising demands have all combined to break the backs of these vulnerable people in the district as well as in Sitai Block.

The figure shows (Fig. 2) shows that the majority i.e. 85.5 % people engage in primary activities (85%), the secondary (8.2%),

tertiary (4.4%), and quaternary (1.9%) activities consecutively. Based on their economic activities, satisfaction level has been drawn which shows in figure 3. On behaving of the level of satisfaction, the low satisfaction level is highest (93%), and then moderate (5%) and high satisfaction level (2%). However, emigration is larger in the inadequately developed farming region and predominantly found among the landless farmers (Parganiha *et al*. 2009; Keshri and Bhagat, 2012; Panda, 2016). Thus, labor migration is still largely a survival or a subsistence strategy of rural West Bengal.

Location of the Study Area (Sitai Block).



Source: NATMO

Objectives of the Study

- To identify the present status of migrant workers.
- To execute the reason behind their out-migration.
- To find out their problem and recommended suggestions to improve the livelihood of the migrant worker.

Hypothesis of the Study

- ❖ Agrarian social system triggering out-migration motives.
- ❖ Governmental schemes and policies impact migrant worker's life partially.

Methodology

Based on the literature review, a questionnaire schedule has been prepared. For collecting sample data, the researchers have visited door-to-door surveys i.e. household surveys. Based on Snowball sampling data has been collected. Total 100 household surveys were done by the researchers in 5 gram panchayat areas and among 53 villages. In a summary, the Total population of the study area is 520 and the sample size is 159, hence, N= 159. The survey was conducted from 24th September to 28 October, 2021. The Discussion will continue collaboration with international as well as the national scenario. For the collaborative discussion, data will be collected from the primary survey, Census data, various national/ international institutional websites as well as the internet. For proving the first hypothesis, the Chi-Square test has been done. Due to the unavailability of data of Sitai block, further discussion would be more likely to continue based on the availability of District data. For proving the hypothesis, parametric test like a t-test will be done.

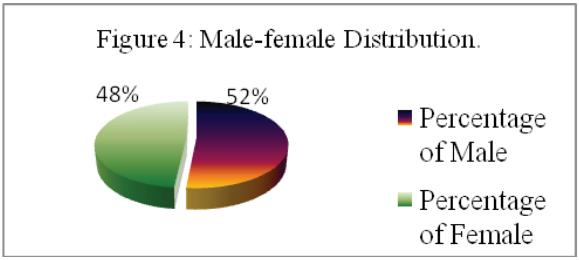
Demographic Characteristics of the Study Area

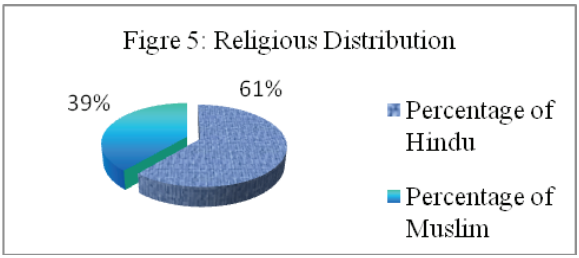
Four essential features of human migration have been hypothesized by social scientists, These are

- The structural forces that encourage 'out-migration;'
- The structural forces that attract 'in-migrants;'
- The motivations, goals, and aspirations of people who respond to these structural forces; and
- The social and economic structures that emerge to connect areas of out-and in-migration (D.S. Massey, 2001).

Demographic characteristics should be discussed to understand the true reasons for outmigration. The demographic characteristics of

the Sitai Block are explained in the tables and figures below. There is a total of 520 Peoples in 100 households with 159 samples related to the out-migrant worker. Among 520 people, 48% were male and 52% female. 4% sex gap indicates the deficiency of women in the study area. As out-migrants are majority men and had to back their home, the number of males increased in the study area. Among the total population of the study area, 61% population celebrate Hinduism and 39% population belongs to the Muslim religion. Figure 4 and 5 shows male-female and religious distribution of the study area.

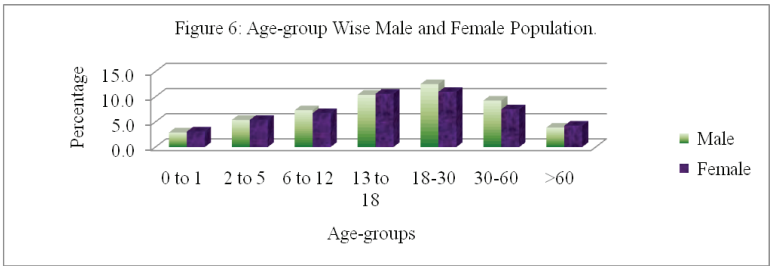




Source: Primary Data, 2021.

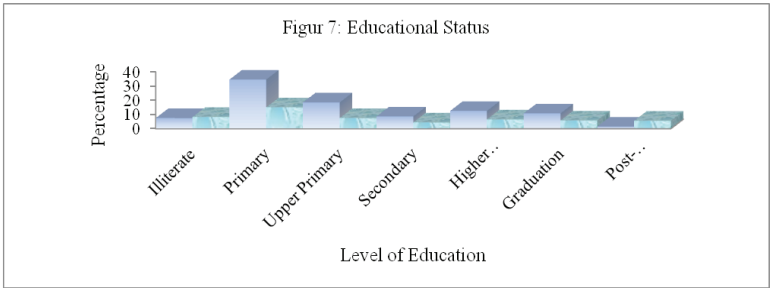
Figure 6, Depicting the age-group of males and females in the study area. It reveals that the age- group of 18 to 30 are amongst the highest where the male percentage is more than females with 12.55% and 11% of the total population. In this group, the overall female percentage is higher within the female age group which is the same as the male age group also. In the second position, 13 to 18 years of age group population where female is more than male with 10.45 and 10.% respectively. In 30 to 60 years of age-group populations female population is more than women. 2 to 5 years of age-group populations

where male and females are with the same percentage with 5% respectively. Between 0 to one and > 60 age group populations, aged populations are more than infant populations. In the aged group population, females are more than males; it means females live more than males. Between 0 to 1 year age group population, the girl child is more than boy child population. This whole diagram explains that 18 to 30 years of the age-group population is highest and being in a working group population, they also migrate more as out-migrants laborer due to unavailability of work in local area.: 7 will explain the educational status of the study region.



Source: Primary Data, 2021.

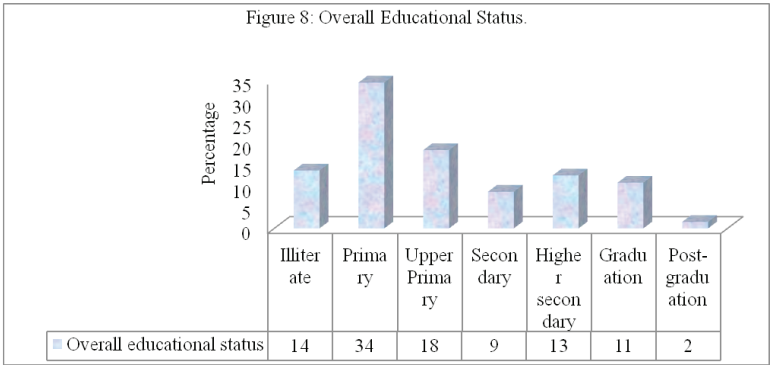
Figure 7 reveals that the maximum population highest attended class in primary where male and female percentages are highest. In this section male population highest than female with 34% and 15% respectively. Next, in upper primary 18% and 8% people attended. In higher secondary males attended more than female with 13 % and 7% respectively.



Source: Primary Data, 2021.

There are significant characteristics between illiterate and post-graduation population wherein illiterate group females and the male population is same standards with both group 8% but in post-graduation, females are than males with 2% and 6% respectively. This is because of present trends which say that girls also need education and for that reason family's males sacrifice their education to earn more money so that he can continue his elder or smaller sister's education. Figure 8 will explain the overall educational status of the population in the study region.

Figure 8: Overall Educational Status.



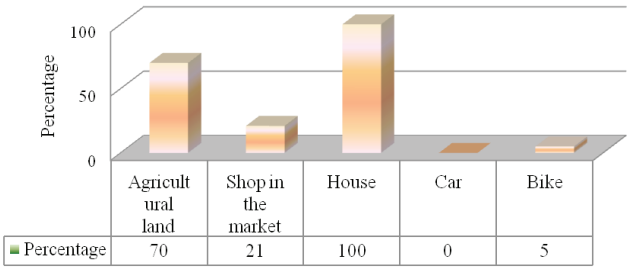
Source: Primary Data, 2021.

From the figure 8, it has been shown that 345 population attended primary education with 34%, followed by upper primary education 18%, 14% illiterate, 13% higher attended secondary education and 2% attended graduation which is the lowest attendance in the sense of educational qualification. Availability of schools and colleges as well as educational infrastructures help a region to raise its minimum standard, but in the study region, it is unavailable.

Household Conditions of the migrant's workers.

Household condition acts as an intrinsic factor of out-migration. But stable family conditions also act as an intrinsic factor of out-migration. Many people migrate for employment whether family conditions are stable or not if the availability of work in the locality is minimum.

Figure 9: Status of the Household Capitals.



Source: Primary Data, 2021

Table 5: The Size of Land in Acres in The Study Region

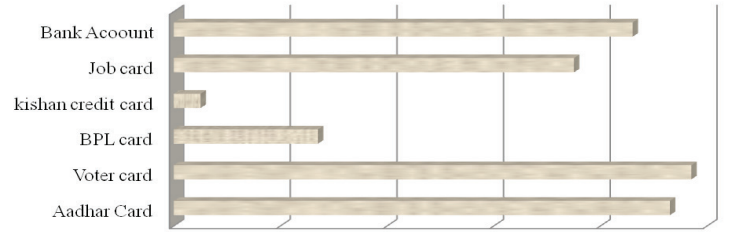
The Size of Land In Acres	Percentage
.5	42
<1	20
<1.5	3
<2>2	5
No Agricultural Land	30
Total	100

Source: Primary Data, 2021.

Figure 9 explains the household capitals. Every migrant has a house to stay in or sustain their life. Being a rural area and agrarian economy 70% population engaged in agricultural activities and has lands. 21% of households have a shop in the market. Probably on the extra time when they don't have to go to the field after seeding the crops, they run the shop in the periodic market.

But somebody has shops in the regular market also 5% of the household has a bike to commute their daily life. None of the households has a car, because of, in rural mentality car is a luxurious thing.

Figure 10. Access of Necessary Documents

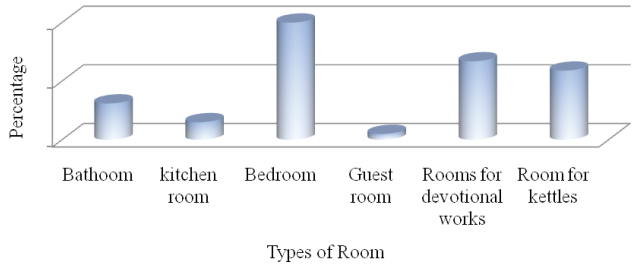


	Aadhar Card	Voter card	BPL card	kishan credit card	Job card	Bank Acoount
percentage	93	97	27	5	75	86

Source: Primary Data, 2021.

In the sense of availability of cultivable land, 42% has more than. 5 acres of land, 20% has >1 of land, 20% has <1 acre of land, 3% has <1.5 acres of land. But it is a matter of concern that 30% of the household has no land to cultivate. They used to income by doing daily laborers or sometimes they took a leased land. The owners have to give some amount of money during field cultivation and production of the crops. In the sense of accessing necessary documents, 97% of peoples have voter I.D, 93% have adhar card, 86%, peoples have a bank account, 75% of peoples has job card. It is a vital feature of the study area where houses room number, it depends on household to household and also income to income. Generally, those who have more wealth also has more room number.

Figure 11: Types of Room



Source: Primary Data, 2021.

Room number also varies based on community and religion. As an example, in the houses of Hindu religious people, the devotional room is a common feature that is absent in Muslim religious person's house. The above cartogram will show different accounts on room type, room number as well as structure.

In the sense of room category, 100% of the household has a bedroom, 67% has a devotional room, 59% has a kettle room, 15% has a kitchen room, 31 % has a bathroom. The existing room number represents the wealth, social establishment in the rural society. 30% of household consists of two-room, 39% of household consist of three rooms, 185 has four rooms, and 4% has 5 rooms. It's a general fact that more room in the rural area represents a variety of purposes of the household. The use of tin is more frequent while discussing the household structure. 89% wall and 95% roof consisted of tin in the study area. Tin is more likely a cheap material than brick or other elements. Its durable and construction cost is minimum while building a house with tin. Where wealth is minimum, savings are made by this type of affordable element. 5%, 2%, and 4% of people use wood, bamboo, and concrete for constructing the wall. On the other side % and 2%, roofs of the hose are made of asbestos and brick or concrete. In the study area roof made of concrete or bricks are very rare. It is considered that the house owner has much more wealth. This is the another reason why village people who have wealth don't make a fully concrete house because they don't want to show off to other villagers that they have more money than other villagers. 93% of the food of the study area is kutcha and 7% are pucca.69% house has a separate bathroom and 67% has a separate devotional room. 83% house has water nearby less than 1 kilometer, 9% has the water source less than 2 kilometers, 3% and 4% house has the source of water near less than 3 and more than 4 kilometers. 97% use the same water for drinking and cleaning, also 97% of houses have no mechanism for purifying the water.

Predicted Global Recession

The worldwide economy has been severely impacted by the corona virus outbreak and the drastic measures taken to contain it. Based on the World Bank estimation, the world economy is expected to contract by 5.2 percent in 2020. The World Bank's Global Economic Prospects report released in June 2020, that 2020 economic recession impact is the deepest recession since World War II, where the per capita share of economies seeing output decreases since 1870. According to the World Bank estimation "*Domestic demand and supply, commerce, and finance have all been badly affected, and advanced economies' economic activity is expected to fall by 7% in 2020. Emerging markets and emerging economies (EMDEs) are anticipated to contract by 2021. This year, they are predicted to contract by 2.5 percent, their first recession as a group in at least sixty years, and per capita incomes are expected to fall by 3.6 percent, pushing millions of people into abject poverty*". The fear of recession is very relevant for India because the pandemic and economic slowdown must occur at the same time. According to government estimates, GDP will be reduced by 0.3–0.5% in the fiscal year 2021, and growth in the first two quarters of that year might be as low as 4–4.5%. (Economic Times, 2020). The impact of recession is real even for a macro-region. The fuel price hike, inflation and price hike in necessary things is the real issues as a impact of covid-19.

Impact of Recession on Workforce

Throughout the pandemic, geographically focused and sector-specific measures have progressively become the standard within countries, and 77 percent of employees were still affected at the start of the year (near to the peak of 85 percent achieved in late July 2020). In 2020, 8.8% of worldwide working hours were lost, equating to 255 million full-time employment, compared to the fourth quarter of 2019. Working-hour losses were notably significant. In Latin America and Carribean, Southern Europe, and Southern Asia in some parts of the world.

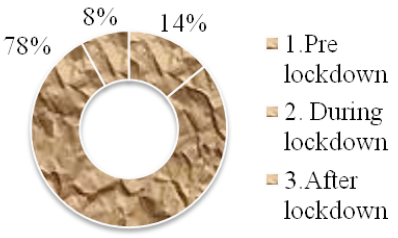
Table 6: Working status of migrant workers.

Status of Work	Percentage
1. Working	9
2. Seeking for Work	51
3. Unemployed	40
	Total:100

Source: Primary Data, 2021.

Working-hour losses were around four times higher in 2020 than they were during the global financial crisis in 2009, equating to 130 million full-time jobs (ILO Monitor: COVID-19 and the world of work, Seventh Edition, Updated estimates and analysis, 2020). Table 6 shows that 9 percent of migrant workers are employed, 51 percent are looking for work, and 40% are unemployed in the research region. The proportion is based on the labor of 159 migrants. As a result, the recession caused by COVID-19 affected both local and macro-regions. Now, there was apprehension about life and work during COVID-19. The workers have to choose one of these two. During the lockdown, 78 percent of workers returned home, 14 percent returned home before the lockdown, and 8 percent returned home after the lockdown.

Figure 12: Back to Hometowns of The Migrants Workers.



Source: Primary Data, 2021.

The United Nations Development Programme conducted a study to learn more about how the recession affected India's migrant laborers. According to the United Nations Development Programme (UNDP), job losses in engineering, gems and jewelry, and clothing

totaled roughly 40,000. Engineering job losses were dispersed over India; gems and jewelry employment losses were concentrated in Gujrat, while garment job losses were concentrated in Ludhiana and Tripura. In the Gulf, some 20,000 construction workers lost their employment. There were 184 additional job losses in the unorganized sector (Kumar *et. al*, UNDP; 2009).

Migration and employment condition in the study area

According to the study of Ajeevika Bureau, 2020, *"India's rural peoples poor migrate seasonally to cities, industries, and farms in search of work, and these are migrants who move back and forth doing a wide range ofcasual work in construction, manufacturing, services, and agriculture, as they are part of India's unorganized, informal workforce of over 350 million people who remain excluded from services and rights as workers and citizens, both in their rural homes and at their places of work in cities. The numbers of rural migrant peoples are around 140 million."*

Table 7: Migrant workers living in different states and neighboring Countries

Area	Percentage
1. Tamilnadu	15.1
2. Andhrapradesh	13.2
3. Karnataka	23.3
4. Maharastra	16.4
5. Kerala	15.7
6. Bihar	10.7
7. Nepal	5.7
8. Total	100

Source: Primary Data, 2021.

Workers are migrating from disadvantaged rural areas to more prosperous urban and industrial areas. States like Rajasthan, Odisha, and Madhya Pradesh have joined the out-migration regions of Uttar Pradesh, Bihar, and Jharkhand. Even in the wealthier states, there is a significant intra-state labor movement. Though migratory laborers have always been drawn to portions of mega -cities and industrial clusters. Kerala, for example, has been a major employer of long-

distance migrants. Economic growth in India nowadays is dependent on the mobility of labor areas, where migrant workers are primarily employed. According to the study, 23.3% people work in Karnataka state, mostly in Bangalore and Mangalore. 15% of workers working in agricultural fields. In Tamilnadu, where 15.1% of people work, they mainly work in the construction site. 16.4% of workers work in Maharastra where they mainly work in the textile industry. The contribution of migrant workers to the economy is enormous but remains to be done in return for their security and well-being. There is an urgent need for solutions to transform migration into a more dignified and rewarding opportunity. Without this, making growth inclusive, or the very least, sustainable, will remain a very distant dream, poor wages, erratic employment, hazardous work conditions and lack of essential services define the experience of migrant workers. When they live within the city, it is often in informal settlements, which are deemed illegal by civic authorities, and hence placed outside planning and provisioning. That's why slums in Indian cities increasing progressively. It is the rural migrant workers who living in the slums to minimize their expenditure cost by cutting room rent so that they can send more remittances to their families and relatives which become a pathetic situation. In every urban area.

Based on, working group, salary per month, owners solidarity, and salary sanction time, factory or company workers responded that they are more satisfied with their salary, owners solidarity, and salary sanction time with satisfaction level 62%. According to the previous statement, based on satisfaction level construction workers in second position (48% satisfied), agribusiness workers in third position (45% satisfied), and brick fielders workers in fourth position (43% satisfied). Based on owners' solidarity based on workers perception, it has been observed that Factories Workers/Company Workers are more satisfied (75%) than last three groups with owners solidarity response rate 68% Construction Worker, 64% of Agribusiness Worker, and lowest Brick-field workers with the percentage of 59%.

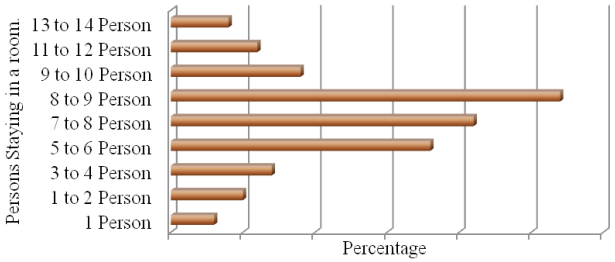
Table 8: Workers Salary, Salary Time and Satisfaction Level.

Working Group	Salary/ Month	Salary Sanction Time	Average Owner's Solidarity, % based on workers response	Livelihood Satisfaction Level			
				Satisfied	Less Satisfied	Not Satisfied	Total
1. Factories Worker, Company Workers	10k To 20k	Monthly	75	62	30	8	100
2. Construction Worker	12k To 18 K	Weekly	68	48	30	22	100
3. Brickfielder	13k To 22k	Weekly	59	43	37	20	100
4. Agro-business Worker	10.K To 17k	Weekly	64	45	30	25	

Source: Primary Data, 2021.

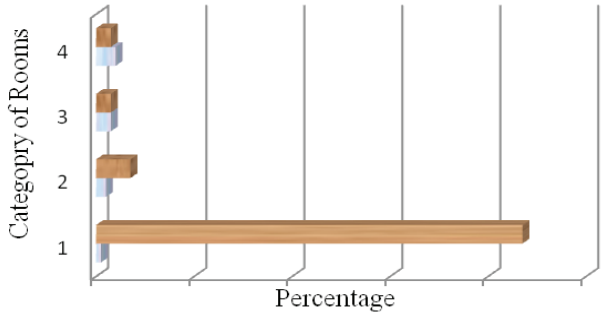
The above percentages are based on a total of 159 migrant workers' responses. Access to public entitlements in India are linked to proof of residence which migrants are unlikely to posses, this results in their exclusion from subsidized food-grains, housing, health care, and other benefits available to local citizens. Rural migrants are unable to cast votes in cities which alienates their voice.

Figure 13:Workers staying in a single room



Source: Primary Data,2021.

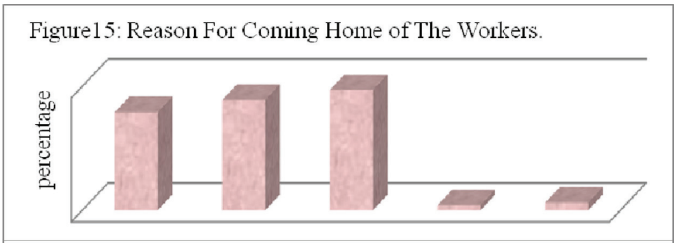
Figure 14:Workers staying in different category of room



Source: Primary Data, 2021.

As a result, migrants survive on the margins, i.e. on construction sites, brick kilns, or polluted manufacturing zones. From figure 13

and 14, it has been observed that in a single room 87% of worker lives. Availability for a single room for a single person is very less, it's 3% only. Available room number more than one is very rare where, 7%, 3%, 3% people get a chance to live in 2, 3, 4 number rooms respectively. On the other side % of workers living in different categories of rooms is stated below as 21% of people with 7 to 8 wokers live in a single room. Followed by 5 to 6 person, 9 to 10% person, 3 to 4 %, 11 to 12 person, 1 to 2 person,13 to 14 person, and 1 person respectively have to stay in a single room. Figures 15, 16, and 17 explain why the workers had to come in home, stay time at home and what will be the post-lockdown scenario in the working station. 97%, 89%, and 79% workers came home due to shortage of money, due to unavailability of work and due to lockdown.

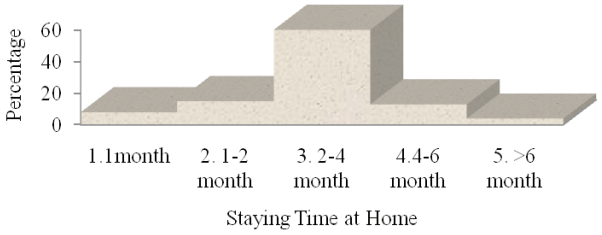


Source: Primary Data, 2021.

Followed by, due to illness of family members and for festival. 2 to 4 months staying at home workers are the highest in number. Followed by 1 to 2 months, 4 to 6 months, 1 month, and lastly > 6 months consecutively. The prediction is based on workers' response whether there will be enough work or not in the working station, 91% of workers said that there will not be enough work. Followed by, due to illness of family members and for festival. 2 to 4 months staying at home workers are the highest in number followed by 1 to 2 months, 4 to 6 months, 1 month, and lastly > 6 months consecutively. The prediction is based on workers' response whether there will be enough work or not in the working station, 91% of workers said that there will not be enough work. Followed by a new type of work has

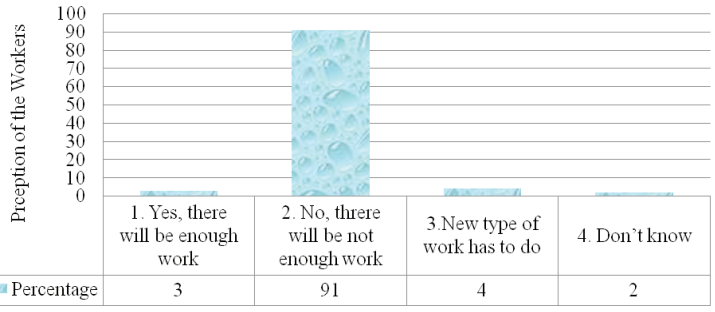
to do, there will be enough work and lastly, some workers don't know what will be the situation.

Figure 16: Staying Time At Home Of The Migrants Workers.



Source: Primary Data, 2021.

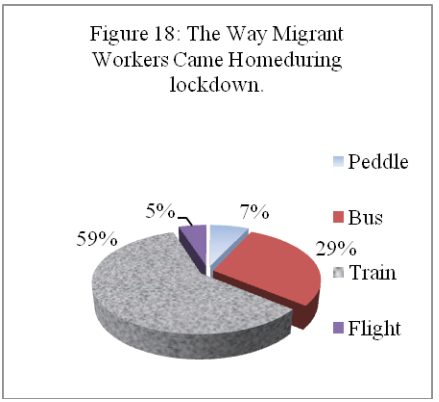
Figure 17: Post Lock-down Scenario at Destination



Source: Primary Data, 2021.

Because migrant workers move around a lots in search of work, the government notified in the Parliament on March 24, 2020, that "it is not viable to retain record/data on migrant labor workforce." However, when an unprecedented migrant worker crisis unfolded in India after 68 days of lockdown, it became evident that trustworthy data was vital to formulating an effective migrant worker policy. Between March 25, 2020, and May 1, 2020, troubled migrant workers, stranded without jobs, savings, shelter, food, transportation, or any organized support structure, began arduous treks back home with their families and meager belongings, according to a report published by Business Today on July 28th, around 1.14 crore migrant

workers returned home, more than the population of Uttarakhand, resulting in at least 971 non-Covid deaths, including 96 workers who died on trains. It has been observed that during lock-down there was an emergency rule issued during the pandemic.



Source: Primary Data, 2021.

Table: 9. Family size, income, and minimum income are needed to sustain the livelihood of the Migrant workers.

Family size	Number of families	Average income of the household from agricultural activities per month	Need minimum wage to sustain livelihoods
1 member	1 member	6 K	2000
2 member	2 member	11 K	5000
3 member	3 member	13K	5500
4 member	4 member	15K	6000
5 member	5 member	13K	6600
6 member	6 member	8K	7000
7 member	7 member	7K	7800
8 member	8 member	4K	9000
9 member	9 member	9K	8500
10 member	10 member	3K	5000
11 member	11 member	5K	7900
12 member	12 member	6K	8200

Source: Primary Data, 2021.

Now, a substantial number of migrant laborers are rushed to their homes. As transport systems were fully defaulted by the State as well as Central Government, the shear experienced had to suffer by the Migrants laborers. 59% of workers came to the home in the emergency train, 29% on the bus, 75%, and 5% on the flight. It is an important fact that what is the average family size of migrant workers and how much they actively engaged in agricultural activities, what is the average income from that agricultural activities.

The Chi-square test has been done to prove that the income from agriculture in the worker's family houses act as an intrinsic factor of out-migration in the study are. The result has been discussed below.

Table 10: Expected Income (Chi-Square Test).

The average income of the household from agricultural activities per month (₹)	The average income of the household from agricultural activities per month (₹)	Need minimum wage to sustain livelihoods In (₹)
2000	2537	2463
5000	5582	5418
5500	5835	5665
6000	6597	6403
6600	7155	6945
7000	8626	8374
7800	8525	8275
9000	8373	8127
8500	9388	9112
5000	7104	6896
7900	4618	4482
8200	10758	10442
	Chi-Square test result	1.21027

Source: Primary Data, 2021.

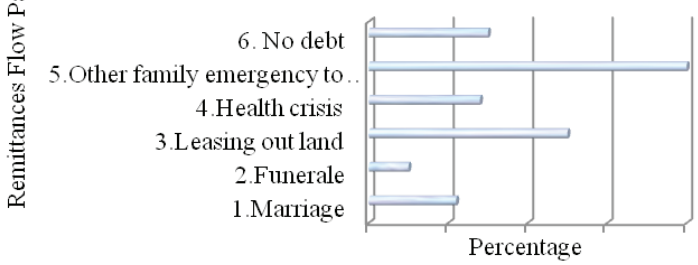
In 11 Degrees of Freedom (12-N) with 0.05 probability and 95% confidence level, the calculated value is 1.2027 which is much less than the tabulated value of 19.63. This explains that there is a significant relationship between agricultural activities and income-generating from agricultural activities. Hence, the null hypothesis is rejected and the alternative hypothesis accepted. the hypothesis

enlisted about the fact that agrarian social system triggering out-migration in the study area i.e. Sitai Block.

Workers and Their Remittances Flow Pattern

Remittances are the most immediate advantage of migration, and the following sections look at how debt episodes affect the remittance transaction and how the money is spent. Remittances are increasingly being given to migrant families, acquaintances, and relatives, regardless of their level of income. A migrant who tries to keep in touch with family through a letter or sporadic phone calls but not through remittances is more likely to be viewed as selfish and failing to fulfill his or her moral and social commitments.

Figure 29. Incidents of Debts And Remittances Flow Pattern.



Source: Primary Data, 2021.

In such circumstances, the response would be something along the lines of: he/she lives abroad but simply sends us greetings (Girmachew Adugna Zewdu, 2019). Migrant workers' remittances are used fulfill a variety of objectives. Around 40% of those who received remittances utilized them for family expenses during the lockdown, around 25% for land leasing, 14% for health emergencies, 11% for marriage purposes, and 5% for funerals. According to the concept of altruism, migrants remit because they care about their families who have been left behind. Altruism, on the other hand, does not explain why some migrants remit more than others, why some

remit for longer periods, and why some do not remit at all. 'Migrants may not be equally altruistic to everyone in the recipient household, and they may respond more to the needs of some family members than to others,' writes Posel (2001), (p.166).

Poverty Profile

The Planning Commission of India has established a poverty line based on recommended dietary requirements of 2,400 calories per person per day for rural areas and 2,100 calories per person per day for urban areas. The average calorie need is calculated using the population composition by age, gender, and employment categories, as well as the appropriate calorie norms established by the Indian Council of Medical Research. The poverty line in rupees is the midpoint of the expenditure class when calorie needs are met. On this basis, the rural and urban cutoff points for 1991-92 prices are ₹ 181.50 and ₹ 209.60, respectively.

Table 11: Poverty profile of India.

Social and Religious Class	Percentage of Living in Poverty
1. Urban Hindus	20.40%
2. Urban Hindu General	8.30%
3. Urban Hindu OBC	25.10%
4. Urban Hindu SC/ST	36.40%
5. Urban Muslims	38.40%
6. Urban Other Minorities	12.20%
7. Rural Hindus	22.60%
8. Rural Hindu General	9.00%
9. Rural Hindu OBC	19.50%
10. Rural Hindu SC/ST	34.80%
11. Rural Muslims	26.90%
12. Rural Other Minorities	14.30%

Source: Poverty in India based on Social and Religious Classes; The Sachar Committee look at the poverty by social and religious class, 2017.

The poverty level has been set at ₹ 50,000 per year for a family of five people. Rural areas receive ₹ 10,890, while urban areas receive ₹ 12,570. (Chand, 2012). The COVID-19 pandemic has thrown India into its greatest economic quagmire since independence. According

to the World Bank, nearly 20% of the country's population lives in extreme poverty. A person who lives on less than $1.90 per day is considered poor. Even though a big portion of India's middle class has been pushed back below the poverty line, the stock market recovered by over 75% in 2019, allowing for an increase in employment and economic development inside the countryAccording to labor market indices, urban households are now more vulnerable to poverty than they were before the pandemic (World Bank, 2020).

According to the World Bank's website infographic India's Poverty Profile, which was published on May 27, 2016, although being four years old, the data from 2012 shows that 270,000,000 (27 crores) Indians are poor, implying that one in every five Indians is impoverished. The seven low-income states are home to 62 percent of India's impoverished and 45 percent of the country's population. Rural India is home to 80% of India's poor. The seven States are described in table number 12. In West Bengal, Purulia district had the highest poverty ratio at 49.69%, followed by Uttar Dinajpur (42.84%), Maldah (35.7%), South 24 Parganas (28.3%), and Birbhum (27.6%). Kolkata had the lowest poverty ratio in the state at 2.8% (Indian express,2016). According to Planning Commission data using the Tendulkar committee's estimates, about 20% of the population live below the poverty line. The urban poverty rate in the state at 15% is higher than the national average by a percentage point.

Table 12: State wise numbers of poor in Millions (India).

State	Number of poor (In millions)
Uttar Pradesh	60
Bihar	36
Madhya Pradesh	24
Odisha	14
Jharkhand	13
Rajasthan	10
Rajasthan	14
Chattisgarh	10

Source: www.https://worldbank.org/en/news/infographic/2016/05

The rural poverty rate is higher than the urban poverty rate by 8 percentage points; though it is lower than the national average. whereas in the coochbehar district poverty rate is 22.5% (mint, 2015). Additionally, Ray *et al.* (2015) emphasized poverty as the most important cause of Seasonal labor migration from rural to urban or from backward to developed regions in developing countries. In Sitai block, study reveals 16/05/27/India's-poverty profile that 27% percent of people live in below the poverty line from the total of 520 surveyed people (Primary Survey, 2021).

Impacts of covid – 19 on Rural Migrants Labourers

There are various issues and impacts faced by rural migrants. The authors have classified them into indicators. The impact has been discussed based on migrant workers' responses. While discussing the matter, it is divided into two parts, pre-covid and post- covid situations.

1. **Physical indicators:-** There are four elements in physical indicators such as physical health, access to medical care, and mental health. In the pre-covid situation, 77% responded that they were in stable condition whereas, in post-Covid, it is 67%. Access to medical care was more good condition in the pre-Covid situation than post- Covid. It is around 55% and 30%. In the sense of mental health condition post- Covid situation harshly affected the migrant's mental health condition. 61% were stable in pre- Covid and 41% in post- Covid situations. The indicator's percentage is based on 159 Migrants worker's perception.
2. **Social indicators:-** 4 elements in social indicators have been considered. they are Racial, ethnic segregation, Religious segregation, Criminal justice, safety Below percentages based on 159 workers' responses. Racial and ethnic segregation was more in pre- Covid (71%) than post-Covid (81%). Religious segregation was more in pre- Covid than post- covid. It is around 73% and 83% respectively. Handling criminal justice 40% in pre- Covid and 48% in post- Covid situations. In the case of safety, 67% in pre- Covid and 47 % in post- Covid due to fear and anxiety of the coronaviruses.

3. **Economic indicators:-** In the economic indicator, three elements have been considered. These are Income and wealth, Employment status, Income supplements. All the responses are in pre- Covid supportive where these rates are 68%, 64% and 48%. In post-Covid condition, it is 42%, 39%, 34%.
4. **Livelihood assessment:-** In livelihood assessment indicators, three elements have been considered are Natural capital, Financial capital, Social capital. These all are pre-Covid supportive elements according to responses from the working migrants' population. In prior Covid these are 55%, 43%, 60% respectively. In the post-Covid, it is 45%, 33% and 49% respectively.
5. **The physical capital:-** The physical capital of the migrant population was in a better position before the Covid situation (71%) than post-Covid situation (51%) among 159 migrant workers.
6. **Human capitals:-** Human capitals were also better in the pre-Covid situation (64%) than post- Covid Situation (44%) among 159 migrant workers.

Impact of Governmental initiatives on Migrant workers

The national and state governments in India attempted to deal with the economy and the poorest among the poor through various economic packages such as the Pradhan Mantri Garib Kalyan Yojna (PMGKY) program, but the successful implementation of this package constitutes a huge test and difficulty (Singh, 2020; Jha 2020). In addition, the state administration is attempting to broaden its activities to include village residents.

Table 13: Nature of schemes taken by the District

1. Rural Connectivity	8. Works on Individual Category
2. Flood Control	9. Rural Sanitation
3. Land Development	10. Drought Proofing
4. Water Conservation & Water Harvesting	11. Fisheries
5. Renovation of Traditional Water Bodies	12. Rural Drinking Water
6. Bharat Nirman Rajeev Gandhi Sewa kendra	13. Anganwadi
7. Irrigation Canel	14. PlayGround

Source: http://coochbehar.nic.in/HTMfiles/Developmentactivities.html

Table 14: Performance of 2014-2015 in Coochbehar District (Till January 2015)

Person days Generated	**60,25,233**
• Female person-days generated	33,04,937
• Job card holding families	6,25,246
• Families demanded & received job	2,20,684
• Average person-days per family	27.30
• Female participation ratio	55%
• Average wage per person-day	$169/-
• Wage proportion to total expenditure	87%
• Job card holder with Bank/P.O. A/c.	95%
• Utilization of fund	94%

Source: http://coochbehar.nic.in/HTMfiles/Development_activities.html

According to table 13, 14 initiatives have been taken for the improvement of the various parts of the District. Table 13 and Table 14 show different initiatives and performance by the district. But in level performance of MGNREGA has not been depicted. According to table 14, On average 27.30 person-days had been generated, and also women participation rate is higher than male participants.

Table 15: Governmental initiatives and beneficiaries of Sitai Block.

Initiatives	**Total number of eligible beneficiaries**	**No of Beneficiary**	**Percentage**
Old-age pension	42	29	69.0
MGNAREGA	318	81	25.5
Kannasree	147	111	75.5
Ruposhree	112	27	24.1
laxmishree	76	0	0.0
Self Help Group	118	77	65.3
Widow pension	8	3	37.5
Single girl child	17	2	11.8
Girl child scholarship	175	69	39.4
SC/ST/ Minority Scholarship	318	187	58.8
Postmetric Scholarshp	121	59	48.8
Another	7	4	57.1
Yuboshree	65	7	10.8

Source: Primary Data, 2021.

Now table 15 will depict the above-mentioned table's average reflection. The below table will depict the ground reality of MGNREGA as well as other schemes.

Table 16: Various Criteria for Determining the Samples.

Schemes and policies	Criteria
Old-age pension	Old age
MGNAREGA	Above 14 To 60 years
Kannasree	5 to 30 years of female
Ruposhree	Above 18 years of female
laxmishree	Above 21 to 60 years of female
Self Help Group	Above 18 years of female
Widow pension	Widow
Single girl child	Single girl child
Girl child scholarship	5 to 18 years of female
SC/ST/ Minority Scholarship	SC/ST/Minority student
Post-metric Scholarship	H.S to B.A student
Another	Post-graduation student
Yuboshree	Above 18 to 30 years of male who is not engaged in any kind of governmental

Source: Primary Data, 2021.

Table 13 reveals that only 25% of people were helped by the MGNREGA initiatives which is very little. The most successful scheme of the Government is the old-age pension whose success rate is 69% in the study region. Followed by self-help Group with 65.3 percent. The most successful scheme as revealed by the study is Kannasree which is mainly for girls students to promote girls' education all over West Bengal. More than 70% of eligible girls' students accessed these schemes. But it is significantly noticeable that for the boys' education such type of schemes is not available. As a result in higher education, the number of boys students significantly decreasing day by day as compared to the girls' students. In the case of old-age pension schemes moreover successful where around 80% people could access. The least successful scheme is Yuboshree where around 11% of eligible youth could access the scheme. Self-help groups are also a successful scheme of the government where women can get access to money with the lowest interest rate as well as they

can deposit their money. It has been reported from the field survey that the State government sanctions money to the group occasionally.

Table 17: Relationship between beneficiaries and Government initiatives (Student's t-Test).

Initiatives	Total Number of eligible beneficiaries	No. of Beneficiary
1. Old age pension	42	29
2. MGNAREGA	318	81
3. Kannasree	147	111
4. Ruposhree	112	27
5. laxmishree	76	2
6. Self Help Group	118	77
7. Widow pension	8	3
8. Single girl child	17	2
9. Girlchild scholarship	175	69
10. SC/ST/Minority Scholarship	318	187
11. Post-metric Scholarship	121	59
12. Another	7	4
13. Yuboshree	65	7

Calculated T- value; 0.06

Source: Primare Data, 2021.

The table value t for (N-1) 12 degrees of freedom at 5% i.e at 0.05 probability level of significance is 0.06. Since, the computed value of t = 2.18 is greater. The calculated value of t is less than the table value, so the null hypothesis is accepted. Hene, it is clear that there is no significant relationship between governmental schemes and beneficiaries in Sitai Block. Lastly, schemes could not properly be impacting migrant's life.

Findings

The findings of the study area as below

- ❖ The livelihood status of migrant labours is very poor. There is a shortage of basic essential needs during the pre-covid-19 as well as during the covid-19 pandemic situation.
- ❖ Agro-based economy pushes the villagers to work outside of the local area as well as abroad.

- ❖ The sending remittances of the laborers' used to fulfill the basic needs of his/ her family. But, this covid-19 pandemic hampered the remittances flow of the laborers' to their families and relatives.
- ❖ The damaged socio-economic and mental health of the laborers' further strikingly damaged by the covid-19 pandemic. The long-term stability of the covid-19 pandemic hampered the livelihood pattern of the laborers' in Sitai Block.
- ❖ The effectiveness of governmental schemes and policies toward migrant laborers' are very negligible. With low literacy, and high policy and scheme sanction procedure of the government, works as burden to the migrant laborers'.
- ❖ The status of the women's education progressively increasing in Sitai Block.

Concluding Remarks

As the study reveals that agriculture is the main occupation of the region, it's inevitable as an intrinsic factor of out-migration of the region. Crop cultivation patterns happen in seasonal ways, to sustain livelihoods; people have to income all over the year. It is one kind of determinant factor that seasonal income reduces the average income of the region. As well as no such agro-based factory was found in the study region. It is found from the field survey that during crop production the income of workers increased as well as out-migrants decreased. But after the crop production workers started to migrants to other states or region's to find a job. In the case of government schemes and policy, has no such impact on migrant workers' life. Everyone needs capital to run their family. It has become a determinant factor for the prosper of the family if income source is one or it depends upon totally one person. Any capital from any source whether it is from schemes or policies or not, significantly impacts workers' family prospers. Government should implement the schemes and policies in such a way that it reaches out to every eligible village people. Corruption of the official staff is a major problem in this scenario. They charge a commission from the beneficiaries for sanctioning the schemes to the beneficiary (Field Observation). Government should

look after this matter. Promoting agro-based industries in this region will also significantly reduce the out-migration. Extra importance in the cottage industry will improve the income of females in the regions. Direct sanctioning money to the workers' bank account would also be an effective measure. As migrant workers out- migrating mostly to the other states, the state government should strictly be listed the workers' profiles digitally. Also, focusing on small-scale industries in rural areas would significantly improve the average income patterns of the migrant workers as well as villager's life. Proper monitoring of the MGNREGA schemes in rural areas will also reduce the out-migration as well as village infrastructure in Sitai Block.

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Chapter 8

Whether area or productivity is a more influential factor for production of horticulture crops? Evidence from Assam

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Abstract: Assam is one of the main states of the North Eastern Region and it is identified as one of the 14 global bio-diversity hotspots in the country. The unique agro-climatic condition of Assam permits growing of different varieties of horticulture crops. The state can provide income as well as nutritional security to the farmers by agricultural diversification through horticulture in the state. Therefore, the present study tries to focus on the growth trends and potentiality of horticulture crops in the state compared to that of India. Whether area or productivity is more influential factor for production of horticulture crop in the state is also examined mathematically. It is found from the study that the productivity growth of the state is even better than the country average for some of the horticulture crops like spices and nut crops. The study of change in area effect, productivity effect and their interaction effect on growth of production reveals that the production of most of the horticulture crops in Assam has been influenced mostly by productivity increase than the expansion of area during the study period. Government has prepared some development agenda and action plan for Sustainable development Goals (SDGs), 2030 to make the sector vibrant and sustainable and to minimize environmental degeneration.

Keywords: Agricultural diversification, growth trends, area effect, productivity effect, Sustainable Development Goals

Introduction

The North Easter Region is one of the richest hot spots with 136 genetically different horticultural species (Dubey *et al*., 2006). Assam is one of the main states of the North Eastern Region and it is one of

the 14 global bio-diversity hotspots in the country. The state occupies a significant position among the states of India regarding area, production and productivity of horticulture crops (e.g. first position in area of pine apple and litchi; second position in production of pine apple, litchi, orange and areca nut; third position in cabbage; and first position in productivity of lady's finger; second in productivity of orange and tomato in 2003-04) (CMIE, 2006). Assam is a flood prone state and the productivity of the major food crop rice is not stable. Therefore, diversification of agriculture through horticulture can reduce the impact of major crop failure and can provide income and nutritional security to the farmers. Moreover, the land man ratio is also declining in the state due to population pressure. There is decline in labour absorption in primary sector as the proportion of workers in agricultural sector was 46 percent in 2011 as against 62 percent in 1991 and the contribution to SDP has also declined from 29.61 per cent in 2002-03 to 15 per cent in 2019-20 in Assam (Government of Assam, 2021). Horticulture crops can be planted with small holdings of the people or homestead (*bari*) which is a unique characteristic of Assamese society.

However, only 15 per cent of the gross cropped area in Assam is being used for horticulture crops (Government of Assam, 2018). Therefore, there is tremendous scope for pushing the acreage under these crops in the state. Nevertheless, the potentiality of horticulture in the state is yet to be fully harnessed.

Review of Literatures

Agri-Horticulture Sector is the principal occupation of majority (60%) of the rural population in the state in terms of employment and livelihood. Agro-horticulture sector continues to providing employment of more than 50 per cent of the total workforce and support more than 75 per cent population of the state directly or indirectly. Growth in the agri-horticulture sector now stands at 4.5% and contributes 17.89% to the State Gross Domestic Product at current price in 2013-14. Agri-Horticulture sector continues to providing employment of more than 50 per cent of the total workforce

and supports more than 75 per cent population of the state directly or indirectly (Government of Assam, 2022b).

A few studies have been conducted to study the status of horticulture crops in Assam. The study done by NERAMAC (2015) analysed the scope of setting up of horticulture based food processing industries in the state. Some studies were conducted by the government (Government of India, 2005) and analysed the potentiality of horticulture crops in the state. Recently a study (Lahkar and Baishya, 2020) tried to assess one of the major constraints i.e. marketing of horticultural production in the state. According to a study conducted by Das et al. (2), the average yield (productivity) of horticulture crops was higher in the state compared to that of the country in 2003-04. The study examined the growth trends in area, production, and productivity of horticulture crops of Assam over a period of time from 1993-94 to 2003-04 and it was found that the expansion of area affected the production of most of the horticulture crops in Assam and further expansion of the area under horticulture crops may increase the production. However, with fixed land, there is always a limit of area expansion and any expansion is discouraged in hill districts to get rid of evil effect of shifting cultivation. Therefore, the present study is an attempt to examine whether the area or productivity is more influential factor to affect the production of the state after 2003-04 in the state. The potentiality of horticulture crops in the state compared to India is also tried to discuss in the paper.

Objectives of the Study

With this backdrop, this study seeks specifically to: (i) assess the present status of Assam in comparison with India; (ii) analyse the growth trends in area, production and productivity of major horticulture crops in the states compared with the country as a whole over a period of fifteen years from 2003-04 to 2017-18; (iii) examine whether the area or productivity is more influential factor to affect the production of the state so far.

Materials and Methods

Horticulture encompasses a wide range of fruits, vegetables, flowers and ornamentals, aromatic and medicinal plants, spices and commercial plantation crops. However, this study is confined to the horticulture crops that include fruit crops, spice crops, tuber crops, vegetable, and nut crops as shown in Table 1. The study is based on secondary data. The data have been collected mainly from the report on *Horticulture Statistics-At a Glance 2018*, published by the Ministry of Agriculture & Farmers' Welfare Department of Agriculture, Cooperation & Farmers' Welfare Horticulture Statistics Division, Government of India, CMIE (Centre for Monitoring Indian Economy), March 2006 and published reports by the Government of India and Assam.

The collected data are calculated and analysed. Compound growth rates are calculated to find out the growth trends of area, production and productivity of the crops.

Again, the methodology to examine the effect of area, productivity and their interaction in increasing the production is taken from Singh and Chandra (2001) and Das *et al.* (2007) and are found as

$$\Delta P = Y_0 \Delta A + A_0 \Delta Y + \Delta A \Delta Y \ \ldots \qquad (1)$$

Where, $\Delta A = A_n - A_0,\ \Delta Y = Y_n - Y_0\ ,\ \Delta P = P_n - P_0$

Here, A_0, Y_0 , P_0's are area, productivity and production in base year ; A_n , Y_n , and P_n's are area, productivity and production in current year and DA, DY, DP are the change in area, productivity and production. This approximation is used to examine whether the area or productivity is more influential factor to affect the production in the state.

Results and Discussion

Present Status of Assam in comparison with India

Table 1 depicts the position of Assam among the major horticulture producing states of the country in respect of area,

production and productivity. Assam occupies first position regarding area of cultivation of Pineapple and first position regarding production in Ginger. The area of Ginger of the state is the second highest in the country while the production of Pine apple is the second highest in the country. The third position is occupied by Areca nut in respect of area of cultivation and in respect of production and Guava in respect of productivity. Assam occupies fourth position for Cabbage and Coriander in case of area and production. While the fifth largest area of cultivation is in the crop Sweet Potato; the fifth highest production is in Mandarin (Orange), Cabbage and Lady's finger. The fifth highest productivity is in Sweet Orange, Garlic and Beans for the State. While Turmeric, Garlic, Potato, and Tapioca occupy the sixth position in case of area of cultivation; Garlic, Radish and Tapioca occupy the sixth position in production. The area of cultivation is the seventh largest for Mandarin (Orange), Lemon, Chilli and Lady's finger; production is the seventh highest for Potato; productivity is seventh highest in Pineapple, and Mandarin (Orange), and Ginger. While the eighth position is occupied by Banana, Papaya, Brinjal and Cauliflower in respect of area; Papaya, Chilli, Cauliflower and Coconut occupy the eight positions in respect of production and Tapioca occupies the eight positions in respect of productivity. The ninth position is occupied by Lemon and Areca nut in respect of productivity. While the tenth position is occupied by Coconut in respect of area; Banana, Lemon and Sweet Potato occupy the tenth position in production and Lady's Finger in respect of productivity. Figures show that Assam has occupied comparatively better position in respect of cultivation of area. However, the state has not been able to maintain the same position in production and productivity for most of the crops except Ginger, Pineapple and Areca nut. Even the position deteriorates in respect of productivity of the crops compared to area under cultivation and production (except Guava and Beans). Therefore, it becomes apparent that although Assam occupies comparatively better position in terms of area under cultivation, the state is not at par in terms of production and productivity and there is need to increase production and productivity for sustainable growth.

Table 1: Position of Assam among the major horticulture crop producing states of India regarding area, production and productivity 2017-18

Sl. No.	Crops	Area	Production	Productivity
Fruit crops				
1	Guava	-	-	3rd
2	Banana	8th	10th	-
3	Pineapple	1st	2nd	7th
4	Sweet Orange	-	-	5th
5	Mandarin (Orange)	7th	5th	7th
6	Papaya	8th	8th	-
7	Lemon	7th	10th	9th
Spice crops				
8	Chilli (dry)	7th	8th	-
9	Turmeric	6th	-	-
10	Garlic	6th	6th	5th
11	Ginger	2nd	1st	7th
12	Coriander	4th	4th	-
Tuber crops				
13	Radish	5th	6th	-
14	Potato	6th	7th	-
15	Sweet Potato	5th	10th	-
16	Tapioca	6th	6th	8th
Vegetables				
17	Brinjal	8th	10th	-
18	Cabbage	4th	5th	-
19	Cauliflower	8th	8th	-
20	Beans	-	-	5th
21	Lady's Finger (okra)	7th	5th	10th
Nut crops				
22	Coconut	10th	8th	-
23	Areca nut	3rd	3rd	9th

Note: (-) indicates that Assam has not occupied position among top ten states.

Source: Government of India (2018)

However, to confirm about the low production and productivity compared to other states of the country we have to study the growth experience of the state.

Growth trends in area, production and yield of horticulture crops of Assam compared to India

Growth trends in area under cultivation

Table 2 presents the comparative growth rate of area under cultivation of horticulture crops of Assam and the country as a whole during the period from 2003-04 to 2017-18.

Table 2: Growth trend in area ('000 ha) of horticulture crops in Assam compared to India

S No.	Crops	Assam		India		CAGR from 2003-04 to 2017-18 for Assam	CAGR from 2003-04 to 2017-18 for India
		2003-04	2017-18	2003-04*	2017-18		
1	Total Fruits	112.2	147.3	4000.0	6506.2	1.83	3.30
2	Total Spices	83.8	101.6	2400.0	3877.9	1.29	3.25
3	Total Vegetables	210.0	300.2	6200.0	10259.1	2.41	3.41
4	Total Tubers	89.0	111.3	1598.3	2445.1	1.50	2.87
5	Total Nuts	95.3	100.7	2300.0	2593.4	0.37	0.80

Note: *implies that the source of data is Economic Survey, 2004-05, India except tuber crops

Source: Government of India (2005), CMIE (2006), Government of India (2018)

The compound growth rate (CAGR) of area under all horticulture crops of Assam although exhibits a positive trend, however, the growth rates are much below than all India growth rate. Thus, it can be said that the expansion of area under horticulture crop is not very large during the study period in the state. This may be due to increase of population pressure and decrease of land-man ratio in Assam.

Growth trends in production

Table 3 depicts the production rate of most of the horticulture crops of Assam during the period which is much below compared to that of all India. The nut crops exhibit even a negative growth rate for a long 15 years.

Table 3: Growth trends in production ('000 tonne) of

horticulture crops in Assam compared to India

S No.	Crops	Assam		India		CAGR from 2003-04 to 2017-18 for Assam	CAGR from 2003-04 to 2017-18 for India
		2003-04	2017-18	2003-04*	2017-18		
1	Total Fruits	1351.3	2123.6	47500.0	97357.5	3.06	4.90
2	Total Spices	194.7	302.0	3200.0	8123.9	2.97	6.41
3	Total Vegetables	3282.3	3292.9	90000.0	184394.3	0.02	4.90
4	Total Tubers	585.1	779.0	8422.0	57760.1	1.93	13.70
5	Total Nuts	223.6	193.9	12900.0	17245.6	-0.95	1.95

Note: *implies that the source of data is Economic Survey, 2004-05, India except tuber crops

Source: Government of India (2005), CMIE (2006), Government of India (2018)

Growth trends in productivity

While comparing the productivity growth of horticulture crops of Assam with India for 15 years, it shows significantly high productivity at par the country except vegetables (Table 4).

Tabe 4: Growth trend in yield (MT/ha^{-1}) of horticulture crops in Assam compared to India

S No.	Crops	Assam		India		CAGR from 2003-04 to 2017-18 for Assam	CAGR from 2003-04 to 2017-18 for India
		2003-04	2017-18	2003-04	2017-18		
1	Total Fruits	10.8	15.5	10.3	15.0	2.43	2.54
2	Total Spices	2.1	3.6	15.5	2.1	3.69	-12.49
3	Total Vegetables	14.1	13.1	11.6	18.0	-0.47	2.98
4	Total Tubers	5.9	8.1	46.6	64.1	2.15	2.15
5	Total Nuts	7.4	19.4	6.7	9.5	6.68	2.34

Source: Government of India (2005), CMIE (2006), Government of India (2018)

From the above table it is evident that the productivity of spices and nut crops is much better than the all India average. Although productivity of fruits and tuber crops is at par with the national

average, the productivity of vegetables show a negative growth rate during the study period in the state.

Now it is important to study whether area or productivity or their interaction effect was more influential for production of the horticulture crops of the state during the study period.

Examining production as a combined phenomenon involving area effect, Productivity effect and interaction effect

Decomposing the change in production into area effect and productivity effect and their interaction effect would reveal the strength of forces behind the observed changes in production growth. It is apparent from Table 5 that productivity effect on production is high in case of horticulture crops except vegetables. This implies that productivity plays a major role in the growth of production of majority of crops during the study period. On the other hand, the growth of production of vegetable crops is mainly due to area. Among the five numbers of major sub-crops, vegetables show a negative growth in productivity which has already been reflected from the study of growth trend in productivity (refer Table 4). Therefore, it can be said that the productivity affected the production of most of the horticulture crops in Assam and further increase of productivity may increase the production in the state. However, in case of vegetables, area effect is more influential on the production of vegetables and expansion of area may be helpful to increase production.

Table 5: Effect of change in area, productivity and their interaction effect on growth of production during the period from 2003-04 to 2017-18

Sl. No.	Crops	Area (A)		Production (P)		Productivity (Y)		DA	DY	DP	Area effect	% of Area effect	Productivity effect	% of productivity effect	Interaction effect	% of interaction effect
		2003-04	2017-18	2003-04	2017-18	2003-04	2017-18				Y_oDA	% of Y_oDA	A_oDY	% of A_oDY	DADY	% of DADY
1	Total Fruits	112.2	147.3	1351.3	2123.6	10.8	15.5	35.1	4.7	772.4	380	49.2	526.36	68.15	164.48	21.3
2	Total Spices	83.8	101.6	194.7	302	2.1	3.6	17.8	1.5	107.3	37.19	34.66	126.49	117.89	26.85	25.02
3	Total Vegetables	210	300.2	3282.3	3292.9	14.1	13.1	90.2	-1	10.6	1268.04	11962.62	-200.44	-1890.95	-86.04	-811.7
4	Total Tubers	89	111.3	585.1	779	5.9	8.1	22.3	2.2	193.9	132.08	68.1	198.19	102.19	49.77	25.66
5	Total Nuts	95.3	100.7	223.6	193.9	7.4	19.4	5.4	12	-29.7	39.89	-134.3	1147.6	-3863.97	65.26	-219.73

Source: Calculated from the data from Government of India (2005), CMIE (2006), Government of India (2018)

Government Initiatives, Policy Perspectives and Sustainable Development Goals (SDGs)

Government of India introduced centrally sponsored scheme under Horticulture Mission during 2001-02 and Rashtriya Krishi Vikash Yojana (RKVY) during 2008-09 and the scheme has shown remarkable progress both in area, production & productivity of Horticulture Crops and income of the farmers in the state.

Some initiatives in horticulture sector during 2000-01 to 2016-17 are

(i) Setting up of Directorate of Horticulture & Food Processing during 2008-09.

(ii) Horticulture crop area increased by almost 50%.

(iii) Production increased by 100%.

(iv) Productivity increased by 40%.

(v) Establishment Tissue Culture Laboratory in private sector at Silchar.

(vi) Establishment of Centre of Excellence for Vegetables& Flowers at Khetri and for Citrus at Bamunigaon (Boko)

(vii) Automated V Type Nursery at Ulubari (Government of Assam, 2022a)

The schemes under Horticulture are (i) Horticulture Mission for North East & Himalalayan Region(HMNEH) under MIDH; (ii) Rastriya Krishi Vikash Yojana – Horticulture (RKVY - Hort); (iii) Micro- Irrigation under PMKSY (PDMC); (iv) Mission Organic Value Chain Development for North Eastern region(MOVCD NER) and (v) State Plan schemes.

Adoption of Organic vegetables cultivation through HMNEH and MOVCD, Roof Top Gardening system in Urban area for awareness on Health hazard to avoid use of chemicals are introduced. 2000 number of Roof Top Garden structure has been supplied during 2013-14 to the city dwellers of greater Guwahati for Organic cultivation. Massive programme has been undertaken for supply of elite planting materials to farmers field through establishment of Tissue Culture Lab and “V Type” nursery.

Out of 17 SDGs of United Nations, Goal-1 (to end Poverty) and Goal-2 (Zero hunger) which are related to Agriculture and Horticulture sector, a Development Agenda and Action Plan for Sustainable development Goals, 2030 is prepared by the Directorate of Horticulture and Food Processing, Assam. The vision of Assam horticulture is that of a vibrant sector which is an engine of growth for the state economy, provides food and nutritional security, supports the farmers for socioeconomic uplift to have a comfortable life, minimizing environmental degeneration and helps the state in the path towards food self sufficiency and provides a boost in the intake of proteins, fish and fruits and vegetables to meet nutritional security and is an attractive enterprise (Government of Assam, 2022a).

Some major issues in Assam's Agri-Horti Sector are smaller size of land holding, lack of elite quality planting material and seeds, inadequate marketing facilities, improving efficiency and quality of public service delivery, fostering technological innovation, policy and institutional changes to facilitate service delivery, organizational reforms etc.

The Assam Vision 2030 under Goals 1 & 2 envisions that the Government will aim at adopting all steps to end poverty in all forms in the state, to eliminate hunger and malnutrition. Doubling productivity and cropping intensity by emphasising sustainable horticulture in the state are the objectives. The above goals are tried to be achieved through sustaining the soil health and sustaining the productivity and production.

Summary and Conclusion

After re-examining the scope of diversification for horticulture crop in Assam, it has been found that although the growth rate of area under all horticulture crops of Assam exhibits a positive trend, rates of growth are lower than the national average. Similarly, the rate of growth of production of most of the horticulture crops of Assam during the study period is much lower compared to all India average. However, in case of growth of productivity over a period of fifteen years, the state picture is better. For some horticulture crops,

especially, spices and nut crops, the productivity of the state is even better than the country average.

The study reveals that the production of most of the horticulture crops in Assam has been influenced mostly by productivity increase than the expansion of area so far. As the land man ratio is declining in the state, there is less scope for area expansion. However, mixed farming may help in this regards. There exists a homestead (*bari*) in almost every household in Assam which may be used for scientific plantation of horticulture crops. Nevertheless, there is no other option to increase productivity by modern techniques for sustainable growth in the long run.

As there is imperfect coordination between demand and supply and horticulture crops are perishable by nature, cold storage is an indispensable requirement for the farmers. It plays an important role in the marketing too. Government has already launched some initiates like Horticulture Mission for North East, Mission Organic Value Chain Development for North Eastern region etc. More government initiative is needed to strengthen the *Gaon Panchayats* so that they can help the farmers to increase production and can help marketing to make this village-based economy self-sufficient. Proper infrastructure, technology, marketing and price policy are very important in this regards. Most of the areas of Assam are considered as organic by default and there exists sufficient scope for organic farming in the state as well. Government should give proper attention for agricultural diversification to promote these horticulture crops for sustainable development of the state. Effective and rigorous initiatives are needed to achieve the SDGs for the development of the horticulture sector in the state.

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