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Editorial

We are happy to present the select best (full) papers under the proceedings of the 106th Annual Conference of the Indian Economic Association (IEA) organised during 21-23 December 2023 at the School of Open Learning, University of Delhi, New Delhi.

India is the 5thlargest economy in the world, and will be the world's 3rdlargest economy by 2027, when its GDP crosses US$ 5 trillion (IMF estimates). The 21st century will be India's century, as its economy is speedily passing through economic transformation. But the economy witnessed various challenges including growth, poverty, inequality, inclusivity, employment, good governance, etc. The IEA has been strongly debating these issues. The themes chosen for this Conference were as under:

1. India's Aspiration to be a Developed Nation: Innovation, Technology, Infrastructure and Entrepreneurship.
2. Financial Sector: Technology, Performance and Inclusivity.
3. Multi-dimensional Poverty and India: Food, Nutrition and health, Educational Attainments (Skill) and Living Standard.
4. Research (including Education), Data and Artificial Intelligence for Development.

We received very good well-researched papers from the scholars on the above-cited themes. The selected full papers are published after Referees' Reports for basic quality norms.

We congratulate to the paper contributors on behalf of the office bearers and the Executive Committee members of IEA. We encourage them to participate whole-heartedly in our Conferences. We acknowledge the support and cooperation extended by the University of Delhi, especially its very able Vice Chancellor Prof. Yogesh Singh, Prof. Payal Mago, Director School Open Learning, Prof. Ajay Jaiswal and Prof. Projesh Roy. Our deepest sense of gratefulness is due to Prof. S Sreenivasa Murthy for extending cooperation in bringing these papers in their well-recognised 'The Journal of Institute of Public Enterprise'.

Disclaimer: Views are personal

D K Madaan **V K Malhotra**

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Decoding India's Nutrition Puzzle:
Some Options to Address Under nutrition

Ramesh Chand*

India has achieved impressive growth in food production with the adoption of green revolution technology that began during late 1960s. This enabled the country to raise food production at a faster rate as compared to the growth rate in human population leading to improvement in per capita food production and availability. The improvement started around 1969-70 when country produced 365 kg food per person per year. Per capita food output increased by 25% in the next three decades and reached 455kg per person by 2000. Food production started rising at accelerated rate from the beginning of new century and reached 684 kg by the year 2021-22 ie 50 per cent increase in per capita food output in two decades (Chand and Singh, 2023). This increase in per capita food output is expected to increase per capita food intake and in turn improve nutrition and health of people of the country. On the other hand, various studies on under nutrition based on Consumer Expenditure Surveys of NSSO and nutrition norms of ICMR-NIN indicate high prevalence of under nutrition in India. Further, these studies do not support significant decline in incidence of under nutrition or hunger among Indian consumers. Rather they find increase in incidence of under nutrition (Deaton and Dreze, 2009; Radhakrishna et al. 2004; Chand and Jumarani 2013). This has created state of confusion and also raised several questions like:

1. Why there is mismatch between achievements in food production and nutrition status of population?
2. Are ICMR-NIN norms appropriate to capture under nutrition in India?
3. Why there is huge divergence in incidence of under nutrition based on ICMR-NIN norm and FAO Norm?
4. What is the effect of household income on hunger or under nutrition?
5. What explains trends in India's under nutrition?
6. Can millets help in eliminating under nutrition?
7. What should be India's strategy to improve health and nutrition?

I have attempted to address above questions and issues based on the analysis of changes in food consumption and dietary patterns and trend in availability and composition of food output in India during the last 3-4 decades. The paper is based on data and estimates derived from following sources:

- Studies based on Consumer Expenditure Surveys 1983 to 2011-12.
- FAO estimates of hunger and under nutrition 1979-81 to date.
- National Family Health Surveys 1992-1993 to 2019-21.

Changes in Consumption Pattern

The basic determinant of nutrition status of population is the quantity and composition of food. Therefore, changes in nutrition status also depend upon the changes in intake of different types of foods and food commodities. Experience of large number of countries show that changes in food consumption over time follow a particular pattern called food transition. This so-called food transition has following stages (Landy, 2009):

* Member, NITI Aayog, Government of India, New Delhi;
Delivered Presidential Address in the Annual Conference of Indian Economic Association, School of Open Learning, University of Delhi on 21 December 2023.

– First stage: Starts when in a poor country development brings enough income to people for eating more in absolute quantity. Usually corresponds to more cereals and calories intake.
– Second stage: Starts when development reach a point allowing population to shift from cheap calories (cereals) to more costly calories such as meat, egg, fish, milk products, fruits and vegetables.

The consumption pattern in India and changes therein for rural and urban combined are presented in Table 1 for the period 1983 to 2011-12. These are estimated from reports of Consumer Expenditure Surveys of NSSO. Average consumption of cereals and cereal products was 161.7 kg per person per year in the year 1983. Subsequent surveys show steady decline in per capita intake of cereals which reached 130 kg by the year 2011-12. Per capita intake of pulses also fell to two third over a period of 30 years. As it will be shown subsequently, the decline in per capita intake of cereals happened despite the fact that per capita production of cereals in the country followed significant increase. In contract to this, the decline in pulses was due to decline in production and availability. All other types of fruits namely, vegetable, fresh fruit, edible oil, eggs, meat and fish and dairy products show increase in per capita intake. Intake of sugar shows small decline over time. Per capita intake of eggs in India between 1983 and 2011-12 increased 8 times. The second highest increase was noticed in the case of edible oil whose intake doubled in thirty years.

Table 1: Changes in Consumption of major food commodities in India based on NSSO Consumer Expenditure Data

Item	Rural+Urban: Kg/year or as specified			
	1983	1993-94	2004-05	2011-12
Cereals and products	161.7	154.6	140.7	130.0
Pulses and products	12.4	9.5	8.9	9.2
Vegetables	42.8	55.7	72.9	55.9
Fresh fruits	3.1	2.9	4.2	4.4
Fresh fruit (No): banana, coconut, pineapple, orange	---	41.6	41.1	43.2
Dry fruit	0.4	0.5	1.5	0.9
Edible oil	3.8	5.1	6.4	8.0
Eggs (No)	2.1	10.5	14.5	16.8
Meat and fish	3.5	4.0	4.4	4.9
Sugar and product	10.4	10.1	9.4	9.8
Fresh milk and milk products (eq. litre)	39.2	55.4	55.0	63.2

Source: NSSO, various reports based on Consumer Expenditure Surveys.

The changes in consumption pattern during 1983 to 2011-12 revealed significant diversification in dietary pattern away from cereals throughout.

The impact of changes in consumption pattern on dietary energy intake is presented in Table-II. It is pertinent to mention that per capita intake of dietary energy, i.e. calories intake is used as the main indicator of nutrition status in India and in other countries. Population with dietary energy intake below recommended level or norm is considered under nourished or hungry. However, this norm differs across countries. The norm is derived from the energy requirement suggested by national agencies as well as Food and Agricultural Organisation of the United Nations. In case of India, this norm is prepared based on the energy requirement of reference man and women recommended by ICMR - NIN (Indian Council of Medical Research and National Institute of Nutrition). Dietary energy allowance for Indian population prepared by the expert group constituted by ICMR

and published in its report "Nutrient Requirements and Recommended Dietary Allowances for Indian Population" (ICMR 1990) have been used by various studies to examine incidence of under nutrition in the country. ICMR-NIN have revised their RDA periodically but studies on nutrition covering the period 1983 to 2011-12 have used the energy norms that correspond to 2400 Kcl for rural and 2100 Kcl for urban population which corresponds to recommendation of ICMR (1990). As compared to this, FAO considers 1800 KCL per person per day as the minimum norm for dietary energy intake. Number of persons consuming less than the normative amount of food energy are classified as under nourished and/or hungry.

Calorie intake in rural as well as urban population showed a decline after 1987-88 which continued till 2004-05. There was a small increase in dietary energy intake during 2011-12 as compared to 2004-05 but it was still lower than the dietary energy intake in earlier NSSO Round covering period 1983 to 1999-00 (Table 2).

Table 2: Dietary energy intake and share of cereals in it among rural and urban households, 1983 to 2011-12.

Year	Calorie intake (Kcal)		% calorie intake from Cereal	
	Rural	Urban	Rural	Urban
1983	2221	2089	75.69	62.37
1987-88	2233	2095	73.80	61.86
1993-94	2153	2171	71.03	58.53
1999-00	2149	2156	67.55	55.05
2004-05	2047	2020	67.54	56.08
2011-12*	2099	2058	61.10	51.64

Source: Deaton, A. and Dreze, J. (2009) Nutrition in India: Facts and interpretations. Economic and Political Weekly, 44(7): 42-65.

Note: *Source Srivastava, SK, and Chand, R. (2017) Tracking Transition in Calorie-Intake among Indian Households: Insights and Policy Implications. Agricultural Economics Research Review, 30(1) :23-35.

Cereals remained the prominent source of energy intake during 1983 to 2011-12. Their share in total energy intake was 65% in rural and 62% in urban population in the year 1983. The decline in intake of cereals as reported in Table-I resulted in decline in share of cereals in total energy intake. However, cereals continue to be the dominant source of energy with 61% share in rural and 51.6% share in urban population during 2011-12.

Information presented in Table-1 and 2 revealed that reduction in calorie intake caused by reduction in cereal intake could not be matched by increase in consumption of non-cereal food. The consumption pattern of Indian households and nutrition intake, during 1983 to 2011-12, did not follow the first stage of food transition. However, the diversification of food bowl is observed to correspond to Bennet's Law which asserts that a rise in income leads to the consumption of more costly food at the expense of cereals (Padilla 1996 quoted in Landy 2009b).

It is obvious that average calorie intake in India remained lower than the level recommended by ICMR (1990). The consequence of this is that under nutrition remained rampant in the country during the above period, ie. 1983 to 2011-12 (Table 3). According to various studies, proportion of population that is found under nourished based on the ICMR-NIN norm was 66.1% in rural India, 61.5% in urban India and 64.8% for the whole country. The incidence of under nourishment as estimated by various studies show significant increase over time. Three fourth population of India was reported under nourished in the year 2004-05 (Deaton and Dreze,

2009) which showed small decline to reach the level of 72.1% in the year 2011-12 (Srivastava and Chand 2017) the latest year for consumer expenditure survey data in the country.

Table 3: Incidence of undernourishment in India, 1983 to 2011-12.

Year	Undernourishment %			Population under poverty %	Per capita income at 2011-12 prices Rs.
	Rural	Urban	Combined		
1983	66.1	60.5	64.8	44.5	20858
1987-88	65.9	57.1	63.9	38.9	23766
1993-94	71.1	58.1	67.8	36.0	28608
1999-00	74.2	58.2	70.1	26.1	37968
2004-05	79.8	63.9	75.8	37.2#	45611
2011-12*	77.24	59.41	72.14	21.9#	63462

Source: Same as in Table 2.

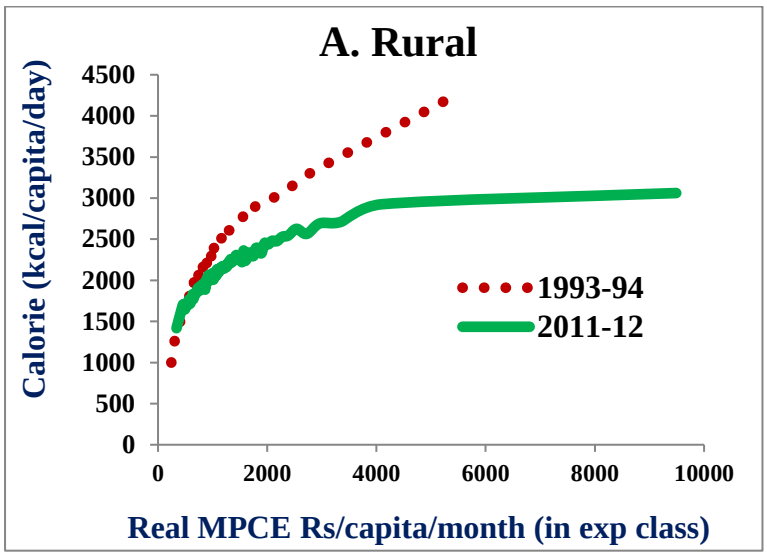
There was a change in criteria used for definition of poverty line in 2004-05.

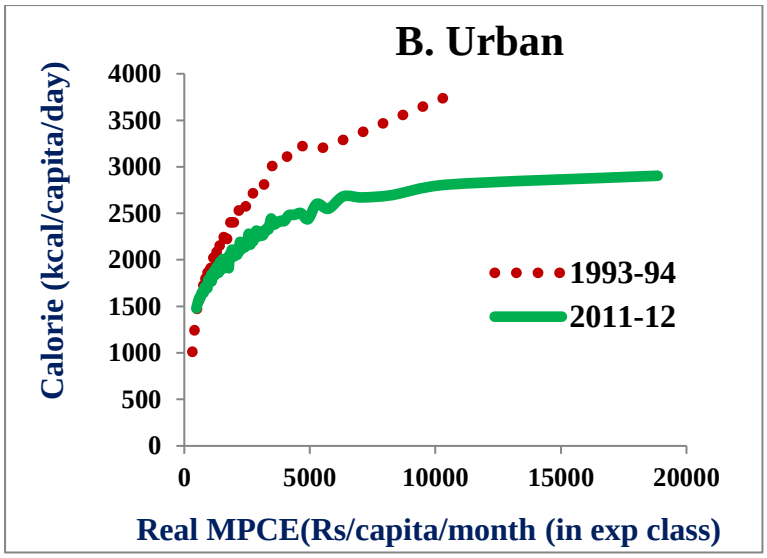
A large number of studies attributes under nutrition to poor access to food because of low income and poverty. Therefore, it is imperative to look at the trend in income and incidence of poverty. The data on per capita income and incidence of poverty for the corresponding years of CES is also included in Table-3. This shows that per capita income in India increased three times at 2011-12 prices between 1983 to 2011-12. Incidence of poverty (head count ratio %), for the said period is reported based on two set of poverty lines. The first set covers the period 1983 to 1999-2000. The poverty line was revised in the year 2004-05. The first set indicates that population under poverty in India fell from 44.5% in 1983 to 26.1% in 1999-2000. Similarly, poverty shows a drastic decline between 2004-05 and 2011-12. It looks ironical that under nourishment and poverty moved in opposite direction. The obvious question that follows from Table-3 is why hunger did not decline at all when income increased and poverty declined? This also underscore the need to look at other factors to explain persistent level of under nutrition. Was there any supply constraint? Is the ICMR-NIN norm for under nutrition too high and doesn't accurately capture energy requirement of Indian population? Do food prices have any role to play in this? I will turn to these issues in a later session.

Evidence from Disaggregate (unit level data)

Two types of factors play important role in explaining dietary energy intake. These relate to income and changes in dietary preferences over time due to changes in lifestyle, nature of work and physical activities, comfort of life and nutrition awareness. The effect of income on calorie intake was seen by looking at calorie intake by households arranged in ascending order of monthly per capita expenditure while effect of change in dietary preference and other factors was seen by comparing income calorie relationship over time (Figure-1A and 1B).

Fig 1: Real monthly per capita consumption expenditure and calorie intake across expenditure classes 1% to 100%, arranged in ascending order, A-Rural and B- Urban.



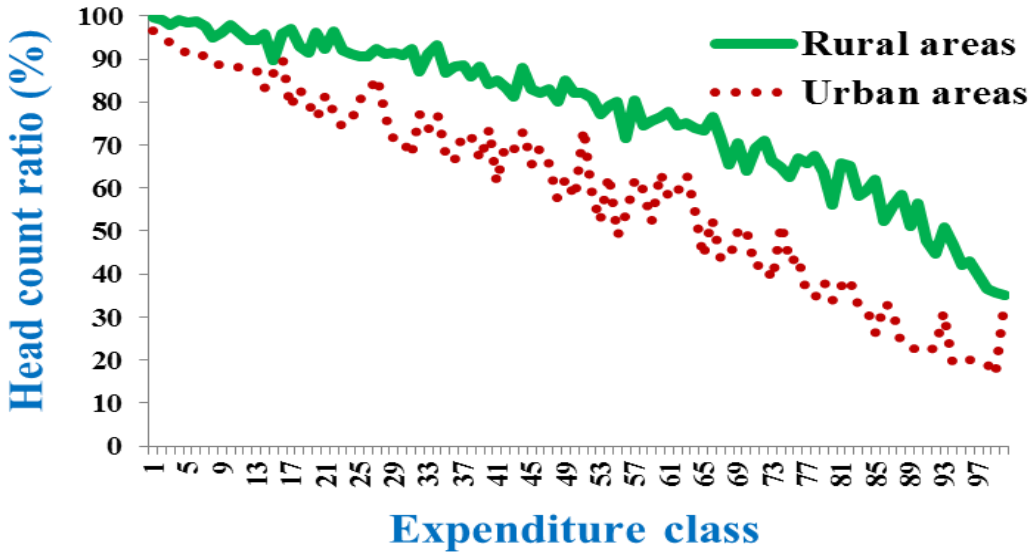


Mean daily calorie intake increased with increase in expenditure class in both the CES years 1993-94 and 2011-12 in rural as well as urban households. Per capita dietary energy intake during 2011-12 varied from 1418 kcl (1st expenditure class) to 3061 kcal (100th expenditure class) in rural areas. In urban areas, top expenditure class consumed 1425 kcal more than the poorest households. In both the cases, calorie intake for same level of expenditure (at constant prices) declined over time ie downward shift in MPCE- calorie curve over time. These patterns suggest a positive relationship between income and calorie intake in cross section data but negative association with income over time.

Downward shift in MPCE – calorie curve over time seems to be the result of changing lifestyle and activity burden. Rise in mechanisation of manual operations, increased access to better means of transportation and communication are some of the factors which involves lower energy spending. These changes raise question about relevance of uniform dietary energy norms during the study period.

Incidence of undernourishment as per the ICMR-NIN norm in various expenditure classes is presented in Fig 2. This shows that almost all households in rural and urban areas in bottom 1% expenditure class consume food that does not meet their minimum energy requirement. This proportion decline as we move to higher expenditure class but it did not vanish. One fifth of households in top expenditure class were found to be consuming less than what was considered minimum energy requirement for them. This raises another serious issue as to why some households in high income categories were not consuming food that give them required energy. This also suggest to examine the appropriateness of dietary energy norms used in various studies on nutrition in the country.

Fig 2: Prevalence of undernourishment among expenditure classes with households arranged in ascending order 1 to 100%, CES data 2011-12.



FAO Estimates of Under nutrition

FAO uses uniform norm of 1800 KCL as threshold to ascertain under nutrition or hunger. This is much lower than the average of recommended by ICMR-NIN which is 2400KCL for rural and 2100 KCL for urban households. Second FAO uses different methodology to prepare indicator of undernourishment which is not based on actual household consumption. FAO estimate is derived from supply side or food balance sheet subjected to specific types of distribution over population taken from limited sample in different countries. FAO estimates are reported for moving average of three years to take care of year-to-year variation in stocks.

According to FAO 261 million persons were undernourished in the beginning of 1980. They constituted 38 per cent of total population of the country (Table 3). Prevalence of under nutrition declined to 25 percent in next decade and further to 18.4 per cent in the second decade after 1980. Thus, the period between 1980 and 2001 witnessed halving of prevalence of under nutrition, from 38% to 18.4%, along with reduction in absolute number of undernourished persons. There was some deterioration in under nutrition in the first half of the first decade of 2000. The second phase of improvement in under nutrition started after 2004-06 which brought down under nutrition to around 13.2% during 2016-2019. Recent years coinciding with COVID 19 indicate increase in undernourishment.

Table 3: FAO Estimates of number and prevalence of undernourished population in India.

Year (3 Year Avg.)	Number of people undernourished (million)	Prevalence of undernourishment (percent)
1979-81	261.50	37.95
1990-92	215.60	25.03
2000-02	198.30	18.40
2001-03	219.30	20.10
2002-04	239.30	21.50
2003-05	249.60	22.10
2004-06	247.80	21.60
2005-07	228.80	19.60
2006-08	207.20	17.50
2007-09	199.00	16.60
2008-10	198.00	16.30
2009-11	195.90	15.90
2010-12	193.10	15.40
2011-13	189.00	14.90
2012-14	190.80	14.90
2013-15	192.00	14.80
2014-16	190.50	14.50
2015-17	184.10	13.90
2016-18	176.30	13.20
2017-19	180.20	13.30
2018-20	200.00	14.60
2019-21	222.10	16.30
2020-22	233.90	16.60

Source: FAO State of Food Insecurity, various Issues.

Divergence Between FAO Estimates and Studies based on CES data

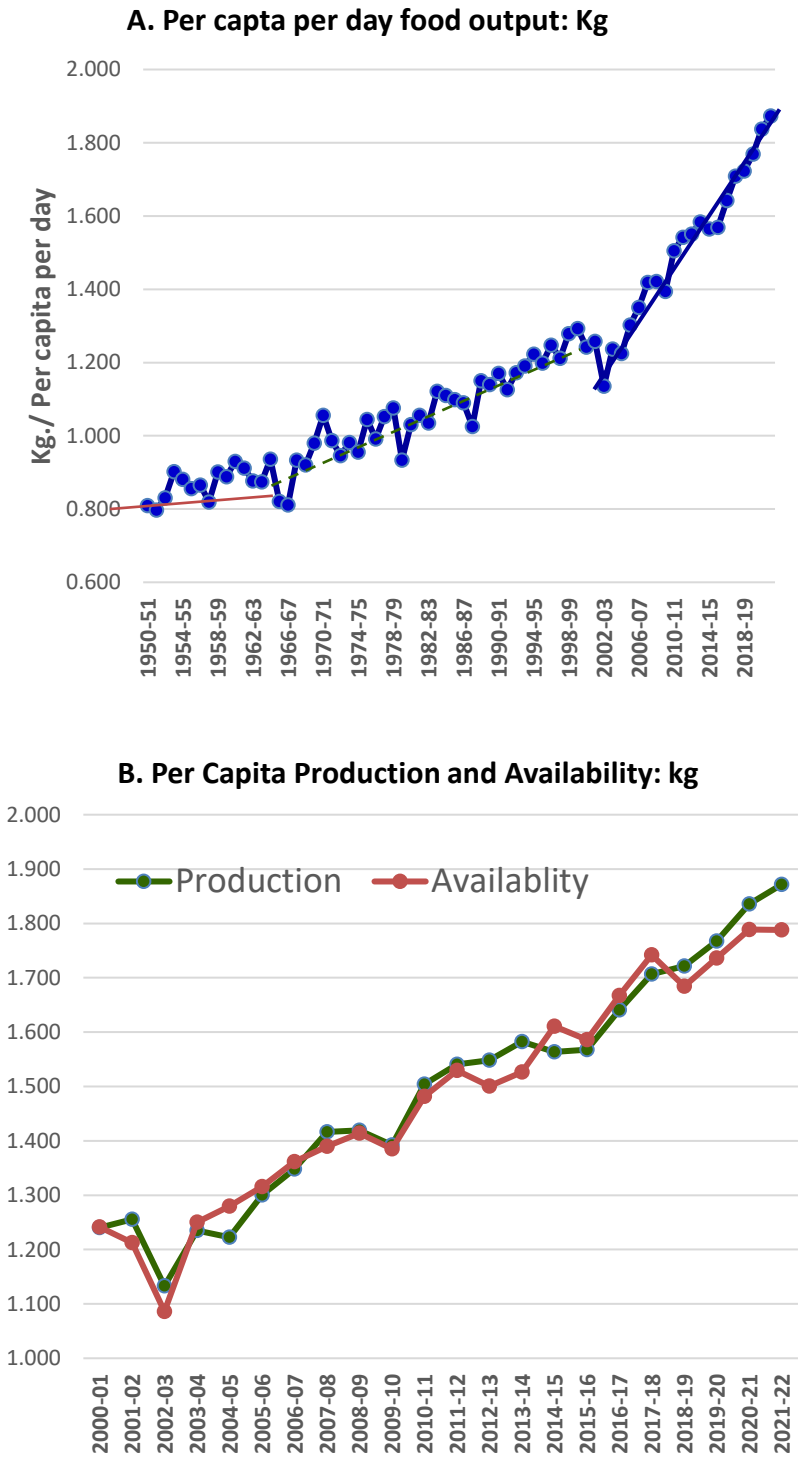
The incidence of under nutrition reported by FAO during early 1980s was 38% whereas estimates based on ICMR-NIN norm report undernourishment to be as high as 64.8%. Second, FAO estimates show a declining trend in undernourishment over time which dropped below 15% by the year 2011-12 whereas, studies using CES data and ICMR-NIN norm indicate increase in under nourishment to inflict 72% of population of India. Such a wide gap and divergence in two sets of trends in under nutrition is mainly due to the calorie norm used in the two types of estimates. FAO estimates are found to be closely following the trend in poverty and per capita income in the country whereas, estimates derived from CES data by various studies implies that reduction in poverty and increase in per capita income in India have no effect on under nutrition.

Food Production and Availability

Status of nutrition is also affected by availability and production of food. It is well known that in India food production in most of the period since adoption of Green Revolution increased at a much faster rate than

increase in human population (Chand and Singh, 2023). Per capita food production and availability are depicted in Figure-2A and B. Part A of the Figure presents trend in per capita food production for the period 1980-81 to 2021-22 while part B presents production as well as availability adjusted for export and import and change in stock.

Fig. 3: Per Person Food Production and Availability



India produced around 374 kg of food per person in a year during early 1980s. Per capita food production increased to 562 kg during 2011-12 and further it increased to 683 kg during 2021-22. Between 1983-84 and 2011-12 per capita food production increased by 50%. Availability of food followed more or less similar trend.

The second dimension of food that affects nutrition is composition of food basket. Changes in food basket can be seen from the per capita availability of different types of food (Table 4). There is moderate to very high increase in per capita availability of most of food during the first decade of 21st century which continued in the second decade. The only commodity to show decline in availability are nutri cereals and sugar.

Table 4: Per capita availability of various foods: kg/year

Item	2000-01 to 2002-03	2010-11 to 2012-13	2019-20 to 2021-22
Cereals	162.4	178.3	189.3
Nutri cereals	15.5	15.0	12.2
Pulses	12.8	17.4	20.4
Sugar	28.0	28.2	26.8
Edible Oil	10.4	17.2	19.6
Fruits	42.2	64.1	75.5
Vegetables	85.3	126.1	143.2
Onion	3.9	12.4	19.6
Potato	22.3	35.3	38.6
Milk	80.6	104.9	152.1
Egg (number)	37.0	54.3	88.2
Meat	1.6	3.7	5.6
Fish	5.2	6.4	9.6
Food total	430.4	549.0	646.5

Note: Availability is taken as Production +import-export adjusted for change in stock.

It is important to mention that availability doesn't imply intake as food – it includes part of food commodities used for feed, seed, industrial use and wastage. It can be considered as a proxy for the trend in per capita availability of food. These estimates show that per capita annual availability of food in the country increased from 430Kg per person in the beginning of 21st century to 549 kg during the triennium 2010-11 to 2012-13 and 646 kg in early 2020s. Cereal share in the total quantity of food declined from 38 per cent to 29% despite increase in their availability. Despite 3.5-fold increase over two decades share of meat products in total quantity of food remain below 1 per cent.

Trend emerging from CES data and supply side data show large and increasing divergence. CES data shows very small improvement in total diet and decline in per capita intake of cereals. Supply side data show very large improvement in availability and absorption of cereals and total food.

Health Outcome: Anthropometric Measures

Health outcomes are also considered to reflect the effect of changes in nutrition though they are affected by other factors like health care, sanitation hygiene access to clean water etc. Health indicators of children like stunting and underweight show steady improvement between 1992-93 and 2019-21 (table 5). Women with body mass index below normal in total population of women fell to half; from 36.2% in 1998-99 to 2019-21, along with doubling of obese or over- weight women. The incidence of anaemia especially among women remain quite high in the country.

Table 5: Health indicators in respect of children and women as seen from NFHS data

Indicator	NFHS Years				
	1992-93	1998-99	2005-06	2015-16	2019-21
Children under 5 years who are stunted (%) #	na	51.0	48.0	38.4	35.5
Children under 5 years who are underweight (%) #	51.5	42.7	42.5	35.8	32.1
Women whose Body Mass Index (BMI) is below normal (%)	na	36.2	35.5	22.9	18.7
Women who are overweight or obese (%)	na	10.6	12.6	20.6	24.0
Children under 5 years who are anaemic (%)	na	74.2	69.4	58.6	67.1
Pregnant women age 15-49 years who are anaemic (%)	na	49.7	57.9	50.4	52.2

Source: National Family Health Survey (India fact sheets of different years).
Note: # The estimates for for years 1998-99 and 1992-93, are for children aged under 3 years.

Explaining the Puzzle

There is a complete mismatch between the trend in total food production, composition of food, availability of food per person, poverty and per capita income on one hand and incidence of undernourishment as revealed by studies based on CES and ICMR-NIN norm for minimum dietary energy intake. Lot of evidence point to the ICMR-NIN norm being much higher than what is relevant for India. Moreover, the same norm has been used for the period 1983 to 2011-12 when country witnessed lot of changes in lifestyle, energy expended, mechanisation etc. Nevertheless, there is under nutrition in the country and reasons for it vary across income groups. Poor access to nutritive food, is the main reason for prevalence of under nutrition among low-income households. Prevalence of under nutrition in the high-income households cannot be explained by lack of purchasing power. Chand and Jumrani (2013) termed this as 'voluntary hunger', i.e., consuming food that doesn't give recommended energy by choice. It seems that awareness about importance of dietary energy and its deficiency is not high in the country. This is supported by the fact that per capita intake of cereals, which is the cheapest source of energy, is found to be declining in the household's consumption expenditure survey. This has been acknowledged by many studies including study by Deaton and Dreze (2009).

A completely different explanation for absence of food transition in India is provided by Frederic Landy (2009a and b). According to this author, India is far from having completed even first stage of food transition. According to Landy, India's dietary changes are strongly influenced by India specific social and cultural factors and these need to be invoked to explain the absence of dietary transition in India that was witnessed in almost all the countries. Landy says it could be termed as The Hindu Food Transition. The cultural and religious beliefs are said to be strong factor in slow transition towards non vegetarian food. Moreover, the Tridosha theory, or that of heat of different foods is generally widely accepted (Landy 2009 b).

Some studies emphasise the need to go from purely calorie analysis to a more qualitative one and look at nutritional situation in terms of protein, carbohydrates, fats, and micro nutrients (Dorin 1999).

There is significant change in physical activity over time which implies that calorie requirement has gone downward. However, studies on CES data till 2011-12 used the ICMR (1990) norm for the reference year 1989 which seems to be much higher than actual dietary energy requirement. ICMR-NIN have published a report that updates the nutrient requirements for Indians, based on concepts related to the distribution of nutrient requirements in normal individuals (ICMR-NIN 2020). The report provides Estimated Average Requirement (EAR) and the Recommended Dietary Allowances (RDA) derived from the EAR. The incidence of under nutrition and malnutrition for India in recent years should be examined based on these new norms and recommendations. Hopefully this will provide more realistic assessment of status of nutrition in the country.

Concluding Remarks

Estimates of under nutrition in India based on CES data are not available beyond year 2011-12 because of data availability. India started largest food safety programme in the world in year 2013 which entitle by law right to food. Under this (NFSA) cereals are supplied to two third of population at a highly subsidised rate under public distribution system. These supplies through PDS meet about 40 per cent of total intake of cereals as food by the beneficiary households. PDS supplies under NFSA have been made totally free now. These provisions are expected to improve per capita intake of cereals and total food and thus improve under nutrition. However, estimates of under nutrition with the progress in NFSA based on CE data are not available at national level. Only FAO estimates on undermatron are available for post NFSA period which show small decline in under nutrition till the beginning of Covid period.

“ICMR –NIN” norms for nutrition used hitherto by various studies that used CES data till year 2011-12 do not seem to have captured true nature and extent of changes in under nutrition in India. The ICMR-NIN have now come with the recommendation on estimated average requirement and recommended dietary allowance relevant to the nutrition requirement around 2020 and recent period. There is thus need for fresh assessment of under nutrition in India based on the current recommended dietary allowance.

FAO norm, which is much lower than the national norm shows prevalence of hunger among well to do households or high-income households. This can happen either due to lack of awareness about energy needs of the body or personal choices to settle below recommended energy intake level.

To sum up, estimates of hunger based on outdated norms derived from decade old data cannot be considered to represent current status of undernutrition in the country. Second, social, religious and cultural factors impart strong specificity to dietary pattern of majority of Indian population. They need to be appropriately reckoned to fully grasp under nutrition and malnutrition among Indian population.

Disclaimer: Views are personal

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Evolution of Digital Technology in India-An Assessment

Dhulasi Birundha Varadarajan*

Abstract

India is having 1.39 billion population and considered as one of the over Populated countries in the world. At Present the digital economy is contributing to India's economic growth, with the 6.5% real gross domestic product (GDP) for the Financial Year 2024.Government of India launched the Digital India programme in July 2015 with the objective of taking India into a digitally oriented society and knowledge-based economy. Digital adoption is enhanced by decisive government action and private-sector innovation. Globally the digital global economy is growing from 11.5 trillion dollars in 2016 to 15 trillion dollars in 2023.

This paper deals with the Concept of Digital economy, Measurement of Digital economy, Backward and forward linkages Digital India Programme, Role of Digital Technology in Various Sectors of India such as Employment, Industries, Unified payment interface, Aadhaar Net Work, Smart Phones, e-Commerce Start-ups Unicorns, Education sector, Health services, Agriculture sector and Women safety. As a concluding remark, the analysis of the web economy in coming years in India, Challenges to digital evolution and few Suggestions are made. This paper used secondary data from web sources. The Statistical tools applied are percentage analysis and compound Growth rate.

Keywords: Digital Economy, Digital India Programme, Contribution of Digital Economy.

Introduction:

India is having 1.39 billion population and considered as one among the over Populated countries in the world. At Present the digital economy is contributing to India's economic growth, with the 6.5% real gross domestic product (GDP) for the Financial Year 2024.Government of India launched the Digital India programme in July 2015 with the objective of taking India into a digitally oriented society and knowledge-based economy. Digital adoption is enhanced by decisive government action and private-sector innovation. Globally the digital global economy is growing from 11.5 trillion dollars in 2016 to 15 trillion dollars in 2023.(Pankaj Jagannath Jayswal,2022).

Concept of Digital economy:

The term digital economy was first evolved in the 1990s and having recognised digitalization is multidimensional in character .The term digital economy was then popularised by Don Tapscott through his book entitled, " The Digital Economy: Promise and Peril in the Age of Networked Intelligence ," with the objective of transforming the type of technological innovation by including digital technologies in commodities and services across all-around of sectors. Deloitte(2021) defines digital economics as an economic activity that's generated by human and technology connections .Research publisher, The Conversation, explains that the digital economy reflects how digital technology affects production and consumption services, products, techniques, and skills and how they are integrated across economies in digitalisation(Wharton, 2023) .

Through the operations of digital technology, the economic activities are enhanced by connecting individuals, businesses, devices and data and their emerging invention sand technology. Due to its reliance on digital technology and online transactions ,the digital economy had changed the transaction pattern of traditional industries through internet of things (IoT), artificial intelligence (AI), virtual reality, blockchain and autonomous

* Emeritus Professor, Senior fellow, ICSSR, New Delhi, Former Chairperson, Senior Professor & Head, Department of Environmental Economics, School of Economics, Madurai Kamaraj University, Madurai-625021.
Email: dhulasibirundha@yahoo.com

vehicles . Because of its dependence on internet connectivity, earlier the digital economy was known as the internet economy, the new economy or the web economy. But by comparing the internet economy, economists and business leaders assert that the digital economy is more advanced and complex in nature. In the late 20th century with the transition from analog electronic and mechanical devices to digital technologies, the Digital Revolution took place, reflects the move from the third industrial revolution to the fourth industrial revolution. to bridge the physical world and cyber world. (Kinza Yasar, Mary K. Prat, 2023).

Measurement of Digital Economy:

The measurement of the growth of internet economy can be done through various indicators. Such as the Bureau of Economic Analysis 2022 report measured the impact of the internet economy by with the indicators such as Infrastructure, hardware and physical materials that support the use of computer networks, information and communications (ICT), Commodities and other assistances, Software and priced digital services, computing charges to the customer and E-commerce margins, (Masterclass ,2022).

Backward and forward linkages:

The base of E-good, and E-service. are classified into five categories namely: (a) machinery (b)electronic formatting, outputting, (c) E-publishing (d) broadcasting services, and (e) expert services under Asian Development Bank (2021) framework and core digital economy were identified by its backward and forward linkages. Under ADB's framework a distinction between digitally enabling and digitally enabled products are made.

Table 1(Appendix) explains the contribution of Digital economy towards the GDP of Indian economy and to Global Economy. The Positive projections by various agencies asserts the key role played by Digital sectors.

Initiatives of Digital India:

In July 2015, the Government of India launched the 'Digital India' initiative. This initiative emphasises on developing a secure digital infrastructure, offering internet services and providing every citizen has access to the Internet through high-speed Internet networks connection to rural areas, improving digital literacy and job opportunities. This venture emphasises key dimensions namely, a) establishing the practice of protecting IT systems and assets against both physical and cyber threats, b) providing web service, internet service, electronic service and c) ensuring access to the Internet to every digital citizen.

Table 2(Appendix) shows the Budget Estimates from 2015 to 2023 towards North Eastern areas and to Industry by Ministry of Electronics and Information Technology of India.Total allocations to these heads are shown in Column 1 and three.Out of Total allocations Budget estimates for Digital India Programme under these heads are shown in Columns 2 and 4.Percentages to total are given in Shaded columns.From this it is observed much variations in percentage share. There is Lower compound growth rate of Total budget estimates and Budget Estimates for Digital India Programme under these two heads namely North Eastern Areas and Industry.

The Figure 1 (Appendix)Showing The Percentage Share also exaplains that there is much variation in the Budget Estimates towards Digital India Programme.

Role of Digital Technology in Various Sectors of India:

Employment: Regarding the composition of Population in India, 67%8 of India's population belongs to the working age group. There is an estimate that over the next decade 25% of the incremental global workforce will come from India and by 2030, India's working age population will exceed 1billion (Ernst & young India,).

But the notable feature pointed out by the RBI report is that only limited employment would be in the internet sectors of the Indian economy. As per Periodic Labour Force Survey, workers employed in the total internet economy were estimated at 4.9 million and 15.2%. in telecommunication services. In Total ,62.4 million

workers were employed in the internet sectors in 2019. McKinsey & Company conducted a study of 25,000 Americans on 2022(Mc Kinsey Global Institute,2019) found that 58% of Americans want to work from home at least one day a week while 35% want the option to work from home full-time. (Wharton, 2023). The 1,500 Global Capability Centres (GCCs) in India representing 45% of global GCCs are access to manpower who are skilled in new technologies. (Ernst& young India, 2023). Some 40 million to 45 million displaced workers would be reemployed by acquiring digital skills.

Industries:

Many small, medium, and large enterprises have adopted UPI (Unified Payments Interface) and BHIM (Bharat Interface for Money), with UPI transactions worth of INR 10.7 trillion in August 2022. (STI tech, Digital Technology-,2022). Through the MTB Scheme (Monthly Benefit Plan), the SME sector was given a push. Hundreds of small-scale units a was promoted centrally through electronic media regarding technology, product design and low prices. Indian Government had Set up Software Parks at Bangalore, Pune, Bhubaneshwar and Delhi to assist Industries.

Unified payment interface UPI:

India's unified payment interface (UPI), a real-time digital payment system, has revolutionised digital payments in the country. According to a study by the World Economic Forum, up to February 2023, approximately ₹300 lakh crore has been transacted through UPI since its inception in April 2016. If this amount had not been transacted through UPI, it would have cost the economy approximately ₹5.50 lakh crore to ₹7.2 lakh crore depending on the alternatives such as cash, credit cards and debit cards (Rajeev Jayaswal, 2023,). Digital KYC (Electronic Know your customer) and Jan Dhan Yojna 452 million Indians benefitted under the banking and financial services. (STI tech, Digital Technology,2022). India today accounts for the real-time digital payments by 260million unique users, with a share of over 40% through the adoption of Unified Payments Interface (UPI), (Ernst & young India ,2023). From November 2019 to January 2023 there is three times increase of digital transactions in India from 300 crores to 1,052 crores. (Srivastava2023).

Aadhaar:

In India 1.35 billion individuals had been provided online bio-metric based digital identity known as Aadhaar with the objective tha t no Indian should remain without individual identity. Now 99% of Indian adults are holding Aadhaar number and Government has made linking the Aadhaar number with bank accounts and mobile phones. By including Pradhan Mantri Jan Dhan Yojana (J), (A) Aadhaar (for identification and authentication) and (M) Mobile (for telecommunications), a system called JAM trinity is evolved. During the short period, nearly 300 million bank accounts opening up India which facilitated financial inclusion. **(**Rajat Kumar**,** 2022).

Net Work:

IT sector in India contributes USD 300 billion. With already existing network of over 28 lakh kilometres, now high-speed Wi-Fi hotspots and constructing the network of OFC (Optical Fibre Communications) are developed. India had launched rural broadband connectivity project known as Bharat Net wherein 2.5 lakhs gram panchayats were connected. Due to Internet adoption and digital penetration 658 million active internet users. This growth would facilitate the digital advertising and marketing result in earning of $780 billion by 2026. (Pankaj Jagannath Jayswal,2022). Between 2016 to 2021 there is also an increase of Mobile broadband (MBB) from345 million to 765million. As of December 2021, by 2030, with 500 million to 600 million online shoppers India would have considered the second largest country in online shopping.

Smart Phones:

In India, mobile phones subscribers are1 billion mobile subscribers in 2015 and adding 6.83 million new mobile subscribers amounting the total of 1003.49 million, out of which urban 578.11 million, are from urban and 425.38 million mobiles are rural subscribers. According to Ericsson (2015), India the mobile broadband coverage (3G or above) worldwide had increased from 1 billion subscribers in 2010 to 7.7 billion subscribers in 2020. When near-zero subscriptions were introduced in 1999 (when NTT DoCoMo introduced the first smartphone with a mass uptake) there were 6.1billion subscriptions in 2020. (CSD,2023). As per 2019, 200 million smartphone users and 550 million internet subscribers are in India **(**Rajat Kumar, 2022).

e-Commerce:

The e-commerce market emerged in all sectors of the Economy at a yearly rate of 51 % from Rs 2,484.9 billion in 2017 to Rs 8,526.5 billion in 2020. Besides, it gave also the employment orientation to warehouse management, content strategy, and marketing professionals. (Rajatkumar Dani , 2022).ONDC (Open Network for Digital Commerce)reduced the platform fees by 20-30%, facilitating such growth.(STI tech, Digital Technology- ,2022).Digital platforms and e-payment systems helped ONDC , E-commerce market to grow from USD 38 billion in 2021 to USD 120 billion in 2026 in India .Government marketplace (GeM), which is one of the largest procurement platforms with annual gross marketing value of US$14.2b would grow to US$350b by 2030. (Ernst & young India, 2023).

Start-ups:

Due to the emergence of digital revolution many start- ups are started in digital market-places with the objective of creation of employment. On this line during the 2014-19 period, technology-based start-ups in India had grown by 12-15%. These Start-ups had offered employment in the areas of Big Data, analytics, and cloud computing. and also, in employment in the field of cyber security, social media services, and mobile application development. Now in India there are 21,000 startups, out of which about 9,000 are technology startups. (Master class, 2022). As of 03rd October 2023, India, being the 3rd largest ecosystem for startups globally with over 1,12,718 DPIIT-recognized startups across 763 districts of the country. Due to India's emphasis on financial inclusion and expanding market opportunity for entrepreneurship had led start-up ecosystem through 84,000 recognized start-ups. (Ernst & young India, 2023).

Unicorns:

A privately held startup company industry with a value of over $1 billion of the venture capital investments is defined as Unicorn. India had 107 unicorns with a total valuation of US$341billion. As of 03 October 2023, India is home to 111 unicorns with a total valuation of$ 349.67 billion. Company that has secured a valuation of more than $ 10 Bn is known as decacorn, 56 companies' world over had achieved the decacorn status as of 03rd October 2023. (Ernst & young India, 2023).

Education sector:

Government of India had introduced the schemes such as SWAYAM, e-PATHSHALA, Mid-Day Meal Monitoring App/ Shaala Sidhi/ Shaala Darpan and OLABS in the education sector with the aim to digitalise the Education sector. To boost up higher education digitally, Indian Government had initiated the schemes namely the National Scholarship Portal, e Granthalya, National Knowledge Network and Digital literacy program for rural adults. These efforts would definitely help to deliver education to the needy and bridge the gap between haves and have-nots of education. To digitally educate rural people, The Pradhan Mantri Grameen Digital Saksharta Abhiyan (PMGDISHA) was introduced which will cover 6 crore households in rural areas. (Rajatkumar Dani, 2022).

The introduction of Massive Open Online Courses (MOOCs) facilitates students to gain free access to high-quality university courses such as design and use of ICTs, having recognised the fact that no computers to nearly 15 crore rural households, special training materials are also being sent through smart phones, tablets, laptops, and other devices. (Masterclass, 2022).

Other Sectors:

Health services:
With the aim to achieve a safe and healthy future society, digitalisation of the health sector is much needed in this hour. Digital AIIMS (All India Medical Sciences) made an interrelationship between UIDAI (Unique Health Identification Number) and AIIMS. An open-source health management system i.e. the 'e-hospitals' scheme helped to increase accessibility of the people in remote areas.

Agriculture sector:
Digitalisation of India had also benefited Farmers. The Digital Programmes in the Agricultural sectors are Kisan, Farmer portal, Kisan Suvidha app, Pusa Krishi, Soil Health Card app, eNAM, Crop Insurance Mobile APP, Agri Market app and Fertilizer Monitoring App. Plans to connect rural areas with high-speed Internet networks under what we call "ICT for All" as platforms, which hold technology and a shared digital infrastructure were included under The Digital India Program.

Women safety:
In the wave of digital technology revolution, several apps are developed to ensure women safety in India. For example**,** 'Nirbhaya app' and 'Himmat app' had been introduced which helped to send distress calls. Nirbhaya is a mobile phone app introduced by Uttar Pradesh Police in India with the objective to improve the safety of women. Similarly, Delhi Police with the aim to have women's safety, has introduced a mobile application named HIMMAT (Courage) (Rajat Kumar**,** 2022**).**

The future of the digital economy:
According to the prediction of The World Economic Forum by the next 10 years, business models built on digitally enabled platforms would account for 70% of all new value created. (Kinza Yasar, Mary K. Prat, 2023) The technologies which are expected to shape the digital economy's future: AI and machine learning. Transformation of traditional sectors to Digital connectivity, Healthcare transformation and Cybersecurity advancements. Regarding the advantages of the digitalisation, the digital economy provides numerous benefits such as Increased productivity, Reduced costs, Extended reach, Access to more data, Greater convenience, Improved customer experience and Personalization. The disadvantages of the digital economy are loss of Privacy and uncertainty regarding security, Waves of disruption, Job displacement, Monopoly, Digital divide and Environmental footprint.

Challenges to digital evolution:

- The Major Challenge is slow and delayed infrastructure development. Connectivity to rural areas is essential to overcome digital divide. To achieve sustainable infrastructure development, it would be difficult to explore PPP models. Government can incentivize startups to obtain better connectivity through its policies.

- The next challenge is improving IT literacy. It is a herculean task how to inculcate Digital literacy among the masses especially Rural People.

- The biggest challenge is protection of data, especially financial data, is a big concern. Digital medium is still relatively unsafe with which may lead to cyber-attacks becomes a big challenge especially when in commercial and financial transactions are made.

Suggestions:

- Technology companies should adopt public-private partnership and they must encourage better integration of automation, data, and new technologies
- At schools at early levels, Steps must be taken to impart skills required to blossom in a digital economy, specifically. Invest in building capabilities, including partnering with universities and outsourcing or gaining talent to undertake digital projects.
- The government at the central and state levels, as well as industries, should capture the local and global market. Prior importance should be given to Start-ups, Unicorns, and companies focusing on R&D.
- If India is to achieve its digital potential there is a need for the integrated efforts of all stakeholders.
- Now it is the time to develop digital infrastructure and public data and to take care of strong privacy and security safeguards.
- Peoples should be informed about the importance of digital economy to bring behavioural changes to prepare workers and consumers to utilise the digital opportunities.

Conclusion:

Now India is moving towards the leader on World's technology platform through private sector, expanding technology capabilities, its innovative entrepreneurial potential, and through various policies. Since 2014, a set of Policies such as Digital India, Skill India, Make in India, and 'Smart Cities' were initiated with a aim to overcome bureaucratic outlook, red tapism and leading the country more investor-friendly. The Digital revolution has given considerable benefits to society at large. Because of India 's digital conversion, the lives of every Indian had changed with the usage of digital technologies. Thus, currently what we are visualising is the real changes and the digital revolution may have its impact on poverty reduction and creation of technology-oriented job opportunities and thereby enhancing the overall economic development of the country.

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Table 1: Contribution of Digital Economy in India and Globally

Year	Digital Economy	Data	Estimation By
2011 to 2019	Compound Growth Rate	10.6%	RBI
2014-2019	share of India's core digital economy	5.4% of Gross Value Added to 8.5%	RBI
2019	share of digitally oriented sectors	22.4%	RBI
2014 and 2019	non-digital output multiplier fell	From 1.68 to 1.57	RBI
2014 and 2019	the digital output multiplier increased	from 1.34 to 1.50.	RBI
2016-2025	global internet economy	US$11 trillion i.e., 15.5% of global gross domestic product (GDP) Expected to reach 2025. US$23 trillion (24.3% of global GDP)	Joint collaborative research by Huawei and Oxford Economics
2019-2025	India's internet economy	US$200 billion in 2019, which is expected to rise to US$500 billion by 2025	Study by MeiTY (2019)

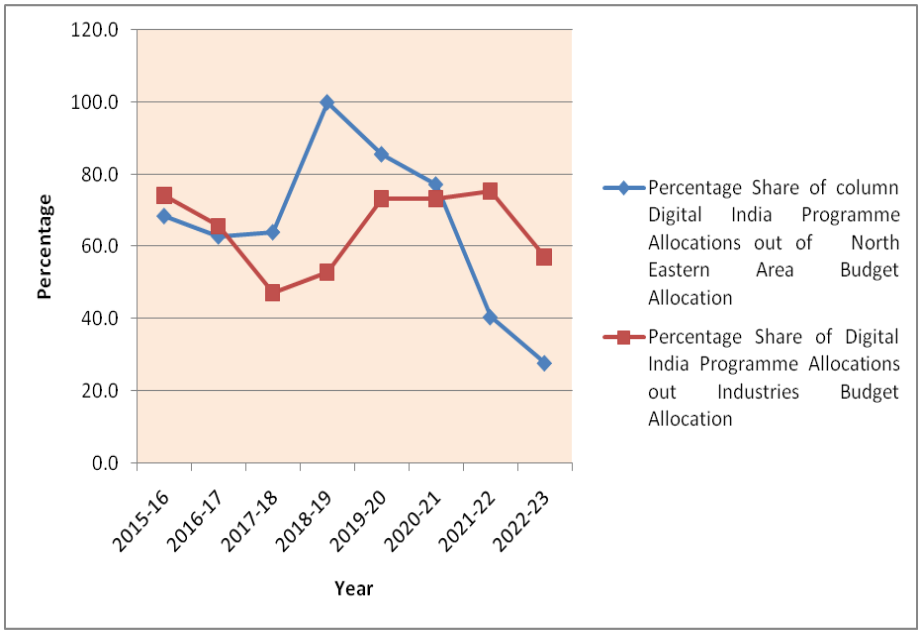
Source: Srivastava, D.K, 2023,Pankaj Jagannath Jayswal,2022 , STI tech, Digital Technology-,2022, Ernst & young India, 2023, Mc Kinsey Global Institute,2019

Table 2: Budget Estimates of Digital India Programme of North Eastern Area & Industries & Percentage Share of Digital India Programme. Share of Budget Allocation to Digital India Programme out of Industries allocation

	North Eastern Area-Major Head 2552			Industries -Major Head 2852		
Year	Total Budget Allocation Rupees in crores 1	Digital India Programme Allocations 2	% Share Of column 2 to 1	Budget Allocation to Industries Total Rupees in crores 3	Digital India Programme Allocations 4	% Share Of column 4 to 3
2015-16	24.39	16.7	68.5	167.8	124.3	74.1
2016-17	30.4	19.1	62.8	135.2	88.7	65.6
2017-18	26.1	16 .7	64.0	255.1	120.1	47.1
2018-19	30.8	30.8	100.0	435.7	230.1	52.8
2019-20	37.5	32.1	85.6	362.3	265.5	73.3
2020-21	39.5	30.5	77.2	397.4	290.8	73.2
2021-22	68.06	27.5	40.4	673.4	507.5	75.4
2022-23	106.76	29.5	27.6	1043.3	595.1	57.0
Total 2015 to 2023	363.5	202.9	55.8	3470.2	2222.1	64.0
Compound Growth Rate	0.203	0.074		0.256	0. 216	

Source: Various Issues of Demands for Grants of Ministry Electronics and Information Technology of India, https://www.google.com/search?q=DETAILED+DEMANDS+FOR+GRA+NTS+OF+DEPARTMENT+OF +ElECTRONICS

FIG 1: Budget Estimates of Digital India Programme of North Eastern Area & Industries & Percentage Share of Digital India Programme. Share of Budget Allocation to Digital India Programme out of Industries allocation



Empowerment of Craftswomen in Handicraft & Handloom Sector: A Study of Selected Craftswomen at Suraj Kund Craft Fair 2023

A M Jose,[*] Vani Aggarwal[#] and Faraz Ahmad[&]

Abstract: This study examines the empowerment of women in India's handicraft and handloom sector, focusing on craftswomen participating in the 2023 Suraj Kund Craft Fair. Using a mixed-methods approach, the research explores the socio-economic and cultural factors that impact craftswomen's empowerment, highlighting their access to resources, financial independence, skill development, and decision-making. Through interviews, observations, and surveys, we analyzed the Fair's influence on empowerment outcomes such as economic growth, skill enhancement, and social recognition. Additionally, we identified challenges hindering full empowerment and proposed actionable recommendations to address them. The study also evaluates the Fair's initiatives, policies, and support mechanisms to understand its role in expanding craftswomen's visibility, market reach, and economic opportunities. By analyzing the successes and obstacles faced by these craftswomen, this research provides insights for policymakers and stakeholders on enhancing socio-economic conditions for women in this sector. Ultimately, the study emphasizes the importance of empowering craftswomen as key to preserving cultural heritage and promoting women's economic inclusion in the handicraft industry.

Keywords: Suraj Kund Craft Fair 2023, Handicraft and handloom sector, Craft-women, Women's' Empowerment, Sustainable livelihoods, Sustainable development.

1. Background of the Study

UN SDG Goal 5 aims to achieve gender equality and empower all women and girls. Despite making up half of the global population, women continue to face significant gender inequality, hindering progress. Promoting craft businesses can enhance the economic, social, and political status of women in communities. The Suraj Kund Craft Fair, held from February 3 to 19, 2023, featured the northeastern states and attracted over a million visitors, showcasing diverse handicrafts and empowering local artisans. This study involved interviews with 48 craftswomen to explore their empowerment challenges. The fair, established in 1987, is now one of South Asia's largest handicraft events.

2. Theoretical Framework

Women's empowerment enhances agency, capabilities, and autonomy, allowing women to participate in social, economic, and political processes. This concept is vital for assessing the empowerment of craftswomen in the handicraft sector and identifying factors that aid or obstruct their progress. Mignosa and Kotipalli (2019) explore global craft dynamics, contrasting Western views—often devaluing craft—with the higher status of craftsmanship in Eastern nations. Their analysis includes the interests of policy agencies and designers in crafts. The gender and development framework highlights barriers to craftswomen's empowerment, and guiding strategies to overcome these obstacles (Hansrod,2019). Additionally, the sustainable livelihoods approach examines individuals' capabilities and resources for achieving resilient livelihoods (DFID, 2023). This theory evaluates the sustainability of craftswomen's livelihoods and identifies enhancing factors. Influential scholars, including Robert Chambers and others, have shaped this approach, which is inter disciplinary. Martha Nussbaum and Amartya Sen's capability approach focuses on individuals' freedom to pursue valued lives,

[*] Professor and Head, Amity School of Economics, Amity University Haryana.amjose@ggn.amity.edu
[#] Assistant Professor-Analytics, SOIL School of Business Design, Gurugram, Haryana.
[&] Assistant Professor, Amity School of Economics, Amity University Haryana. fahmad@ggn.amity.edu

assessing craftswomen's abilities to meet their goals. Finally, the social capital approach (Coleman, 1988) investigates how social networks and trust facilitate or hinder craftswomen's empowerment, highlighting the importance of community relationships.

3. The Handicraft and Handloom Sector in Indian States

Handicrafts are defined as goods primarily made by hand, often enhanced by ornamental techniques, with distinctive aesthetic and cultural features. In India, artisanal activities have historically supported livelihoods and contributed to the economy, with artisans creating textiles, toys, tools, and furnishings using traditional techniques. However, the artisan population is declining due to market challenges and skills loss. The Craft Council of India estimates around 200 million artisans, with handicraft exports valued at $4.35 billion in 2021-22, reflecting significant growth potential in a $400 billion global market (IBEF -2023). This sector is vital for employment, particularly for women, yet faces issues like lack of education, capital, and technological exposure (Government of India, 2016). Over the past 30 years, the number of artisans has decreased by 30%, highlighting the urgent need to invest in preserving this cultural heritage and supporting livelihoods (The Edmond de Rothschild Foundation 2013). Indian handicrafts industry encompasses over seven million regional artisans and 67,000 exporters/export houses, promoting diverse art and craftsmanship domestically and globally. With exports totalling Rs 24,500 crore (see Figure1), handicrafts represent India's rich cultural heritage. Additionally, there are 744 handicraft clusters in India involving approximately 2,12,000 artisans, producing over 35,000 products.

4. Women in Handicraft &Handloom Sector

The handicraft sector in India is a major employment source after agriculture, providing livelihoods for millions, particularly women. Despite its significance, the sector faces challenges due to volatility and reliance on statistics that favour formal industries. Misleading terms like 'informal' fail to recognize established systems. The handloom sector employs over 3.5 million individuals, including 2.5 million female weavers, driving women's economic empowerment (refer to Table 1). Currently, the handicraft sector employs approximately 6.9 million artisans, with 56.13% being women. Additionally, textiles and apparel, including handicrafts, accounted for 10.5% of India’s merchandise exports in 2021-22.

Women significantly contribute to India's handicraft and handloom sector, but their participation varies across states. They play a crucial role in preserving traditional techniques and generating livelihoods, highlighting the need for enhanced support in markets, finance, and training. This study explores the empowerment dimensions of craftswomen at the Suraj Kund Craft Fair 2023. The objectives of the research are:

- To explore opportunities for the empowerment available to Craftswomen in the handicraft and handloom sector through participating in the Suraj Kund craft mela.
- To assess the extent to which the Suraj Kund mela supported the craftswomen in empowering them in different ways socially, economically, and educationally.
- To identify the opportunities and challenges faced by Craftswomen in the handicraft and handloom sector at Suraj Kund Craft Fair 2023, and propose strategies and recommendations to enhance the empowerment of Craftswomen in the handicraft and handloom sector.

5. Research Methodology

The research aims to study the empowerment of craftswomen in the handicraft and handloom sector, focusing on participants from the SK Craft Fair 2023. The study seeks to identify aspects of empowerment and the factors that facilitate or hinder it. Using purposive sampling, 48 craftswomen from various states were selected based on their experience and expertise (refer to Figure 3). Detailed structured interviewswere conducted to

gather qualitative and quantitative data, to explore their experiences and perspectives on empowerment. Ethical guidelines, including informed consent and confidentiality, were followed to protect participants' rights. Figure 2 presents the state-wise distribution of craft workers participants in Suraj Kund Mela 2023.

Data were analysed using content, thematic, and statistical analysis to identify patterns and relationships among variables. Conclusions on craftswomen's empowerment were drawn, leading to recommendations for policies and interventions to enhance women's empowerment in the sector. While providing a thorough approach, the study's findings are limited to the 48 sampled craftswomen and may not capture the long-term impact of empowerment programs on the lives of Craftswomen.

5. Results and Findings

5.1 Demographic Profile

Age distribution among women craft workers at the SK Mela included 2 to 4 participants aged 22-35, 2 to 4 aged 35-50, and 2 to 3 over 50 (refer to Figure 4). Educational backgrounds varied: 11 were primarily educated, 16 completed secondary education, and 1 was postgraduate. Interviewed craftswomen represented various reservation categories, including 14 OBC, 9 SC, 9 General, 7 ST, and 7 BPL. Monthly incomes ranged from 8,000 to 70,000.

5.2Results of In-depth Interviews

Despite their significant role in India's handicraft sector, women artisans face numerous challenges to empowerment (See Figure 5). Some of the issues and challenges in empowering craftswomen in India, based on our field observations and in-depth interviews, are as follows:

(i) *Limited Access to Credit:* Many craftswomen struggle to secure loans due to a lack of collateral, hindering business investment. Initiatives like the "Pradhan Mantri Mudra Yojana" aim to provide collateral-free loans, which are crucial for their growth.

(ii) *Poor Market Access:* Operating mostly at grassroots levels, craftswomen have limited access to wider markets. High logistical costs and inadequate digital skills prevent them from engaging in e-commerce. Events like the Suraj Kund Mela help them showcase products and connect with buyers.

(iii) *Low Bargaining Power:* Due to low education and market exposure, craftswomen often accept lower prices, reducing their profits.

(iv) *Lack of Skills:* Many artisans lack the technical and marketing skills necessary for competing globally, limiting innovation and quality.

(v) *Social Barriers:* Gender discrimination and restricted mobility hinder their participation in economic activities.

(vi) *Insufficient Government Support:* While there are policies aimed at supporting women artisans, their implementation has been weak.

6.3 Market Access and Representation

To assess the representation and market access of women craftworkers at the Suraj Kund fair, four dimensions were studied (see Figure 6).

(i) *Marketing Channels:* 67.35% of the 48 craftswomen felt the fair improved market access for their products, while 26.53% said it somewhat helped, and 6.12% reported no improvement.

(ii) *International Recognition:* 77.55% believed the SK mela gave their talent international recognition, with 12.24% stating it somewhat helped, and 10.20% feeling it provided no recognition.
(iii) *Self-Help Groups:* 65% felt the mela helped showcase their self-help group talents, while 22.54% said it somewhat helped, and 6.12% disagreed.
(iv) *Cultural Representation:* 73.47% thought the mela celebrated India's cultural diversity, while 22.25% felt it somewhat represented rural ethos, and 4.08% disagreed. Overall, most women felt the mela provided good marketing opportunities for their state products.

6.4 Socio-Economic Benefit

Figure 7 highlights the socio-economic benefits for women craftworkers at the Suraj Kund Fair 2023, focusing on two key dimensions.
(i) *Employment Opportunities:* A significant 73.47% of craftswomen affirmed that the SK Mela initiative increases employment opportunities, while 18.37% felt it promotes women's employment. Only 4.08% disagreed.
(ii) *Household Economic Conditions*: Regarding improvements in household economic conditions, 63.26% of women reported positive impacts, with 24.49% indicating some benefits. Conversely, 12.24% felt the initiative did not help.

Overall, most craftswomen believe the SK Mela significantly enhances their employment and economic situations.

6.5 Empowerment of Craftswomen in Handicraft and Handloom Sector

To analyze women's empowerment among craftswomen at the Suraj Kund fair, four aspects were examined (refer to Figure 8):

(i) *Exhibition Opportunities:* 71.41% felt empowered by showcasing their crafts, while 24.59% believed the fair assists in empowerment. However, 4.08% felt it does not create opportunities, citing a male-dominated vendor presence.
(ii) *Economic Empowerment:* 71.43% believed the fair helped them economically, with 24.49% indicating some benefit. Only 2.04% felt it provided no economic empowerment.
(iii) *Social Empowerment:* 65.31% reported social empowerment through the fair, while 32.65% felt somewhat empowered, and 2.04% disagreed.
(iv) *Educational Empowerment:* 63.27% felt the fair contributed to their education, with 22.45% noting some impact, while 4.08% saw no educational benefits.

Overall, most craftswomen felt that the Suraj Kund fair positively influenced their empowerment across economic, social, and educational dimensions.

6. Opportunities and Challenges: Craftswomen in Suraj Kund Fair 2023

At the Suraj Kund fair, craftswomen gain opportunities to showcase their state art, enhancing sales and income. Key benefits include:
(i) *Market Access:* Selling handmade products, building a social media presence, partnering with schools for craft education, and hosting live demonstrations.
(ii) *Economic Benefit*: Conducting guided tours, offering workshops, and selling artworks.
(iii) *Social Benefit:* Collaborating on unique pieces, showcasing modernized traditional crafts, and developing marketing and social skills.

With these benefits, there are some problems craftswomen also face during the fair (refer to Figure 9). Craftswomen in India face significant challenges at events like the Suraj Kund Craft Mela and in daily work. They struggle with a lack of recognition, limited market access, financial constraints, inadequate infrastructure, and insufficient training. Societal norms also restrict their mobility, highlighting the need for comprehensive support systems to empower them.

7. Conclusion

This study has examined the empowerment of craftswomen in India's handicraft and handloom sector, with a focus on their experiences at the 2023 Suraj Kund Craft Fair. The research underscores the vital role of craftswomen as custodians of cultural heritage and contributors to sustainable livelihoods. Findings reveal a complex landscape influencing their empowerment, shaped by challenges such as limited access to resources, financial independence, and societal norms. Nevertheless, craftswomen demonstrate resilience and adaptability, utilizing innovative strategies to sustain their craft.

The Suraj Kund Craft Fair emerges as a crucial platform that enhances visibility, expands market reach, and fosters economic opportunities for craftswomen. Beyond its immediate impact, the fair provides a model of empowerment by advancing social, economic, and educational dimensions—enhancing visibility, financial autonomy, and skill development. Such events underscore the potential of community-based initiatives to elevate the socioeconomic status of women artisans.

The study contributes to existing theories by adapting frameworks like Social Capital Theory, which highlights the role of community networks in strengthening craftswomen's resilience. The Sustainable Livelihoods Approach underscores that empowering craftswoman not only supports household stability but also enhances broader community welfare. Additionally, the Capability Approach is expanded, illustrating how increased freedom and access to resources allow craftswomen to achieve valued outcomes like financial independence.

Globally, this fair-based empowerment model has wider applications, offering insights for marginalized artisans worldwide. The research advocates for gender-inclusive economic policies that recognize women's role as cultural custodians, emphasizing the need for supportive frameworks that acknowledge and economically value their contributions. In doing so, this study offers practical and theoretical insights to uplift craftswomen in informal sectors across diverse communities.

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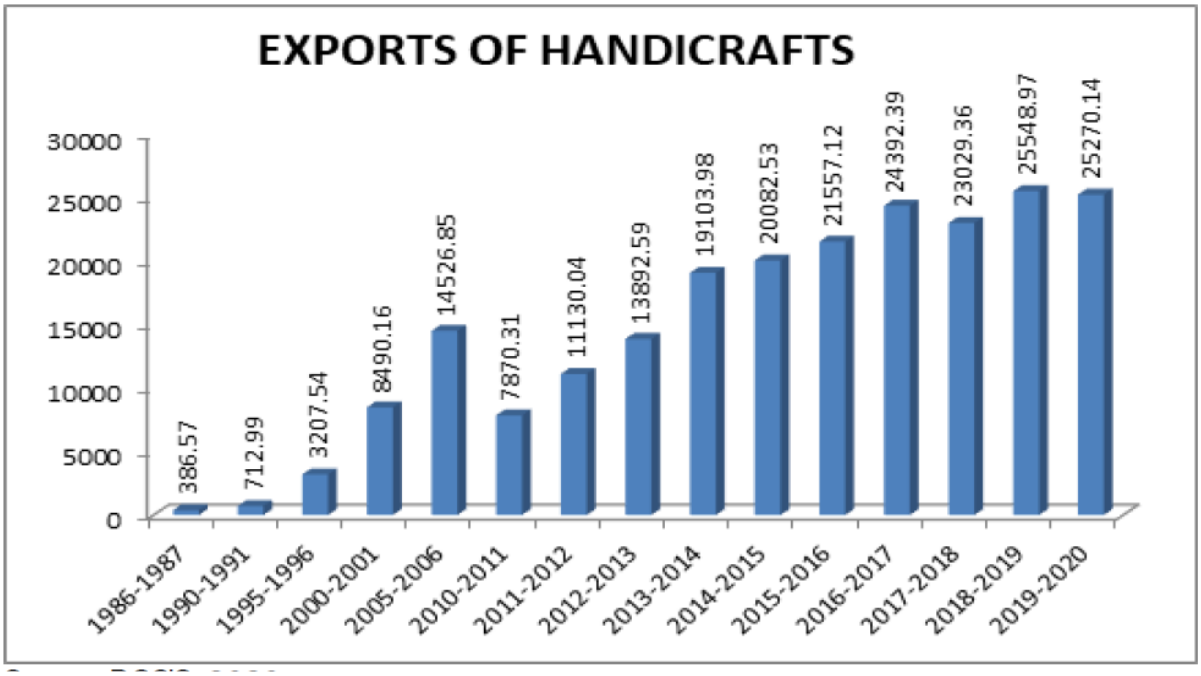
Figure 1. Trends in Handicraft Exports -1986-2020 (in Rs Crores)



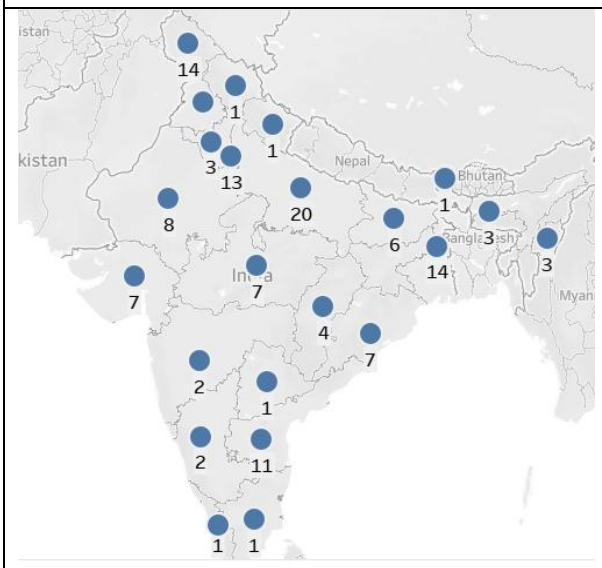
Source: IIFT, Challenges, Opportunity & Threat for Indian Handicraft Exports, accessed at https://www.epch.in/iift-epch-study/Report.pdf.

Table 1. Gender-wise Distribution of Number of Handloom Workers			
Gender	Rural	Urban	Total
Male	7,78,772 (26%)	1,96,961 (42%)	9,75,733 (28%)
Female	22,74,516 (74.5%)	2,71,769 (58.0%)	25,46,285 (72.3%)
Transgender	403 (0.0%)	91 (0.0%)	494 (0.0%)
Total	**30,53,691**	**4,68,821**	**35,22,512**

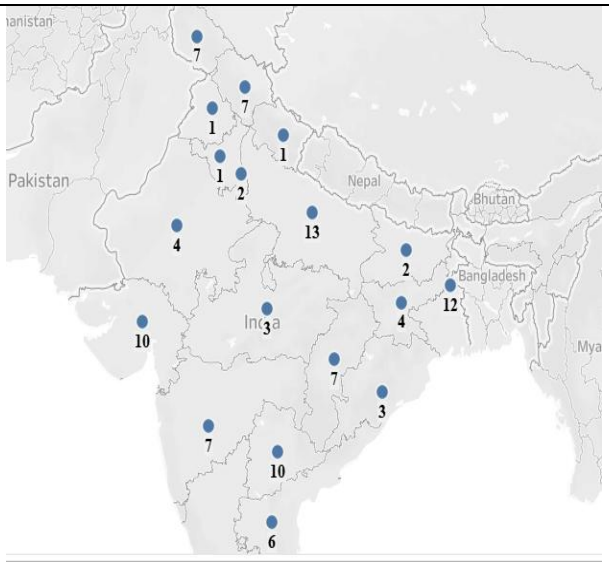
Source: Government of India (2020) *Fourth All India Handloom Census 2019-20*, Ministry of Textiles New Delhi, Accessed at: https://www.hepcindia.com/assets/fronview/4th%20Handloom%20Census.pdf

Figure 2. State-wise distribution of Craft Workers Participants in Suraj Kund Mela 2023

Handicraft Sector

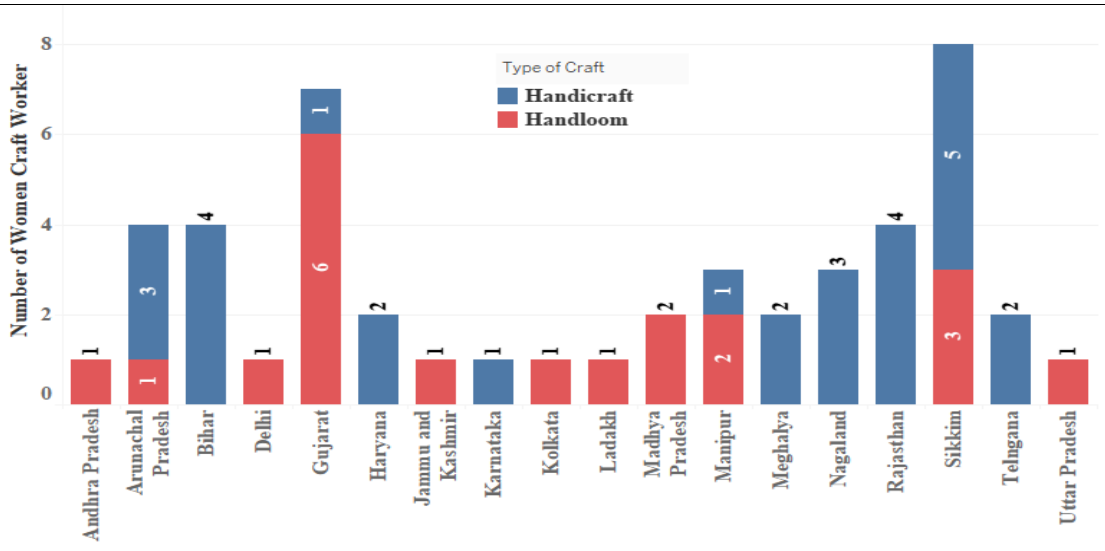


Handloom Sector



Source: Government of Haryana (2023)

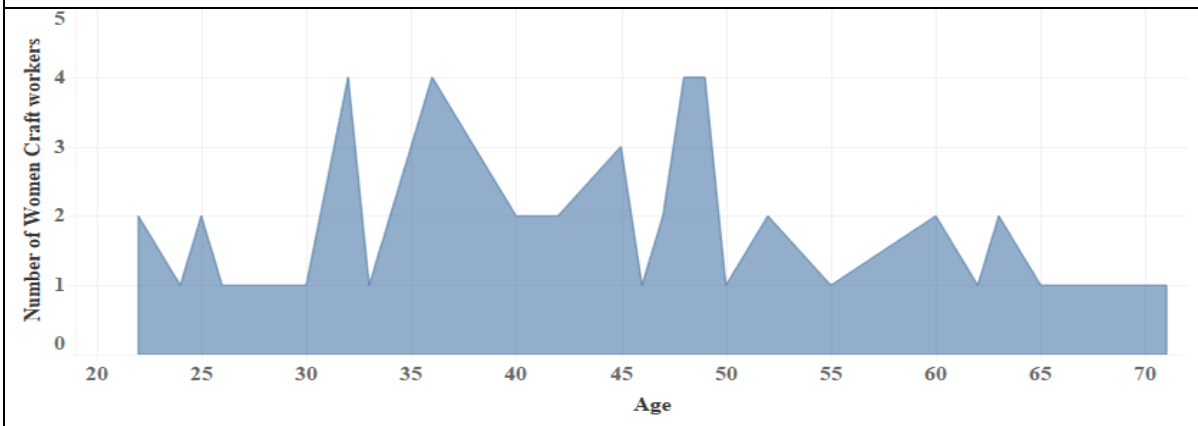
Figure-3 Craftswomen in Handicraft and Handloom Sector: Suraj Kund Fair 2023



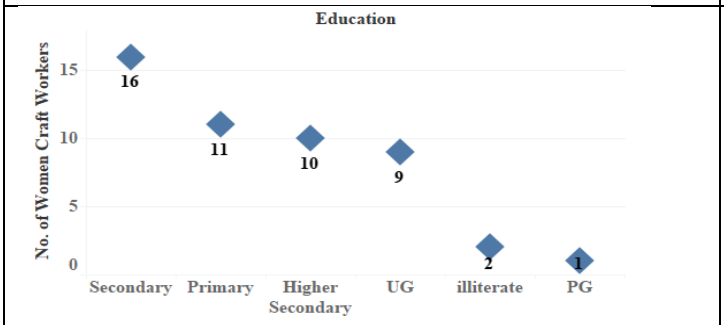
Source: Field Survey

Figure-4 Demographic Details of Sample Craftswomen in Suraj Kund Fair 2023

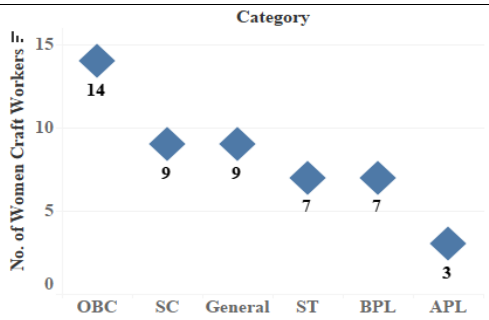
Age distribution (a)



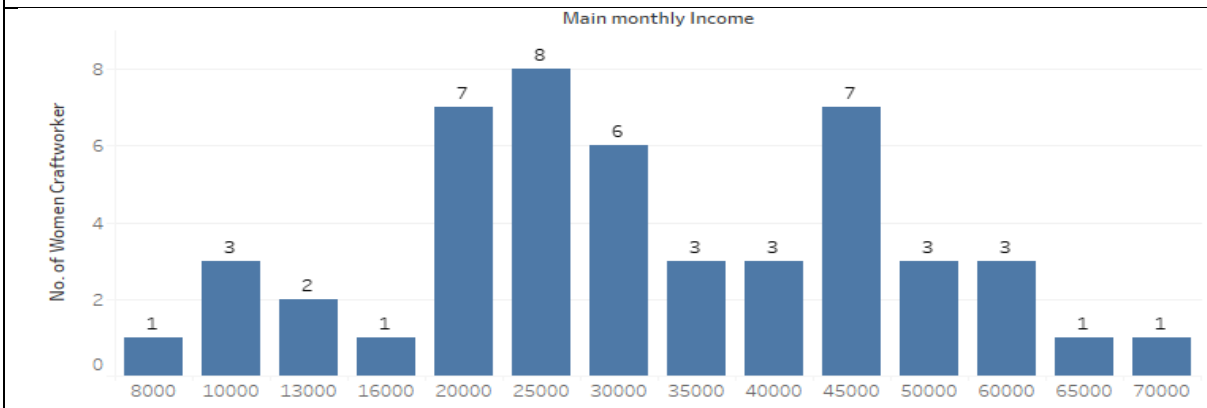
Level of Education (b)



Category of Craftswomen (c)

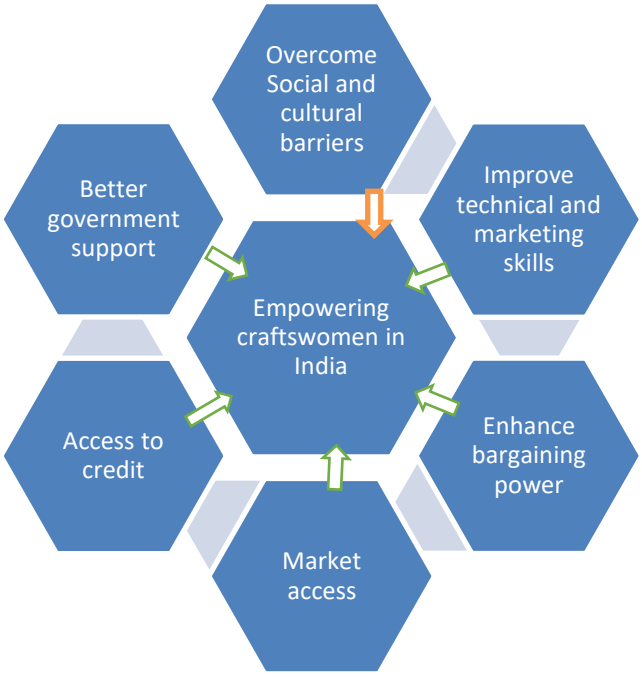


Monthly Income



Source: Field Survey

Figure 5. Empowering craftswomen in India: Challenges and Issues

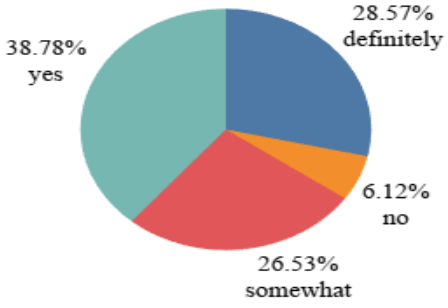


Source: From field observation

Figure 6. Market Access and Representation of Craftswomen in SK Fair 2023

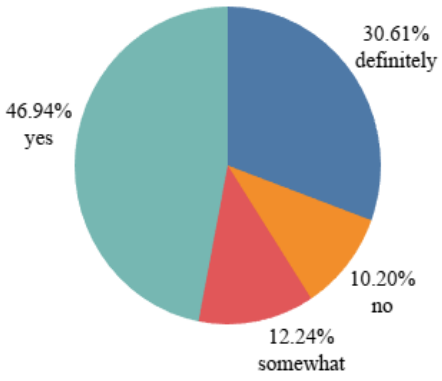
Will the SK mela initiative by the Haryana government enable the craftswomen fromyour state to improve their marketing Channels of the Crafts?

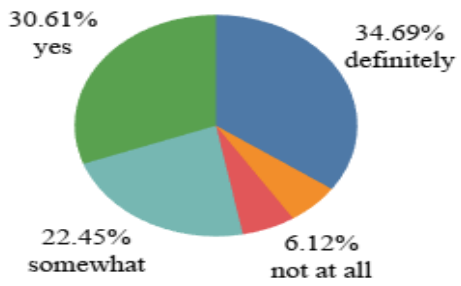
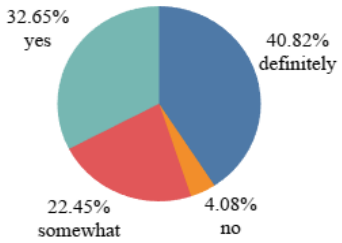
(a)



Will the SK mela initiative give new recognition and flight to their talent at the international level?

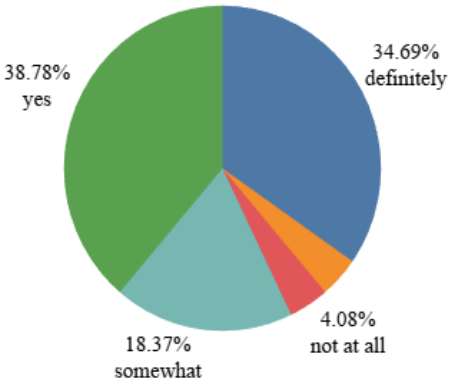
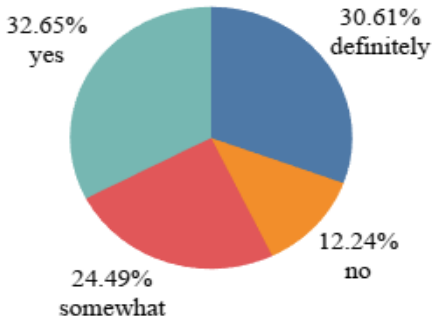
(b)



Does SK Mela help the members of the self-help group that you belong to showcase their talent?	Do you feel that the Mela celebrates the unique diversity of Indian traditions and culture in an ambience, created to represent the ethos of rural India?
(c)  	**(d)** 

Source: Field Survey Results

Figure 7. Socio-Economic Benefit to Women Craft Workers in Suraj Kund Mela 2023

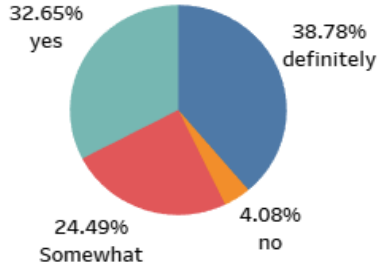
Does the SK Mela initiative increase employment opportunities for women**?**	Does the SK mela initiative by the government enable women to improve their household economic conditions?
 	

Source: Field Survey Results

Figure 8. Craftswomen Empowerment in Suraj Kund Mela 2023

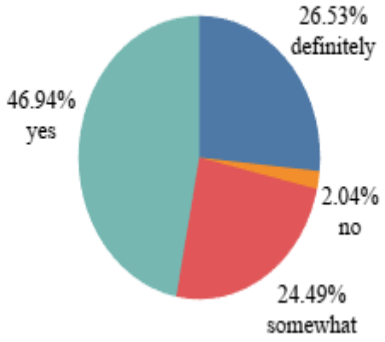
Do you feel that women are empowered by getting an opportunity to exhibit their crafts at the SK craft fair?

(a)



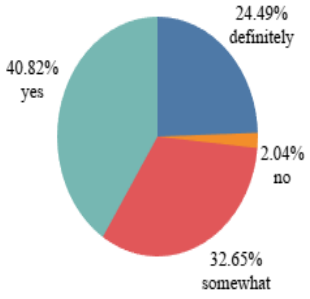
Are you of the opinion that SK Mela empowered you economically?

(b)



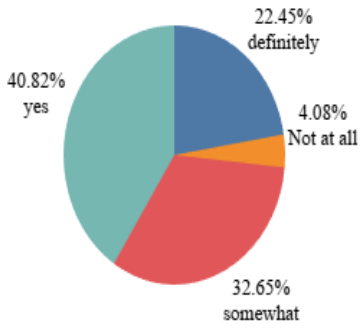
Are you of the opinion that SK Mela empowered you socially?

(c)



Are you of the opinion that SK mela empowered you educationally?

(d)



Source: Field Survey Results

Figure-9 Major Challenges Confronted by Craftswomen

Quantifying the Impact of Digitalization on Indian Exports

Aarushi Rajpal[†] and Suman Makkar[‡]

Abstract

The growth of the Indian Economy is of global relevance attributing the rise to strong investment in digitalization, government expenditures, and exports. Digitalization shapes the future of worldwide trade and investment. It speeds up the scale and scope of trade and accelerates the growth of a nation. It helps integrate supply chains and establish an informed consumer market. The perspective of the present study is to assess the extent of impact of digitalization on exports in the Indian Economy during 2001-2020 using the Autoregressive Distributed Lag (ARDL) Bounds Testing Approach to Co-integration. The results represent a positive and significant impact of fixed broadband subscription on merchandise exports and service exports in both long run and short run. Thus, it implies that digital technology paves the way for faster, sustainable, and effective growth of the Indian Economy leading India towards becoming a globally recognized and developed economy.

Introduction

The onset of the 21st century brought opportunities to foster nations' growth beyond borders. Expanding output and enabling digital technology act as a driving force towards accelerating trade in India. Ranking 5thin the world in terms of GDP rankings in 2023 (IMF, 2024), India withstands diversity and swift growth stimulated by a youthful and technologically adept workforce, optimum production, extensive domestic market, and intensifying information and communication technology.

The early 1990s opened doors for the Indian economy towards globalization and expansion. Globalization aims at network creation and harnessing India's potential by transforming existing social, economic, and geographical barriers. Accompanied by digitalization, India evades the distance barriers and bridges people from all corners of the globe to build strong trade and cultural relations. Digitalization increases the scale, scope, and speed of trade. It affects both the supply side and demand side in the market. On the supply side, digitalization reduces international trade barriers, facilitates the coordination of global value chains, helps disperse ideas and technologies, and connects various businesses and consumers globally. On the demand side, digitalization increases accessibility, affordability, and awareness among the consumers enabling better trade opportunities. Rapid digitalization facilitates the rise of trade of goods and services across international cross-borders. There exists a quantitative rise in international exports post-digital revolution i.e., from $ 43 billion in merchandise exports in 2001 to $ 276 billion in 2020.Similarly, service exports have risen from $ 17 billion in 2001 to $ 203 billion in 2020 (World Bank, 2023).

The quantitative rise in export values is also accompanied by a rise in the quality of exports due to better product and process innovation enabled by digitalization. Hence, it is crucial to understand the irreversible role of digitalization in enhancing trade exports of India and leading India toward the path of becoming a developed economy with global recognition. The influential role of digitalization and technological progress in enabling trade has also been supported by various theories in literature. Jones (1970) examined the role of technological change at any place in influencing and altering the pre-existing trading equilibrium. Further, the theory builds a framework to analyze the impact of any technical change on prices, consumption patterns, production levels, and real incomes of nations in a trading society. The emphasis was on applying Hecksher-Ohlin's theory of

[†] Research Scholar, Dept. of Evening Studies, MDRC, Panjab University, Chandigarh.
Email Id: arushi.rajpal23@gmail.com

[‡] Professor of Economics, Dept. of Evening Studies, MDRC, Panjab University, Chandigarh.
Email Id: makkarsuman@pu.ac.in

trade to Vernon's Product Cycle theory, which suggests that technology be incorporated into the product's early stages as an input mix to obtain a competitive edge in the early stages of production of new commodities. The model suggested adequate inland capital and labour allocation to improve prevailing technology levels and utilize resources to optimum levels since foreign-produced technology is not fully adaptable without using the nation's resources. Borkakoti (1998) in the Neo-technology theory, claims innovation in processes and products is a component of technological advancement. The notion emphasized how a constant process of developing and disseminating new technologies makes it possible for commerce between countries to occur.

Literature Review

Clarke (2002) revealed Internet access to positively influence the export performance of enterprises in Eastern European nations and Central Asia in 1999 where industrial exports of enterprises with Internet access were 6% more than those of industrial enterprises without access to internet. Likewise, Kneller and Timmis (2016) empirically analysed the role broadband penetration on UK service exports of 1570 firms for the period 2000-2002. The results revealed internet access to boost UK business service exports. Also, Wardani et al. (2019) represented information and communication technology as having a significant and positive impact on trade by employing ICT development and bilateral export between Indonesia and its 9 ASEAN partners during 2010-2017. Studying sub indices, ICT access reflected the largest effect on exports whereas ICT skills reflected strong significant impact on imports. The study suggested Indonesia to develop greater trading partnerships with nations having greater technological advancement. Similarly, Podoba et al. (2020) assessed bilateral trade specialization between Japan and Russia during the digital revolution by comparing the product fraction of the nation's exports to its part of global trade from 2001-2019. The results revealed Japan to have export specialization in HS84 (digital products) but the largest share of exports from Japan to Russia were in non-digital products. The study stressed on boosting trade in services post-digitalization and suggested the scope of rising trade with digital cooperation and partnership between nations. Also, Maurya and Lal (2020) emphasized on the role of ICT in acting as a backbone to trade in services post-GATS Agreement 1991. Using a modified gravity model, the study in India for the period 2000-2017 revealed a 1% change in use of ICT to lead to a 0.34% change in total exports in services in India, significant and positive influence on IT-based service exports but an insignificant influence on non-IT-based service exports. Also, Zhou et al. (2022) interpreted the role of broadband in influencing exports of 243 Chinese cities from 2005 to 2019. The study evidenced a rise in exports driven by Broadband China Policy by 6.82%–18.8%. Similarly, Zhu et al. (2022) attempted to examine the extent of trade enhancement driven by digitalization in 133 cities in China. The results revealed exports, imports, and overall trade to rise by the digital economy at a 1% significance level. Further, the Quantile regression results represented a "U" shaped trend for the digital economy signifying its enabling effect up to a certain level of international trade. Additionally, the research has shown that trade exports are more affected by the digital economy than trade imports. As a result, funding for urban digitization has been proposed.

Overall, the existing literature reveals a positive relationship between digitalization and trade in nations. From the literature studied, it has been observed that limited studies have considered the impact of digitalization in this domain by focusing on the Indian Economy including the period of the pandemic. Merchandise export and service export performance have been considered only in a handful of research studies in relation to digitalization.

Research Objectives

The present study intends to interpret the impact of digitalization on exports focusing on Merchandise exports and Service exports with special reference to the Indian Economy.

Data Sources and Research Methodology

The study deploys annual data series from 2001-2020ofExports and Digitalization. Exports are measured using Merchandise Exports (current US$) and Service Exports (BOP, current US$), and Digitalization is measured using Fixed broadband subscriptions. Data is obtained from the World Bank, World Development Indicators, 2023. All the variables are used at natural log values for the study.

The impact of Digitalization on Exports is studied using the following models:

Model 1: ln Merchandise $Exports_t = \lambda_0 + \lambda_1 lnFixedBroadband + \mu_{1t}$

Model 2: ln Service $Exports_t = \Upsilon_0 + \Upsilon_1 lnFixedBroadband + \mu_{2t}$

where ln Merchandise $Exports_t$ = Log of Merchandise Exports; ln Service Exports = Log of Service Exports; ln Fixed Broadband = Log of Fixed Broadband Subscriptions

The initial step in examining the above models is analyzing the level of stationarity of variables using the Augmented Dickey-Fuller (ADF)test proposed by Said & Dickey (1984) and the Phillips-Perron Test proposed by Phillips and Perron (1988). Based on the evidence of the integration order of the variables, the Autoregressive Distributed Lag (ARDL) approach is used to assess the relationship in the long run among them. ARDL method of estimation initially mandates checking the existence of cointegration among the variables, in which the following equations are examined:

$$\Delta lnMerchandiseExports_t = \alpha_1 + \sum_{i=1}^{n} \upsilon_{1i}\, \Delta lnMerchandiseExports_{t-i} + \sum_{i=0}^{n} \upsilon_{2i}\, \Delta lnFixedBroadband_{t-i} + \acute{\rho}_1 lnMerchandiseExports_{t-1} + \acute{\rho}_2 lnFixedBroadband_{t-1} + +\varepsilon_{1t} \quad (1)$$

$$\Delta lnServiceExports_t = \alpha_2 + \sum_{i=1}^{n} \xi_{1i}\, \Delta lnServiceExports_{t-i} + + \sum_{i=0}^{n} \xi_{2i}\, lnFixedBroadband_{t-1} + \eta_1 lnServiceExports_{t-1} + \eta_2 lnFixedBroadband_{t-1} + \varepsilon_{2t} \quad (2)$$

($\upsilon_{1i}, \upsilon_{2i}, \xi_{1i}, \xi_{2i}$) are the short-run factors, and,($\acute{\rho}_1, \acute{\rho}_2, \eta_1, \eta_2$)are the long-run factors. By estimating the aforementioned equations using the OLS approach and using the ARDL F-bounds Test, the presence of a long-term link between the variables is investigated. As depicted from F-test, the null hypothesis considers no existence of long run relationship among the variables (for equation 1, $H_0: \acute{\rho}_1 = \acute{\rho}_2 = 0$; for equation 2, $H_0: \eta_1 = \eta_2 = 0$; is tested against the alternate hypothesis that a long-run association exists among the variables (for equation 1,$H_1: \acute{\rho}_1 \neq \acute{\rho}_2 \neq 0$; for equation 2, $H_1: \eta_1 \neq \eta_2 \neq 0$). The decision is taken based on the estimated value of the F-statistic, if the estimated F-value is greater than the critical upper bound value, there exists long-run cointegration, whereas if the estimated F-value is less than the critical lower bound value, the existence of long-run cointegration is rejected. Further, if the F-value ranges between the critical values, the relationship is termed as inconclusive. The upper bound and lower bound values provided by Narayan (2005) for a small sample size have been used in the study. Once the long-term association is confirmed, the coefficients of the long-run are measured, and thereafter, for the short-run association, an Error Correction Model (ECM) is estimated as follows:

$$\Delta lnMerchandiseExports_t = \text{i}_0 + \sum_{i=1}^{n} \upsilon_{1i}\, \Delta lnMerchandiseExports_{t-i} + \sum_{i=0}^{n} \upsilon_{2i}\, \Delta lnFixedBroadband_{t-i} + \text{u}_1 ECT_{t-1} + \varepsilon_{1t} \quad (3)$$

$$\Delta lnServiceExports_t = \mathrm{i}_1 + \sum_{i=1}^{n} \beta_{1i}\, \Delta lnServiceExports_{t-i} + \sum_{i=0}^{n} \beta_{2i}\, \Delta lnFixedBroadband_{t-i} + \mathrm{u}_2 ECT_{t-1} + \varepsilon_{2t} \quad (4)$$

$(\upsilon_{1i}, \upsilon_{2i}, \beta_{1i}, \beta_{2i})$ are the short-run coefficients, and the adjustment speed parameters$(\mathrm{u}_1, \mathrm{u}_2)$of lagged Error Correction Term, (ECT (-1) should be negative and represent a significant level of stability.

Results and Discussion

The variables' stationarity is primarily tested using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Table 1, represents the results of the unit root analysis, and the summary of the same is presented in Table 2.

The results show that Merchandise Exports are stationary when first differenced under both ADF and PP whereas, Service Exports and Fixed Broadband are stationary at a level under both ADF and PP. Since, Merchandise Exports, Service Exports, and Fixed Broadband evidence mixed order of integration, the Autoregressive Distributed Lag (ARDL) approach proposed by Pesaran et al. (1999) is used to analyze the association among the variables.

Proceeding with the ARDL model of estimation, the optimum lag length of variables is ascertained using the Akaike Information Criterion (AIC). The F-bounds test results in Table 3 for both models depict the estimated F-value to be above the upper bound critical value, I_1(i.e., 11.20976, 16.14791>6.76) at a 1 percent significance level. Hence, the long-run association among variables is evidenced.

Before proceeding further, it is crucial to examine the presence of serial correlation and heteroscedasticity using the Breusch-Godfrey LM test and the Breusch-Pagan-Godfrey test, respectively, to ensure validity. The diagnostic tests are represented in Table 4. Both models confirm consistency, as residuals are serially uncorrelated, and models are homoscedastic, with a p-value that is statistically insignificant in each case.

Further, the long-run and short-run coefficients of models are examined and represented in Tables 4 and 5, respectively. Model 1 shows that if fixed broadband subscriptions increase by one percent, then merchandise exports will increase by 0.30% in the long run also having a positive impact in the short run i.e., with a 1% increase in fixed broadband subscriptions in the short run, merchandise exports will increase by 0.43%. In model 2, if fixed broadband subscriptions rise by one percent service exports increase by 0.33% in the long term. Similarly, in the short term, with an increase of 1% in fixed broadband subscriptions service exports rose by 0.57%.

Also, the steadiness of long-run models is checked by the coefficient of lagged Error Correction Term, CointEq (-1). Table 5 represents the stability of the models in the long term as CointEq (-1) is evidenced to be negative and significant at a 1 percent level of significance. The speed of adjustment for model 1 and model 2 was 56.23% and 42.84% per annum respectively. In the case of the occurrence of disequilibrium, the adjustment in model 1 will take place in 1.78 years approximately, and in the case of model 2, it will take place in 2.33 years approximately.

Conclusion

The study deduces that digitalization up trends trade in India and contributes towards enhancing both merchandise and service exports. Rising fixed broadband subscription enriches consumers with access to global market products and services enabling the elimination of border restrictions and leading to the faster and more efficient economic growth of the Indian Economy. Investment in India's digitalization over the past decades has played a transformational role in creating a positive balance of trade. It acts as a backbone to uplift trade, transport, and financial resources. Therefore, it implies that policymakers should stress upon

investment in rapid digitalization in the coming years to maximize levels of exports and mobilize resources to optimum levels.

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Table 1. Unit Root Analysis

I. Augmented Dickey-Fuller (ADF) Test

Variables	At Level			At First Difference		
	With Constant and Trend	With Constant	Without Constant and Trend	With Constant and Trend	With Constant	Without Constant and Trend
ln Merchandise Exports	-0.511285 (0.9729)	-2.8908* (0.0651)	2.5775 (0.9957)	-3.39037* (0.0932)	-2.8782* (0.0676)	-2.46610** (0.0170)
ln Service Exports	-1.0714 (0.9075)	-3.5324** (0.0185)	3.8074 (0.9997)	-3.8802** (0.0357)	-2.31016 (0.1794)	-1.7619* (0.0744)
ln Fixed Broadband	-1.18385 (0.8847)	-3.80981** (0.0105)	0.24745 (0.7451)	0.59743 (0.9982)	-1.1103 (0.6845)	-1.1391 (0.2206)

II. Phillips-Perron (PP) Test

Variables	At Level			At First Difference		
	With Constant and Trend	With Constant	Without Constant and Trend	With Constant and Trend	With Constant	Without Constant and Trend
lnMerchandiseExports	0.99106 (0.9996)	-3.53360** (0.0185)	2.3384 (0.9928)	-8.7482*** (0.000)	-2.8721* (0.0684)	-2.3368** (0.0226)
lnService Exports	-0.9560 (0.9268)	-4.41839*** (0.0029)	2.8821 (0.9878)	-3.8793** (0.0357)	-2.3101 (0.1794)	-1.6523* (0.0918)
lnFixed Broadband	-1.1670 (0.8884)	-3.90221*** (0.0086)	2.05134 (0.9869)	-3.8476** (0.0378)	-2.48730 (0.1346)	-1.82282* (0.0660)

Notes: (i) Figures in the parenthesis of the type () are *p-values*.
(ii) *, ** and *** denotes significance at 10%, 5% and 1% level of significance respectively.

Source: Author's calculations.

Table 2. Summary of Unit Root Analysis

	ADF	PP
lnMerchandiseExports	I (1)	I (1)
lnServiceExports	I (0)	I (0)
lnFixedBroadband	I (0)	I (0)

Note: I (0) and I (1) stand for order of integration at level and at first difference respectively.

Source: Author's Calculations.

Table 3. F- Bounds Test

Trend specification: Restricted Constant and No trend				
	Model 1 ARDL (1,0)		Model 2 ARDL (1, 0)	
Test Statistic	**Value**	**K**	**Value**	**k**
F-statistic	11.20976	1	16.14791	1
Note: (i) For models 1: Critical Values for Bounds Test: n=35 ($I_0 = 5.763, I_1 = 6.48$); n=30 ($I_0 = 6.027, I_1 = 6.76$) at 1% level of significance. (ii) For model 2: Critical Values for Bounds Test: n=35 ($I_0 = 5.763, I_1 = 6.48$); n=30 ($I_0 = 6.027, I_1 = 6.76$) at 1% level of significance.				
Source: Author's calculations.				

Table 4. Long-Run Coefficients		
Variables	**Model 1**	**Model 2**
lnFixedBroadband	0.305965*** (0.0000)	0.333622*** (0.0000)
Constant	21.3131*** (0.0000)	20.36288*** (0.0000)
Diagnostic Tests		
Serial Correlation	2.24167 (0.1430)	0.324825 (0.7280)
Heteroscedasticity	0.43433 (0.6551)	1.004605 (0.3882)
Notes: (i) Figures in the parenthesis of the type ( ) are *p-values*. (ii) *** denotes significance at 1% level of significance		
Source: Author's calculations.		

Table 5. Short-Run Estimates		
Variables	**Model 1**	**Model 2**
Ln Merchandise Exports (-1)	0.437669** (0.0138)	-
Ln Sevice Exports (-1)	-	0.571548*** (0.0029)
lnFixedBroadband	0.172054** (0.0128)	0.142941* (0.0680)
C	11.98503*** (0.0017)	8.724506** (0.0103)
CointEq (-1)	-0.562331*** (0.0000)	-0.428452*** (0.0000)
Notes: (i) Figures in the parenthesis of the type ( ) are *p-values*. (ii) *, ** and *** denotes significance at 10%, 5%and 1% level of significance, respectively.		
Source: Author's calculations.		

Impact of Economic Growth, Financial Development, and Government Size on Carbon Dioxide and Ecological Footprint. Empirical Insight from India

Anjali Saha [§] and Swati Shastri[**]

Abstract:

This research aims to assess the credibility of the Environmental Kuznets Curve (EKC) by examining two environmental metrics, Carbon Dioxide emissions (CO_2), and Ecological Footprint (EF), in India since 1990 to 2020. The data-driven results reveal that growth of economy significantly and negatively affects both CO_2 emissions and ecological footprint indicators, confirming Inverted N-shaped Environmental Kuznets curve (EKC) in India. In the short term, trade liberalization has a negatively impacted on the ecological footprint, while index of financial development (assess, depth, and efficiency) positively correlates with the ecological footprint over both short-long periods, but insignificantly influences CO_2 emissions. The size of the government index (including consumption, investment, taxes & subsidies, and top marginal tax) has a negative and significant consequence on EF in the short term but a positive correlation with long-term CO_2 emissions. Given the limited coverage of these aspects in the context of India, this manuscript aims to address this research gap through empirical analysis.

Keywords: CO_2, ecological footprint, EKC, financial development, size of government

JEL Classification: E01, E02, Q54, Q56

Introduction:

India's growth has resulted in outstanding progress since independence in a variety of economic frameworks. However, a negativity in the quality of the environment has occurred throughout this time, which includes deforestation, decline in groundwater levels, pollution of water, and deteriorating air quality in urban areas. Given the obvious connection between a decrease in quality of environment and increased economic activity, such as growth of industries, higher consumption of energy, and deforestation, this contrasting trajectory has triggered concerns about the trade-off among growth of economy and environmental quality.

The developing or developed countries that depend extensively on fossil fuels cause substantial CO_2 emissions and pollution. Additionally, Ecological Footprint (EF) are a comprehensive assessment of quality of environment that measures negative effects of activity including forest destruction, agriculture, mining, and manufacturing (Khan et al., 2021: Usman and Makhdum, 2021).

According to the Environmental Kuznets Curve (EKC) theory, early environmental concerns improve as the economy grows. The EKC forecasts a "inverted-U" shape, indicating a reduction in pollution over a specific income threshold. Alternatively, models such as the N-shaped EKC imply that environmental degradation resumes after a certain income level. The Inverted N-shaped EKC shows that as economies increase, early environmental deterioration decreases, followed by a time of deterioration until finally improves. This dynamic interaction underscores the density of the association among economic progress and environmental impact. We construct index for financial development (including access, depth, and efficiency) to assess its var influence on the environment. The size of the government index, encompassing consumption, investment, subsidies, taxes, and the top marginal tax rate, indicates that government involvement can predict environmental quality.

[§] Research scholar Department of Economics, Banasthali Vidyapith Rajasthan. Email id: Sahaanjali358@gmail.com

[**] Associate Professor & Head Department of Economics, Banasthali Vidyapith Rajasthan. Email id: swatishastri21@gmail.com

Literature Review:

In a specific context, Marbet and Alsamara (2015) scrutinize Environmental Kuznets Curve (EKC) in Qatar since 1980 to 2011 employing two different environmental parameters: carbon dioxide (CO_2) emissions and the ecological footprint (EF). The investigation assesses the ramifications of real gross domestic product (RGDP), squared RGDP, development of finance, consumption of energy, and trade liberalization on CO_2 emissions and EF. They employed an autoregressive distributed lag (ARDL) model while considering potential structural breaks. Their study intended to deliberate the short-long term flexibility of CO_2 emissions and EF. The inverted U-shaped EKC hypothesis is not relevant for CO_2 emissions, however, it is supported when employing the EF. In their extension of this study to India, Razib et al. (2023) looked at both EF and CO_2 emissions. In the Indian context, their research showed an N-shaped Environmental Kuznets Curve (EKC). By considering multiple factors, for instance, carbon dioxide emissions and ecological footprint, their research aimed to provide a holistic understanding of India's environmental sustainability journey. Sajeev and Kaur (2020) did research in India that focused on CO_2 emissions and GDP between 1980 and 2020. They used an ARDL model to identify the occurrence of an Inverted U-shaped EKC in India, besides noting the importance of economic freedom, as represented by magnitude of the government index.

In the realm of prior research, investigations have predominantly approached the subjects of carbon dioxide emissions and ecological footprint separately. Few research has ventured into the realm of comparative analysis between the two. In the context of India, a solitary study conducted by Hossain et al. (2023) stands out, as it delved into the examination of both ecological footprint and carbon dioxide emissions. Moreover, the research landscape remains quite sparse concerning inquiries into the relationship between financial development indices (including access, depth and efficiency) as well as the size of government, in the context of both CO_2 emissions and EF. Such investigations are notably limited in number.

Data and Methodology:

The research shall be based on Secondary data. The data for the selected variables shall be collected from the World Bank, Global Carbon Atlas, Global Footprint Network, IMF, Fraser Institute (economic freedom), etc. from 1990 to 2020.

The following table 1 shows the details of variables selected for the study:

To consider the relationship among CO_2 emissions, GDP, the openness of trade, financial development, and size of government, industrialization, and consumption of energy the following equation represents the model:

$CO_2 = f (GDP, GDP^2, GDP^3, T, FD, SG, IN, RE)$

GDP^2 and GDP^3 indicate the square and cubic terms of gross domestic product. The model to estimate the relationship among ecological footprint, GDP, trade liberalization, financial development, industrialization, and consumption of energy the following equation represents the model:

$EF = f (GDP, GDP^2, GDP^2, T, FD, SG, IN, RE)$

The cubic equation describes the relationship as given below:

$$CO_{2t} = \alpha_1 + \alpha_2 GDP_t + \alpha_3 GDP^2_t + \alpha_4 GDP^3_t + \alpha_5 T_t + \alpha_6 FD_t + \alpha_7 SG_t + \alpha_8 IN_t + \alpha_9 RE_t + e_1$$

$$EF_t = \alpha_1 + \alpha_2 GDP_t + \alpha_3 GDP^2_t + \alpha_4 GDP^3_t + \alpha_5 T_t + \alpha_6 FD_t + \alpha_7 SG_t + \alpha_8 IN_t + \alpha_9 RE_t + e_1$$

Where, α_1 is one of the constants, α_2, α_3, α_4, α_5, α_6, α_7, α_8, α_9, and α_{10} are the sole parameters. e_1 is the error term and t is the time. All components will be changed in the natural log shown in the equation below:

$$\ln CO_{2t} = \alpha_1 + \alpha_2 \ln GDP_t + \alpha_3 \ln GDP^2_t + \alpha_4 \ln GDP^3_t + \alpha_5 \ln T_t + \alpha_6 \ln FD_t + \alpha_7 \ln SG_t + \alpha_8 \ln IN_t + \alpha_9 \ln RE_t + e_1$$

$\ln EF_t = \alpha_1 + \alpha_2 \ln GDP_t + \alpha_3 \ln GDP^2_t + \alpha_4 \ln GDP^3_t + \alpha_5 \ln T_t + \alpha_6 \ln FD_t + \alpha_7 \ln SG_t + \alpha_8 \ln IN_t + \alpha_9 \ln RE_t + e_1$

Therefore, the U-shaped EKC existence is possible if, $\alpha_2 < 0$, $\alpha_3 > 0$, and $\alpha_4 = 0$, when $\alpha_2 < 0$ it indicates increase in environmental pollution. And if, $\alpha_2 > 0$, $\alpha_3 < 0$, and $\alpha_4 > 0$, then, an N-shaped connection between environment and economic growth exists. In end, $\alpha 2 < 0$, $\alpha 3 > 0$, and $\alpha 4 < 0$, then an Inverted N-shaped relationship exists. To determine stationarity properties of data Augmented Dickey-Fuller (ADF) and Phillip Perron have been employed.

Co-integration model:

To test the long-run connection between variables Auto-Regressive Distributive Lag Approach (ARDL) given by (Pesaran and Shin, 1995) has been applied.

To test co-integration, the ARDL model to be used is:

$\mathbf{\Delta lnCO_{2t}}$= $\beta_0 + \sum_{i=1}^{n} \beta_1 \Delta \ln GDP_{t-1} + \sum_{i=0}^{n} \beta_2 \Delta \ln GDP^2_{t-1} + \sum_{i=0}^{n} \beta_3 \Delta \ln GDP^3_{t-1} + \sum_{i=0}^{n} \beta_4 \Delta \ln T_{t-1} + \sum_{i-0}^{n} \beta_5 FD_{t-1} + \sum_{i=0}^{n} \beta_6 \Delta \ln SG_{t-1} + \sum_{i-0}^{n} \beta_7 \Delta \ln IN_{t-1} + \sum_{i=0}^{n} \beta_8 \Delta \ln RE_{t-1} + \sum_{i=0}^{n} \beta_9 \Delta \ln NRE_{t-1} + \alpha_1 \ln CO_{2t-1} + \alpha_2 \ln GDP_{t-1} + \alpha_3 \ln GDP^2_{t-1} + \alpha_4 \ln GDP^3_{t-1} + \alpha_5 \ln T_{t-1} + \alpha_6 \ln FD_{t-1} + \alpha_7 \ln SG + + \alpha_8 \ln IN_{t-1} + \alpha_9 \ln RE_{t-1} + \alpha_{10} NRE_{t-1} + \varepsilon_1$

$\mathbf{\Delta lnEF_t}$ =$\beta_0 + \sum_{i=1}^{n} \beta_1 \Delta \ln GDP_{t-1} + \sum_{i=0}^{n} \beta_2 \Delta \ln GDP^2_{t-1} + \sum_{i=0}^{n} \beta_3 \Delta \ln GDP^3_{t-1} + \sum_{i=0}^{n} \beta_4 \Delta \ln T_{t-1} + \sum_{i-0}^{n} \beta_5 FD_{t-1} + \sum_{i=0}^{n} \beta_6 \Delta \ln SG_{t-1} + \sum_{i-0}^{n} \beta_7 \Delta \ln IN_{t-1} + \sum_{i=0}^{n} \beta_8 \Delta \ln RE_{t-1} + \sum_{i=0}^{n} \beta_9 \Delta \ln NRE_{t-1} + \alpha_1 \ln EF_{t-1} + \alpha_2 \ln GDP_{t-1} + \alpha_3 \ln GDP^2_{t-1} + \alpha_4 \ln GDP^3_{t-1} + \alpha_5 \ln T_{t-1} + \alpha_6 \ln FD_{t-1} + \alpha_7 \ln SG + + \alpha_8 \ln IN_{t-1} + \alpha_9 \ln RE_{t-1} + \alpha_{10} NRE_{t-1} + \varepsilon_1$

Wherein Δ represents the first difference, β_0 represents the drift component, $\varepsilon_1$represents the error term, summation signs are represented by error correction dynamics while α shows the long-run relationship. The study will employ the bi-variate Granger causality technique to examine the causal connection amongst macroeconomic variables and environmental quality parameters.

Result and discussion:

We utilized two Unit Root Tests in Table2, namely the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. These evaluate whether null hypothesis of a unit root is valid or if the alternative of stationarity holds.

Table 3 displays the findings for CO_2emissions and EF model specifications. First specification CO_2 emission shows a negative and significant coefficient (1% level) for long-run economic growth (LNGDP), demonstrating that increasing economic growth is associated with improved carbon dioxide emission control. Beyond a particular income level, the squared economic growth coefficient (GDP^2) predicts environmental improvement. Both the GDP^2 and GDP^3 coefficients are significant at the 1% level in both the short-long periods, indicating that there inverted N-shaped EKC in India. This suggests that as economic growth accelerates, environmental degradation decreases, worsens at greater levels of growth, and eventually diminishes, validating the curve's relevance in India for both short-long term scenarios. Similarly to second specification ecological footprint (EF) is Inverted N-shaped EKC exist in India.

Trade liberalization has a negative and insignificant connection with CO_2 emissions, however, for ecological footprint, the relationship is strong and negative at the 1% level. A 1% rise in trade liberalization results in a long-term reduction in ecological impact.

The findings indicate that financial development contributes to higher ecological footprints, implying a reduction in sustainability. As financial development levels rise, it triggers economic growth, which in turn leads to increased environmental pollution, as recognized in the study by Usman et al. (2020).

The size of government (including investment, consumption, taxes, subsidies, and the highest marginal tax rate) has a positive and significant link in the long-run at the 5% level, influencing economic aspects such as infrastructure, public services, and growth (Sajeev and Kaur, 2020).

Industrialization, specifically coal production, displays a positive and significant impact at5% level on carbon dioxide emissions. This suggests that the growth in coal production within industries is influencing carbon dioxide levels. The coefficient for consumption of renewable energy has a highly significantly negative association (1%) with both CO_2 emissions and Ecological Footprint in equally long-short term. The error correction term (ECM) has been discovered to be both negative and significant at a 1% level for both Carbon dioxide emission and EF. A negative ECM value implies that there is an inclination for the system to accurate deviations from the long-run equilibrium path.

In Figures1 and 2, the research discovered that the CUSUM and CUSUM of Squares metrics of ecological footprint and carbon dioxide fall within the critical thresholds of the 5% level of significance.

Granger causality for ecological footprint, as shown in Table 4, demonstrates unidirectional correlation between various parameters, including LNGDP, $LNGDP^2$, GDP^3, LNT, and LNIN. However, there was no evidence of correlation between LNEF and LNFD, LNEF and LNSG, or EF and LNRE, demonstrating that financial development, government size, and renewable energy usage do not predict increases in ecological footprint. The Granger causality test for carbon dioxide in Table 5 shows unidirectional relationships between $LNCO_2$ and LNGDP, $LNCO_2$ and LNT, $LNCO_2$ and LNFD, $LNCO_2$ and LNSG, $LNCO_2$ and LNIN, implying that changes in growth, trade openness, financial development, government size, and industrialization can predict changes in carbon dioxide. The link between square (GDP^2) and cubic GDP^3 and CO_2 emissions is bidirectional.

Conclusion:

The research focuses on the Environmental Kuznets Curve since 1990 to 2020 in India, with an emphasis on CO_2 emissions and Ecological footprint. It examines the influence of GDP, trade liberalization, financial development, development size, industrialization, and consumption of renewable energy with the ARDL bounds test. The outcome shows an Inverted N-shaped curve concerning both the ecological footprint and CO_2. Trade liberalization decreases the ecological footprint, whereas financial development increases it. Industrialization has a detrimental influence on the environment but has a favorable repercussion on CO_2 emissions in the short run. Granger causality study reveals bidirectional correlation in-between CO_2 emissions and GDP^2 as well as CO_2 and GDP^3. Despite the lack of a clear link, renewable energy usage decreases both Ecological Footprint and CO_2 emissions in a long-short term, boosting the Indian economy.

The observed conclusion has important policy implications, particularly the exploration of an Inverted N-shaped EKC, which indicates lower environmental deterioration near the conclusion of economic growth. Government efforts such as rewarding enterprises in the carbon industry through tax credits for carbon reduction investments and investing in low-income persons for sustainable resource usage are proposed. To maximize the benefits of trade liberalization, including strong environmental criteria, supporting circular economy initiatives, adopting carbon pricing systems, and lowering tariffs, particularly on critical intermediary products, are recommended. Additionally, Policies should also stimulate green financing, sustainable entrepreneurship, prudent debt management, and the use of new technology.

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Table 2: Unit root test: Note: *, ** denotes the 1 % and 5 % of significance level.

Augmented Dickey-Fuller unit root test (ADF)			
Without Constant and Trend			
Variable	Level		First difference
	Adj. t-Stat	P-value	Adj. t-Stat
$LNCO^2$	-0.9854	0.2834	-2.0268**
LNEF	-2.2222**	0.0275	-3.5139*
LNGDP	-0.2155	0.5993	-5.2673*
$LNGDP^2$	-1.0658	0.2519	-7.1856*
$LNGDP^3$	-4.7206*	0.0000	-7.6766*
LNT	1.6018	0.9704	-4.2321*
LNFD	-2.1495**	0.0325	-6.2177*
LNSG	2.0765	0.9891	-4.4875*
LNIN	8.0068	1.0000	-2.1963**
LNRE	-0.0807	0.6474	-12435*
Phillip-Pherenunit root test (PP)			
Without constant and trend			
Variable	Level		First difference
	Adj. t-Stat	P-value	Adj. t-Stat
$LNCO^2$	-0.6184	0.4410	-2.0268**
LNEF	-2.2222**	0.0275	-3.4456**
LNGDP	-0.7114	0.3998	-10.5470*
$LNGDP^2$	-4.5650*	0.0000	-12.7864*
$LNGDP^3$	-4.7221*	0.0000	-15.9276*
LNT	1.2774	0.9453	-4.2550*
LNFD	-2.3447**	0.0207	-6.1318*
LNSG	1.7863	0.9768	-4.4573*
LNIN	7.2015	1.0000	-2.1287**
LNRE	-2.2894**	0.0236	-1.3097

Table 3: ARDL model of Long-short run carbon dioxide and EF

Note: *, ** and ***specify significance at 1%, 5%, 10%.

	Carbon dioxide emission (CO_2)		Ecological footprint (EF)	
Variables (Long-run)	Coefficient	T-statistics	Coefficient	T-statistics
LNGDP	-5.825062**	-2.8238820	-4.261082**	-3.932956
$LNGDP^2$	14.71858**	2.652416	11.05343**	3.686617
$LNGDP^3$	-3.585255**	-2.321138	-2.851010**	-3.258520
LNT	-0.04444	-1.009013	0.019447	0.586500
LNFD	0.154057	0.941912	0.412626**	3.433833
LNSG	0.383599**	2.082022	-0.446210**	-2.239409
LNIN	0.194222	1.285152	-1.153170**	-4.080814
LNRE	-1.374719*	-5.176312	-0.039089*	-7.910994

(Short-run)				
$LNCO_2(-1)$/ LNEF (-1)	-0.526164**	-2.898421	-1.066923*	3.39049
LNGDP	-3.064939***	-2.072385	-2.882308**	-2.659152
$LNGDP^2$	7.744392***	1.917562	7.592175**	2.632600
$LNGDP^3$	-1.886433	-1.636671	-2.065021**	-2.563802
LNT	-0.023385	-0.593842	-0.261387**	-3.078525
LNFD	0.081059	0.746838	0.440240**	2.342045
LNSG	0.201836	1.179019	-0.476071	-1.448260
LNIN	0.371316**	2.121018	-1.136593**	-2.489470
LNRE	-0.723328*	-3.745291	-1.230344*	-3.577117
ECM	-0.526164*	-9.083091	-1.066923*	-7.360070

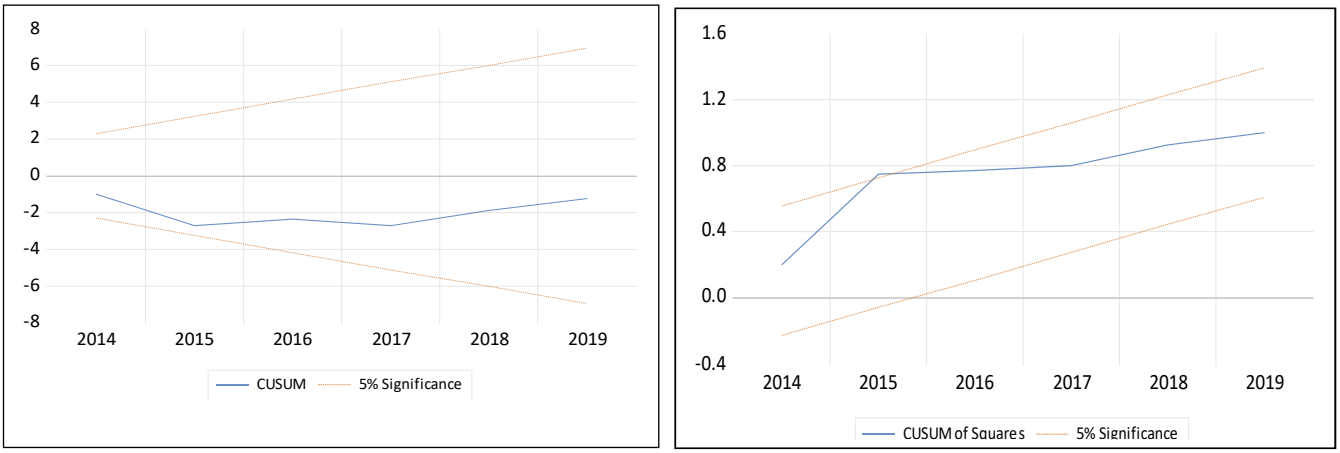

Figure 1: CUSUM and CUSUM of square (ecological footprint)

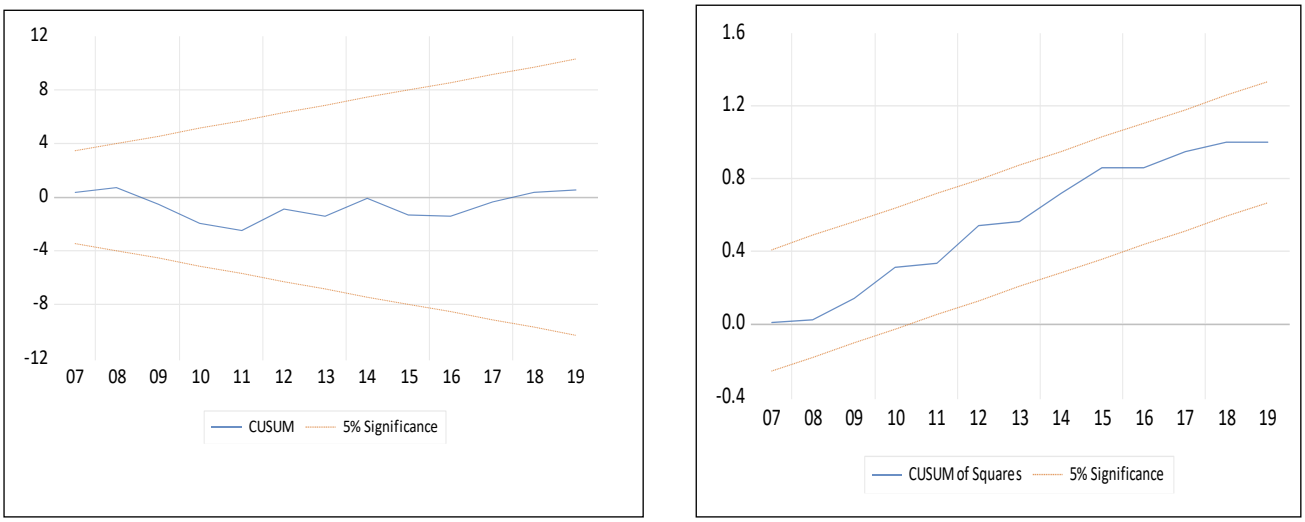

Figure 2: CUSUM and CUSUM of square (CO_2)

Table 4: Result of Granger causality Test (ecological footprint)

Null hypothesis	probability	Remark path	Decision
EF → GDP **GDP ← EF**	0.7145 0.0021	Unidirectional GDP ←EF	REJECT H_0
EF → GDP^2 **GDP^2 ← EF**	0.7144 0.0017	Unidirectional GDP^2←EF	REJECT H_0
EF →GDP^3 **GDP^3← EF**	0.722042 0.0012	Unidirectional GDP^3 ← EF	REJECT H_0
EF → T **T ← EF**	0.72204 0.0045	Unidirectional T ← EF	REJECT H_0
EF → FD **FD ← EF**	0.41279 0.58379	Neutral FD ≠ EF	ACCEPT H_0
EF → SG **SG ← EF**	0.84436 0.26258	Neutral SG ≠ EF	ACCEPT H_0
EF → IN **IN ← EF**	0.0338 0.344099	Unidirectional IN ← EF	REJECT H_0
EF → RE **RE ← EF**	0.8675 0.68908	Neutral RE ≠ EF	ACCEPT H_0

Table 5: Result of Granger causality Test (CO_2)

Null hypothesis	probability	Remark path	Decision
CO_2→GDP CO_2←GDP	0.0016 0.1041	Unidirection CO^2→GDP	REJECT H_0
CO_2→GDP^2 CO_2←GDP^2	0.0010 0.08257	Bidirectional CO^2 ⇆GDP^2	REJECT H_0
CO_2→GDP^3 CO_2←GDP^3	0.0001 0.043	Bidirectional CO^2 ⇆GDP^3	REJECT H_0
CO_2→T CO_2←T	0.8766 0.08788	Unidirectional CO^2←T	REJECT H_0
CO_2→FD CO_2←FD	0.011 0.9402	Unidirectional CO_2→FD	REJECT H_0
CO_2→SG CO_2←SG	0.089 0.29716	Unidirectional CO_2→SG	REJECT H_0
CO_2→IN CO_2←IN	0.0007 0.6038	**Unidirectional** CO_2→IN	REJECT H_0
CO_2→RE CO_2←RE	0.42487 0.9305	Neutral CO^2≠RE	ACCEPT H_0

Analysing the burden of cardiovascular diseases (CVDs) in India: A gender-wise study

Bhed R. Verma[*] and Ram Lal Bhardwaj[#]

Abstract

The paper provides a gender-wise analysis of the prevalence of CVDs and associated OOP health expenditure in India. This study used National Sample Survey (NSS) data of the 75th Round (2017-18) on Health. The study found gender-wise disparities in Out-of-Pocket (OOP) spending on CVD among men and women. The prevalence of CVDs is slightly lower among women than men out of 1000 population. However, the share of average monthly per-patient OOP expenses on CVDs has been measured at INR 2604.77 for women and INR 4413.79 for men in inpatient care. Also, to cope with CVDs-derived OOP expenditure, borrowings and other distress sources are essential sources of finance, particularly in inpatient care. In conclusion, the study proposed the need to change people's behaviour through proper awareness, a national plan to reduce the number of CVD occurrences. Also, government spending on specialised public healthcare infrastructure, including insurance coverage, must rise to reduce the country's economic losses of CVD-derived expenses.

Keywords: Cardiovascular diseases, Out-of-pocket, Healthcare, Borrowings, Expenditure

1. Introduction

Non-communicable diseases (NCDs) have emerged as an epidemic due to epidemiological, demographic, rapid urbanisation and lifestyle changes worldwide. These diseases can be characterised by chronic, long-standing, life-threatening and non-transmissibility from one person to another (Bhagyalakshmi & Kodali, 2019). There are four NCDs, mainly cardiovascular diseases (CVDs), chronic respiratory disease, cancers and diabetes, responsible for 82 per cent of total NCD deaths worldwide. Among them, CVDs are the leading, including a vast disease group inthe heart and blood vessels in the body. The share of CVDs in total deaths due to NCDs is nearly 46.2 per cent (17.5 million) worldwide, but it contributes to more than two-thirds of the total deaths in the South-East Asia Region (SEAR)(Thakur, 2015). According to WHO, at least three-quarters of the world's deaths from CVDs occur in low- and middle-income countries (LMICs).In India, nearly 5.87 million deaths are due to NCDs, accounting for 60 per cent of all deaths (Organization, 2014), where CVD contribute to 45 per cent of all NCD deaths(Sharma et al., 2024).The uninterrupted occurrence of these diseases and their risk factors rapidly increases the burden of CVDs in the country. Findings revealed that the prevalence of CVDs rose from 25.7 to 54.5 million from 1990 to 2016, respectively (Abdul Aziz et al., 2019; Prabhakaran et al., 2018). In 2016, 62.5 million prematurely years of life lost were estimated due to CVD in India. A quarter of deaths in the country are from CVDs with ischemic heart disease and stroke (Prabhakaran, et al., 2016).

In addition to the significant cause of death and disability, it is the critical reason for rising healthcare costs, falling productive efficiency and loss of households' financial stability in the country (Srinivasan, 2009). The economic cost of CVDs has been estimated at $30 billion per annum with the upcoming rising forecast in India (Chaturvedi & Bhargava, 2007; Goyal & Yusuf, 2006). Many studies have concluded that it imposes a significant economic burden on households in India (Boutayeb & Boutayeb, 2005; Bovet & Paccaud, 2011; Prabhakaran & Yusuf, 2010). A few have postulated that it will impact each section of society in the coming years, irrespective of socio-economic and demographic factors(Chauhan et al., 2015; Deepa Shokeen & Aeri, 2015; Indrayan, 2005). Further, by analysing the economic impact of CVDs, Chauhan and Aeri (2015) found that with the rising financial burden of CVDs, households with CVDs affected person experienced more significant

[*] Assistant Professor, Dept. of Economics, Vallabh Govt. College, Mandi, (H.P.), 175001, Email: bhedram4@gmail.com

[#] Assistant Professor, Dept. of Economics, CoE, Govt. Degree CollegeShimla (H.P.), 171006, Email: rlbhardwaj.eco@gmail.com

hardship than their non-affected counterparts. However, Karan, et al. (2014)have concluded that OOP spending is significantly more in CVD-affected households in India.

Earlier, CVDs have been considered a men-centric disease due to the belief that men's absolute risk is higher than women's. But now, the scenario has changed entirely (Möller-Leimkühler, 2007; Nanda & Shivgotra, 2020). Recent trends indicate that the disease has escalated to younger age groups, and it has a significant presence in the case of both genders in urban and rural areas (Indrayan, 2005). The CVD risk factors, such as traditional, socio-economic, and psychological factors among women, have increased to a greater extent and significantly impacted the incidence of CVDs (Gheisari, Emami, Raeisi Shahraki, Samipour, & Nematollahi, 2020; Möller-Leimkühler, 2007). As a result, the absolute numbers of women living with and dying of CVDs & stroke exceed those of men worldwide. Even in India, CVDs are the most important cause of death among women (Office of Registrar General, 2009). In 2011, the WHO reported that age-standardised CVD mortality rates among men and women (per 100,000) range between 363–443 and 181–281, respectively, in India (Organization, 2011). While, Nanda and Shivgotra (2020) found that the prevalence of CVDs in elderly men and women is 38.0 per cent and 40.9 per cent in India, respectively.

Reviewing the prior studies, afew of the studies are mainly concentrated on the economic impact of CVDs on households (Karan et al., 2014; Kumar et al., 2022; Nanda & Shivgotra, 2020; Prabhakaran et al., 2018). However, the rising incidence of CVDs among women is still far from literary exploration. Studies with inadequate literature from clinical trials or limited scope of the earlier studies lack to provide a gender perspective of CVDs in India. Therefore, by keeping this in mind, this study mainly focusses on gender differentials in the incidence and economic burden of CVDs in India.

2. Data and Methodology

2.1 Data source

The paper is based on cross-sectional data from the National Sample Survey Organization (NSSO), 75th Round (2017-18) on 'Key Indicators of Social Consumption in India: Health'. The survey comprises 1,13,823 households comprising 5,55,115 individuals (NSSO, 2017-18). The survey period was from July 2017 to June 2018, during which the recall period for inpatient and outpatient expenditure was 365 and 15 days, respectively. The study includes self-reported data on cardiovascular diseases (CVDs) comprising a group of disorders such as hypertension, heart diseases, chest pain, and breathlessness from which people were living with or hospitalised during the preceding year or period of the survey.

2.2 Methodology

The prevalence of CVD-affected persons (P_C) is measured by;

$$P_C = \frac{1}{N}\sum_{i=1}^{n} Ci, \qquad \ldots (1)$$

Where '*N*' is the populace size, and '*Ci'* is the '*ith'*number of CVDs affected persons.

The economic burden of CVDs has been calculated in terms of per capita out-of-pocket (OOP) health expenses on CVDs, which is givenby;

$$\text{Per Capita OOP} = \sum_{i=1}^{n} OOP_C/N \ldots (2)$$

The average per capita OOP expenses by CVDs affected personsis measured by;

$$\text{Per Patient OOP} = \sum_{i=1}^{n} OOP_C/\sum_{i=1}^{n} Ci \ldots (3)$$

Further, CVDs-derived OOP expenses as a percentage share of total consumption expenditure (TCE) is given by;

$$OOP_{(TCE)} = \sum_{i=1}^{n} OOP_C / \sum_{i=1}^{n} MPCE_i \times 100 \ldots (4)$$

Also, CVD-derived OOP expenses as a percentage share of total consumption expenditure (TCE) of the country's CVD's affected persons is given by;

$$OOP_{TCE_C} = \sum_{i=1}^{n} OOP_C / \sum_{i=1}^{n} MPCE_C \times 100 \ldots (5)$$

Where (from equation 2 to 5)*'N'* is the total populace, '*Ci'*is the '*ith'* number of CVDs-affected persons,'OOP_C' is the CVDs-derived out-of-pocket expenses, '$OOP_{(TCE)}$' is the out-of-pocket expenses as a share of total consumption expenditure, 'OOP_{TCE_C}' is the out-of-pocket expenses as a share of consumption expenditure of the CVD-affected populace. While '$MPCE_i$' is the monthly per capita consumption expenditure of the *'ith'*persons and'$MPCE_C$' is the monthly per capita consumption expenditure of the CVD-affected persons.

Also, the proportion of various sources of finance used to cope OOP health expenses on CVDs has been calculated by;

$$Y = \sum_{i=1}^{n} U/V * 100 \ldots (6)$$

Where Y is the percentage share of source of finance, 'U' is the sum of a particular source, and 'V' is the sum of all sources.

3. Results

3.1 Summary statistics

In Table 1, the details of the sample persons have been given in two categories, i.e., inpatient and outpatient care. Further, the sample has been divided into two groups, i.e., men and women. The survey includes 555,115 sample persons, representing the country's 1,140,187,554 total population. Of them, 58,214 persons reported suffering from severaldiseases in inpatient care. Further, out of these samples, 5,091 persons self-reported that they were affected with CVDs during the preceding year of the survey. On the contrary, a sample of 39,778 persons stated suffering from various diseases in outpatient care, of which 8,146 persons conveyed suffering from CVDs in the country.

3.2 Prevalence of CVDs

Table 2 shows the gender-wise per 1000 prevalence of CVD incidents in India. Findings illustrate that only 2.12 persons suffered from CVD episodes during the preceding year in inpatient care. The frequency is relatively higher among men at 2.26 persons than women at 2.01 persons out of 1000 individuals. In outpatient care, 13.01 persons reported the incidence of CVD episodes, in which the incidence is higher among women. Overall, the figures show that instead of hospitalisation cases of CVDs, women elucidate a high incidence of living with or dying from CVDs in outpatient care in India.

3.3 Level of CVDs-derived OOP expenditure

Table 2 shows the country's average per capita OOP expenses on CVDs is INR 7.63 for inpatient care. Like CVDs' prevalence rate, it is relatively higher among men at INR 9.95 than women at INR 5.13 in India. Also, on average, INR 3600.34 has been spent per patient per month on inpatient care, whereas the amount is INR 4413.79 and 2604.77 for men and women respectively. The figures observed disparities in spending on CVDs among men and women compared to their prevalence rate in the analysis. This disproportionate share of women's OOP spending on CVDs undoubtedly explains the vulnerability of women. Therefore, it is evident that

the percentage of women suffering from CVDs is continuously growing thanmen. However, they are still spending a handful of amounts to cure themselves.

Further, OOP expenditure on CVD as a share of total consumption expenditure (TCE) among men and women has been observed at 0.46 and 0.24 per cent, respectively. Meanwhile, OOP expenditure on CVDs, particularly as a share of consumption expenditure of the affected population, has been measured at 119.48 per cent. Table 2 shows that in inpatient care, men spend more to treat themselves for CVDs than women in India.

In outpatient care, the average OOP expenditure on CVDs is INR 16.10 in India, higher among women at INR 17.42 than men. Although, with a high prevalence rate of CVDs in outpatient care, the per month average OOP expenditure of the affected population has been perceived as moderately lower than inpatient care. Results show that INR 1239.84 is the average monthly OOP expenditure on CVDs in India, where men spend more than women. At the same time, OOP expenditure on CVD as a share of total consumption expenditure (TCE) has been measured at 0.74 per cent, with a higher percentage among women. Further, OOP expenditure as a percentage of consumption expenses of the CVD-affected population is 38.07 per cent in India, where the share is slightly high among men.

3.4 Financing of CVDs-derived OOP expenditure

Table 2 shows that 80.16 per cent of the CVD-affected population use income/savings to finance hospitalisation expenses. Subsequently, borrowings and other remaining coping strategies contribute 10.90 and 8.67 per cent share, respectively. The finding illustrates that income/savings and other remaining methods are slightly high among women, while men employ borrowings mainly to cope with CVDs. However, people borrow funds only when it is unavoidable and mandatory. For instance, men in the country use borrowing to finance OOP health expenditures. Whereas, if the affected persons are women, the tendency of borrowings to cope with CVDs-driven expenditure is relatively low in India. Also, women are more engaged in household activities, compelling them to cure in outpatient care, where women highly employ borrowing to pay CVDs-driven expenditure than men.

Similarly, in the case of outpatient care, income/savings contribute nearly 87 per cent of the country's CVD-derived expenses. It has also been observed that the percentage of borrowings and other remaining strategies are comparatively much less at 1.32 and 3.80 per cent, respectively. Among different genders, men use income/savings more than women, while women use borrowings and other remaining sources.

4. Discussion and Conclusion

The results of the study indicate that the burden of CVD sis emerging as an alarming toll on public health and policy in India. Findings reveal that relatively fewer episodes of CVDs have been reported in inpatient care than in outpatient care, significantly burdening the country's population. Initially, CVDs were considered a men-centric ailment due to the belief that men's absolute risk is higher than women's. But today, with the rising incidence of CVD among women, especially in outpatient care, it can no longer be considered a male-centric disease. Even the risk of heart disease in women is often underrated due to the misconception that women are more protected against CVD than men. For decades, such negligence has made women's treatment strategies less significant against CVDs. Now, women live with and die more because of CVDs & heart disease than men in India (RGI, 2009).

The growing burden of CVDs is raising the OOP spending on medical treatment, risks of catastrophic health expenditure and poverty in India. To compensate for the economic costs of ailments, the country's insurance coverage facilities and healthcare spending are deficient. In India, health insurance coverage is less than 10 per cent of the populace. In comparison, more than 60 per cent of the country's total health expenditure is

paid out-of-pocket (GOI, 2018). Also, the findings show that men's share of average OOP expenditure on CVD is higher than that of women in inpatient care. While on outpatient care, it is higher among women in the country.

Moreover, the treatment costs are higher once anyone gets admitted to the hospital than routine visits for CVDs. Also, women spend less than men, even though they contribute almost an equal share of the country's CVD prevalence, which postulates the existence of gender disparities in the Indian healthcare sector. Women are still economically less independent, and their OOP expenditure against ailment treatment also depends on the mercy of the dominant manly household members. Even the share of borrowing and 'other' approaches to finance CVD-derived OOP expenditure is higher in inpatient care. Facts reveal that the high costs of hospitalisation compel people to manage their financial resources from other sources than savings/income. Thus, the economic costs incurred by CVDs can prove catastrophic for individuals and households and push them below the poverty level. Therefore, India's CVD burden and growing risk factors call for a concerted public health approach to prevent this epidemic.

In conclusion, the rising incidence of CVDs imposes a high economic burden on households in India. To reduce the burden of CVDs, it needed to bring down the episodes of CVDs in the communities. Therefore, the study proposed that it has to be addressed systematically. Firstly, the lifestyle changes associated with bad dietary habits and improper working hours are taking their toll on people. It's necessary to educate people about the risk factors related to changes in lifestyle. Today, there is a need to run a national programme like other ailments eradication programmes that are effectively organised by the country. Secondly, it has been seen that the availability of infrastructural facilities and healthcare delivery systems is inadequate. With insufficient public healthcare facilities, people have to go to private hospitals, which can put a high economic burden on them, especially the underprivileged. Therefore, facilities at the government level are needed to be improved. Lastly, much of the population in India is deprived of healthcare protection schemes. The government should devise measures to include more and more people under insurance coverage. Significantly, people experiencing poverty should be taken care of through its inclusion. Thus, it is high time to initiate appropriate actions to challenge the problem of CVDs; otherwise, it could reach alarming levels that could prove catastrophic for the country.

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Table 1. Summary statistics

Variables	Inpatient			Outpatient		
	Men	Women	Total*	Men	Women	Total*
Total sample	283,200	271,878	555,115	283,200	271,878	555,115
Total estimated population	589,257,319	550,864,001	1,140,187,554	589,257,319	550,864,001	1,140,187,554
Total ailing sample	30,033	28,177	58,214	18,948	20,829	39,778
Total ailing population	14,075,161	13,704,591	27,783,232	39,474,970	45, 793,674	85,269,522
Sample of suffering from CVDs	2,854	2,237	5,091	3,885	4,260	8,146
Estimated population suffering from CVDs	1,328,949	1,085,835	2,414,784	6,853,001	7,948,910	14,802,789
% out of the total population	0.23	0.20	0.21	1.16	1.44	1.30

Note: Figures are based on the author's calculations from the NSSO 75th rounds.

*The total sample and populationalso include the sample of transgender.

Table 2. Gender-wise CVDs' burden and source of finance to cope with the CVDs-derived OOPHE in India (2017-18).

Variables	Inpatient			Outpatient		
	Men	Women	Total	Men	Women	Total
Incidence of CVDs						
Prevalence of CVDs out of per 1000 population	2.26	2.01	2.12	11.61	14.41	13.01
Percentage share of CVDs out of the total ailing population	9.44	7.92	8.69	17.36	17.36	17.36
OOP health expenditure						
Average monthlyCVDs-Derived OOPHE (INR)	9.95	5.13	7.63	14.86	17.42	16.10
Per capita monthly OOPHE of the CVD-affected population (INR)	4413.79	2604.77	3600.34	1277.57	1207.29	1239.84
CVDs-derived OOPHE as a percentage of TCE	0.46	0.24	0.35	0.68	0.81	0.74
CVDs-derived OOPHE as a percentage of TCE of CVD-affected population	138.66	92.85	119.48	38.16	38.00	38.07
Source of finance						
Income/Savings	80.01	80.33	80.16	89.57	84.55	86.87
Borrowings	11.89	9.67	10.90	1.00	1.59	1.32
Others*	7.98	9.52	8.67	2.14	5.30	3.80
Not taking any source	0.12	0.47	0.28	7.27	8.56	7.97

Note: Figures are based on the author's calculations from the NSSO 75th rounds.

*Includes the remaining sources of finance, such as the sale of assets, contributions by friends and relatives and other sources.

REASSESSING THE ELASTICITY OF CRUDE OIL DEMAND IN INDIA: FRESH INSIGHTS FROM COINTEGRATION ANALYSES

Bhimsen Makar[††] and Kanwaljit Kaur[‡‡]

Abstract: This study investigates the relationship between crude oil consumption, crude oil prices, and India's real GDP from 1990–1991 to 2022–2023 using Johansen–Juselius cointegration and ARDL bounds testing methods. The analysis confirms a stable long-term equilibrium among these variables, with crude oil demand significantly influenced by price and income changes in the long run. In the short term, demand remains relatively inelastic, reflecting limited alternatives in key sectors. The findings also reveal a unidirectional impact of crude oil prices on GDP, emphasizing the need to manage price volatility to protect economic growth. The study highlights the importance of promoting energy diversification and sustainable consumption patterns to address India's growing energy needs while ensuring long-term economic resilience

Keywords: crude oil, crude oil price, GDP, inelastic, sustainable consumption

1 Introduction:

India is the world's third-largest consumer and net importer of crude oil, with over 85% of oil requirements being met through imports, a share that is expected to rise to 90% (BP, 2022). Despite its dependence on oil imports, India benefits from surplus refining capacity, enabling it to export significant quantities of petroleum products. According to the International Energy Agency (IEA), oil is expected to remain a key energy source for India's transportation

sector until 2030, due to the limited availability of alternatives to petroleum-based fuels. In the past, the government-controlled petroleum prices, leading to financial challenges for oil marketing companies, which struggled with under-recoveries amid high state and central taxes. However, government subsidies have helped these companies accumulate net profits over time. Key factors driving India's crude oil demand include rising per capita income, fuel prices, and the price difference between gasoline and diesel vehicles, alongside an underdeveloped public transport system. Air quality concerns add urgency to policies targeting gasoline consumption, as many Indian cities rank among the world's most polluted.

Literature Review

Extensive research has explored crude oil demand elasticities, revealing significant variations across economies and regions. Early foundational work by Dahl and Sterner (1991) provided an overview of gasoline demand elasticity, laying the groundwork for subsequent studies. Bentzen (1994) highlighted the role of technological changes in crude oil demand by introducing time trends to account for fuel efficiency improvements. Alves and Bueno (2003) examined cross-price elasticity between gasoline and Sentenac-Chemin (2012) extended this analysis to 1978–2005, confirming price inelasticity shaped by policy and market factors. Paital, Dutta, and Dash (2019) employed ARDL models to study crude oil import demand from 1987 to 2016, revealing significant income elasticity but limited price responsiveness due to regulated prices. Kilian (2020) addressed methodological challenges alcohol in Brazil, showcasing unique regional dynamics.

In the Indian context, Ramanathan (1999) analyzed crude oil demand elasticity from 1970 to 1998, emphasizing high income elasticity. in estimating oil elasticities, offering insights relevant to India. Gupta and Ghosh (2022) incorporated structural breaks to reveal the impact of external shocks on India's crude oil demand, while Chand

[††] Research Scholar, P.U. Chandigarh
[‡‡] Associate Prof (Rtd)in Economics SGGS College, Chandigarh, Guest Faculty, UILS, P.U. Chandigarh

and Sharma (2023) found that renewable energy adoption has reduced income elasticity while increasing price volatility.

Reports from the International Energy Agency (IEA, 2023) and OPEC (2023) projected India's growing contribution to global oil demand. The EIA (2023) and Rystad Energy (2023) emphasized India's energy trajectory and its interplay with policy and technology. This study builds on these foundations using data from 1990 to 2023 and advanced econometric techniques, providing new insights into India's crude oil demand elasticity amidst economic and technological transformation.

Insert Table 1

2. Data and models: Annual data on crude oil consumption (PPAC), Brent crude oil prices (proxy for India's prices), and real GDP (2011–2012 prices, RBI) were analyzed for 1991–1992 to 2022–2023. Log-transformed variables include Lcoc (consumption), Lgdp (GDP), and Lcop (prices). Table 1 summarizes their statistical properties.

2.1 Model

The long-run relationship between crude oil demand, real GDP, and crude oil price is estimated using a linear logarithmic model, as described in the following equation:

$$LCoc = \alpha_0 + \beta_1 Lgdp + \beta_2 LCop + \epsilon_t (1)$$

The coefficients β_1 and $\beta_2$measure the long-term responsiveness of crude oil demand to changes in GDP and crude oil prices, respectively, while $\epsilon_t$captures the error term.

2.2 Johansen–Juselius (J–J) maximum likelihood procedure:

The Johansen-Juselius (J-J) procedure uses maximum likelihood estimation to test for cointegration within a Vector Autoregressive (VAR) framework (Johansen, 1988; Juselius, 1990). It examines whether variables integrated of order one (I(1)) share a common stochastic trend, modeling them at levels or first differences (I(0)) with an error correction term (ECT) with an VAR model of orderρ

$y_t = \alpha_0 + \alpha_{1t} + \sum_{i=1}^{p} \Phi \mathrm{i}_{\mathrm{yt}} - \mathrm{I} + \Psi_{\mathrm{wt}} + u_t (2)$

Where:

- y_t denotes an n × 1 vector of variables that are endogenous and integrated of order one (I(1)).
- t is the time trend (linear).
- $\alpha_0$and α_1 are n × 1 vectors.
  - $\Phi_1, \Phi_2 \ldots\ldots \Phi_{\mathrm{n}}$are the coefficient matrices corresponding to lagged endogenous variables.
  - Ψ is a q × 1 vector containing exogenous variables.
  - u_t is an n × 1 vector of unobserved disturbances, which are assumed to follow a normal distribution with a covariance matrix denoted as Ω.

By taking first differences of the variables $\Delta y_t = y_t - y_{t-1}$ the VAR model can be re-parameterized as follows:

$$\Delta y_t = \alpha_0 + \alpha_{1t} + \sum_{i=1}^{p-1} \Pi_{\mathrm{i}}^{*} \Delta \mathrm{y}_{\mathrm{t-i}} - \Pi_{\mathrm{i}}^{*} \mathrm{y}_{\mathrm{t-1}} + \Psi_{\mathrm{wt}} + u_t (3)$$

Both Π*i and Π* are n × n matrices. Π* refers the long-run multiplier matrix, while Π*i represents the short-run dynamic effects.

The rank (r) of the matrix Π* represents the number of these cointegrating vectors. If r = n, all variables are stationary (I(0). If r = 0, all linear combinations of the variables are non-stationary (I(1)). If 0 < r < n, there are r cointegrating vectors, showing a long-run relationship.
The J-J test involves two primary statistics: the maximum eigenvalue test and the trace test. These test are based on eigenvalues of the VAR model and help to identify how many cointegrating vectors exist.

2.2.1 Maximum Eigenvalue Test: The Maximum Eigenvalue test determines the number of cointegrating vectors by evaluating the largest eigenvalue the largest eigenvalue, λ_1*, of the matrix Π*. If the rank of Π* equals zero (i.e., the largest eigenvalue is zero)it indicates no cointegration. . The test iteratively examines smaller eigenvalues until the null hypothesis of no additional cointegrating vectors is rejected. The test statistic is:

$$J_{max} = LR(r_0, r_o + 1) = -Tln\,(1 - \lambda^*_{(r0+1)}) \quad (4)$$

where T denotes the sample size, $r_0$represents the assumed number of cointegrating vectors under the null hypothesis, and $r_0 + 1$ corresponds to the alternative hypothesis, which tests for the existence of an additional cointegrating vector.

2.2.2 Trace Test: The Trace test evaluates whether the rank of Π* equals a specific value, denoted as Π* equal r_o, represented as rank(Π*) = r = r_o.testing for cointegrating relationships across all eigenvalues. The test statistic is:

$$J_{Trace} = LR(r_0, n) = -\sum_{i=r_o+1}^{n} Tln\,(1 - \lambda_i^*).....(5)$$

where T represents the sample size, n is the total number of eigenvalues, and λ_i^* (for i = 1, 2, ..., n) are the eigenvalues. The rank evaluation method examines the likelihood of the data under both the testable and competing assumptions, providing information about the count of long-term equilibrium relationships (Hamilton, 1994).

2.3 ARDL BOUND TEST The bounds testing method, unlike Johansen-Juselius, accommodates variables with mixed integration orders and simultaneously estimates long- and short-term effects. The unrestricted ARDL model includes first-differenced terms of the variables ($\Delta Lcrude_t, \Delta Lcop_t \Delta Lgdp_t$) and their lagged differences ($\Delta Lcrude_{t-i}, \Delta Lcop_{t-i} \Delta Lgdp_{t-i}$) . Additionally, it includes the error correction terms ($\lambda_1 Lcrude_{t-1}, \lambda_2 Lgdp_{t-1},\ \lambda_3 Lcop_{t-1}$) to account for the adjustment to the lasting equilibrium and ϵ_{1t} is the residual term.

The Standard ARDL representation for three variables (Y, X1, and X2)

$$\Delta Lcrude_t = \alpha_1 + \sum_{i=1}^{n} b_{1i} \Delta Lcrude_{t-i} + \sum_{i=1}^{n} c_{2i} \Delta Lgdp_{t-i} \sum_{i=1}^{n} d_{3i} \Delta lnCOP_{t-i} + \lambda_1\, Lcrude_{t-1} + \lambda_2\, Lgdp_{t-1} + \lambda_3\, Lcop_{t-1} + \epsilon_{1t} \quad (6)$$

Cointegration is tested using the F-statistic; if it exceeds the upper critical value, a stable long-term relationship is confirmed. This approach provides flexibility in modeling complex dynamics among the variables.

3 Results and discussions

The analysis adopts a series of unit root tests—ADF, PP, and KPSS—to evaluate the stationarity of the time series, accounting for potential structural breaks. Additionally, the ADF Break test is utilized to address such breaks, where the ADF, PP, and ADF Break tests assume the presence of a unit root under the null hypothesis, and the KPSS test assumes stationarity.
Table 2 shows that most tests (ADF, PP, KPSS) suggest the series are I (1), although a few instances indicate stationarity. The ADF Break tests reveal that Lcop and Lgdp as I (1), while Lcrude is I (0).

Table 3 results show the optimal lag selection using Lütkepohl's (1993) lag-order determination formula, which considers both the sample size and the number of endogenous variables, where $m * mlag = T^{1/3}$. The Akaike Information Criterion (AIC), Adjusted log-likelihood ratio (LR), FPC and SC and HQ test criteria indicate the optimal lag order as 2. The absence of autocorrelation in the residuals further confirms the appropriateness of the lag selection.

Table 4results shows that while using the maximal eigenvalue tests, the assumption of no cointegration (r = 0) is rejected in favor of r > 0 and r>1 at a 5% significance level. Similarly, the trace statistic also rejects the assumption of no cointegration when compared against r > 0 and r>1 at the 5% significance level. Both methods yield consistent results, suggesting a stable long-term association or cointegration among the variables being analyzed. The maximal eigenvalue and trace tests are particularly suited for determining the number of cointegrating relationships in multivariate time series data, with their theoretical foundations ensuring robust and reliable results in such contexts (Johansen, 1988; Juselius, 1990).

Table 5 shows the results from the ARDL bounds tests for cointegration. Notably, (Lcrude, Lgdp, Lpr) exceeds the upper bound critical value at a significance level of 10%, exclusively in the absence of a time trend. This indicates the existence of a stable relationship among the variables Lcrude, Lgdp, and Lcop. Subsequently ECM analysis is performed to assess whether the variables move toward a steady state over the long term. The ECM results are significant at the 1% level, confirming that the variables in the model return to equilibrium in both cases, whether a time trend is included or not.

Table 6 presents elasticity estimates for crude oil consumption, GDP, and crude oil prices using Johansen-Juselius (J-J) and ARDL cointegration methods. The J-J test estimates long-run price elasticity at -1.82, indicating a 1.82% decrease in consumption for a 1% price increase, consistent with Ramanathan (1999) (-1.52) and Paital et al. (2019) (-1.79). Long-run income elasticity is +3.86, highlighting dependence on GDP growth, aligning with Gupta and Ghosh (2022) (+3.54).

Short-run elasticity estimates show price elasticity at +0.12 and income elasticity at +0.02, reflecting inelastic demand, similar to Havranek et al. (2012) (+0.10) and Sentenac-Chemin (2012) (+0.05).

The ARDL method supports these findings, with long-run elasticities of -0.16 (price) and +0.70 (income) and short-run elasticities of -0.01 (price) and +0.86 (income). The ECM coefficient (-0.70) indicates a stable equilibrium, emphasizing stronger long-term responsiveness compared to the short term.

The assumption related to GDP indicates that the associated probability is below 5%. Consequently, the initial claim cannot be refuted due to insufficient evidence. This finding suggests a unidirectional relationship between crude oil prices and GDP in India. Specifically, changes in crude oil prices appear to influence GDP growth, whereas the reverse is not true—improvements in GDP do not have an effect on crude oil prices, as the original assumption remains valid. These results align with the findings of Sahu and Bandopadhyay (2020)

4. Conclusion and Policy Implications

This study confirms a stable long-term relationship between crude oil consumption, GDP, and crude oil prices in India, as demonstrated by the Johansen-Juselius and ARDL cointegration frameworks. Crude oil demand is significantly influenced by GDP growth and price changes in the long term, while short-term demand remains relatively inelastic. The ARDL results validate these trends and confirm stable equilibrium adjustments. A unidirectional causal relationship from crude oil prices to GDP underscores the critical influence of energy prices on economic growth, with GDP changes having no reciprocal effect on crude oil prices.

These findings highlight the need for policies promoting energy diversification, energy efficiency, and sustainable infrastructure. Stabilizing crude oil prices is essential for protecting economic growth, while long-term price sensitivity suggests the potential for a shift towards alternative fuels and public transportation. Policymakers should prioritize renewable investments to enhance energy security and reduce reliance on crude oil.

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Table 1 Descriptive Statistics

Descriptive Statistics	Lcrude	Lgdp	Lcop
Mean	11.71	15.60	3.71
Median	11.71467	15.60	3.77
Maximum	12.31502	16.58	4.71
Minimum	10.96379	14.62	2.54
SD	0.406764	0.63	0.68
Skewness	-0.302756	0.00	-0.06
Kurtosis	2.080151	1.64	1.59

Source: Author's Calculations using E-views (10)

Table-2 Unit root tests

Variables	Level (intercept and trend)			
	No structural Breaks			Structural Breaks
	ADF	PP	KPSS	ADF_break_test
Lcrude	-2.72	-1.75	0.13**	-6.89(2016)*
Lgdp	-1.83	-2.12	0.10	-3.19(2015)
Lcop	-2.06	-2.06	0.12**	-4.34(2003)
	First Difference (Intercept, no trend)			
ΔLcrude	-4.02*	-3.62*	0.18	-4.52* (2003)
ΔLgdp	-4.95*	-4.95*	0.14	-8.16*(2020)
ΔLcop	-5.58*	-5.21*	0.10	-5.63*(2009)

Source: Author's Calculations using E-views (10)

NA not applicable

∗Rejection of null hypothesis at 5% level of significance

∗∗Rejection of null hypothesis at 10% level of significance

Table 3 Lag length criteria test results

LAGS	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQC**
0	15.80	NA	8.30	-0.88	-0.74	-0.83
1	361.71	596.40	6.77	-24.11	-23.55	-23.94
2	909.42	830.9*	5.08*	-61.27*	-60.28*	-60.96*

* Indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Table 4 Johansen–Juselius likelihood co-integration tests

Null	Alternative	Statistic	5% critical value
Trace Statistics			
$r = 0$	$r > 0$	153.71	29.79
$r \leq 1$	$r > 1$	37.70	15.49
$r \leq 2$	$r = 2$	2.38	3.84
Eigen value statistics			
$r = 0$	$r > 0$	116.01	21.13
$r \leq 1$	$r > 1$	35.31	14.26
$r \leq 2$	$r = 2$	2.38	3.84

Source: Author's Calculations using E-views (10)

Table 5 Bounds tests for cointegration

F-statistics	Without a time, trend	With a time, trend
$F_{Lcrude}\ (Lcrude \mid Lgdp, Lcop)$	4.27*** (4.14)	3.23 (5.06)
ECM (Error Correction Model)	-0.18*	-0.17*

Source: Author's Calculations using E-views (10) (Figures in parenthesis are upper bound I (0) critical value of acceptance of null hypothesis

Table 6 Price and Income Elasticity (Short-run and Long-run)

Cointegration method	Long-run		Short-run	
	Income elasticity	Price elasticity	Income elasticity	Price elasticity
J-J	3.86* (0.00)	-1.82* (0.00)	0.02** (0.03)	0.12 (0.11)
ARDL	0.70* [0.0]	-0.16** [0.07]	0.86* [0.00]	-0.01 [0.61]

Source: Author's Calculations using E-views (10)

Table 7 Results of Toda-Yamamoto (TY) version of Granger Causality Test for Gross Domestic Product and Crude Oil Price

Null Hypotheses	Chi-square statistics	Probability	Result	Conclusion
H101: The change in GDP does not Granger cause any change in crude oil Price	5.374286	0.6144	Accepted	Unidirectional Granger Causality from Crude oil Price to GDP
H201: The change in crude oil price does not Granger cause any change in GDP	15.48611	0.0302	Rejected	

Source: Author's Calculations using E-views (10)

AN ECONOMIC ANALYSIS OF FOOD SECURITY AND POVERTY AMONG HOUSEHOLDS

Anuradha Paul[*] & V. Suthacini[#]

ABSTRACT

Food is always a major concern in the present and the future as it is the basic human necessity. Millions of people worldwide suffer from poverty, which is an incurable condition that is particularly severe in developing nations because their low per capita income, high unemployment rates, and underutilization growth. Food security and poverty are inextricably related as low-income households often do not have the financial assets to acquire sufficient healthy food stuff for live healthy and active lives. This study investigates the perception of food consumption pattern of the household and the effect of poverty on food consumption of the household. This study used primary sources to gather data. A simple random sampling method is applied. The data is gathered from the households using interview schedule. Descriptive statistics, chi square are used to examine the data. Most of the households reveals that the price of food items is high, this indicates that households are worried about getting food for their daily consumption therefore household have shifted to low priced foods. There is an association between poverty and selected variables includes age, educational, gender in addition to income with respect to food consumption. It also indicates that the poverty is a major risk driven factor for the socio- economic conditions and food consumption of the households.

Keyword: Poverty, Food security, household, food consumption

INTRODUCTION

For every human being, food is the most basic necessity. Food is considered to be the basic form of nourishment and a sufficient intake of both quality and quantity food is essential for a healthy and prosperous life (FAO, 2005). Since the beginning of human history, people have worked make certain the fact they must acquire to healthyas well as nutritious food. Every human being needs high-quality food to be healthy and long-lived. Assuring adequate and high-quality food for every human being is acknowledged globally since 1940s of the 20th centuries, given the significance of food for survival of human being. The key aspect of every household and person's well-being is food security.

Conceptual Explanations

Food Security

In accordance with the FAO, food security is the state that ensures everyone always has economical, social and physical access on enough food with nutrients to satisfy the needs and tastes for a healthy as well as active lifestyle. According to the World Bank (1986), food security is the capability of every individual always require admittance to sufficient food throughout a life of wellness and activity. Hence, it is considered that having enough food in an appropriate quantity and quality is essential for national security, economic expansion, social activities, and stability in society. The primary objective of food security towards makes sure that people are able to get enough food and use it to meet their own dietary necessities. Food security isn't the case at individual home as well as country levels same as food security at any other level. At the national level, food security is attained while entirely individuals require somatic as well as financial admittance towards adequate nourishing foodstuff that satisfies their nutritional desires also fondness while maintaining a hale and hearty as well as energetic way of lifespan. Food security on household level states to having both financial and somatic admittance to enough food that satisfies each person's needs with regard to quantity, quality, safe

[*] Ph.D. Research Scholar, Dept. of Agricultural Economics, School of Economics, Madurai Kamaraj University, Madurai
[#] Asst. Professor & Head, Dept. of Agricultural Economics, School of Economics, Madurai Kamaraj University, Madurai

food and cultural accessibility. Food accessibility is the source of foodstuff by way of cultivation, distribution, and exchange; food access is the affordability and distribution of food as well as family and individual preferences (FAO, 2010). Food utilised refers to using food as energy for the body. Food must be used appropriately, that is, it must be able to meet individual's nutritional needs and preferences, even in situations where they can access it.

Poverty

The World Bank defines poverty as lacking the means to meet one's basic necessities, which include clothing, food, shelter and money. Poverty is the absence of money; more generally, it refers to obstacles to daily life. The concept of poverty encompasses all social elements, including social exclusion, gender inequality, isolation, vulnerability, insecurity and helplessness. It also includes low levels of education, poor standard of living, lack of health care facilities and low income and low consumption. Poverty is characterised as the state in which a household or an individual cannot meet their needs for the essentials of living, and that comprise consumption and non-consumption goods that are seen to be the minimal requirements to support a livelihood.

The numeral of individuals alive in poverty as well as hunger rises, association among food security and poverty is especially significant in the present era due to the quick changes in the economic situation that affect small producers, such as farmers and labourers. In developing nations, the level of poverty is directly correlated with food availability, wherein essential food grains remain to be prevalent and have a lower yield, making up three-fifths of the population's daily calorie consumption. Food insecurity is largely caused by poverty. Food security subjective both through a person's buying supremacy and the real obtain ability of foodstuff. Starvation stands begun through financial strategy structures, conventions, ineffective behaviour, inappropriate behaviour, and corruption in both developed and developing nations. Furthermore, socio cultural variables can improve the likelihood of hunger and malnourishment.

REVIEW OF LITERATURE

Various studies had been conducted separately on food security and poverty reduction but this reduces the gap and investigated on perceive households' food consumption patterns and the effect of poverty on food security of the household. The studies reviews were:

Imam Mukhlis et al (2021) analysed the relationships between those residing under the threshold of poverty, food security, cost of food index, growth in the economy and the agriculture sector in ASEAN nations. According to the study's findings, poverty rates were greatly but adversely affected by the rate of food security, economic growth and the agricultural industry's portion of the GDP. In the meantime, poverty rates were greatly and positively related to the population in ASEAN nations. Salyha Zulfiqar Ali Shah et al (2020) study on poverty status and contributing factors with respect to Southern Punjab. The results indicated that a household's age and level of education, as well as the ownership of house, wife contribution, payment sand numeral of wage employees in the house as well as somatic resources reduce the possibility of poverty in Southern Punjab. Greater domestic sizes, main segment service, a larger dependency proportion, as well as rational disabilities were correlated with a greater probability of poverty in Southern Punjab. Sisay Debebe et al (2020) investigated quantify, characterise and evaluate the effect of poverty as well as earnings disparity slated the level of food uncertainty experienced by houses popular Sawla, a city in Southern Ethiopia. The food-in secured households indicated more concerning levels of poverty and inequality of income. It also revealed that the level of household poverty is negatively and significantly impacted by the main occupation, savings, family size, divorce status, education level, and ownership of a residence. The quantile regression model's results showed

that age, education level, family size, health, savings, remittances, and home ownership all had an impact on the income level of households in the research area. N. V. Kumbhare et al (2013) study on measurement of family's food security in India. This study investigated the dynamics of affordable, accessible, and easily available quality food of rural households in two districts Bhandara and Chandrapur in the Maharashtra region's Vidarbha area. The results of the research showed that, comparison to above poverty line (APL) families, below poverty line (BPL) households had a lower overall level of food security. Additionally, it was found that BPL households had worse levels of food availability, accessibility, quality, and affordability than APL households. Annual income, the quality of the food, the usage of modern technologies, and social engagement were some of the factors that need an affirmative and significant effect in family food security. M.A Rahman et al. (2013) study on poverty as well as foods security. The scarceness as well as food stuff safety of fishermen's households in a specific region were the primary focus of the present research. The findings of the research were that age as well as household size had a harmful effect on calorie consumption, earnings, schooling, cultivate land, as well as rental region took a beneficial impact. Majority of fishermen's households experienced food insecurity and poverty. Food costs take up the majority of their income. They had very little money left over after basic expenses. Most of households had low level of food stuff eating score.

OBJECTIVES

1. To get insight the households in the study area perceive their food consumption patterns.

2. To analyse the effect of poverty on food consumption of the household.

HYPOTHESIS

Hypothesis: There is no important association between socio-economic variables, poverty with respect to food consumption.
In order to study the socio-economic variables, poverty with respect to food consumption chi-square test is used

MATERIALS AND METHODS

The present research is carried out in Madurai district of Tamil Nadu. The study is conducted in the Vadipatti block in the Madurai district of Tamil Nadu in India. An Interview schedule is prepared for the collection of primary data in the study area with a total sample of 126 households. This research used primary data and the sample respondents are selected through simple random sampling techniques. The information gathered was codified, categorised, and calculated. Numerical implements for instance descriptive statistics and chi square are employed. Chi-square test is used towards define the association among socioeconomic variables and poverty with respect to households' food security.

RESULT AND DISCUSSION

Table: 1. Socio Economic Profile

The table 1 explains that out of 126 respondent from study, 30% of the respondents belongs to the age group of 25 to 35 years, 23% of the respondents belongs to the age group of 35 to 45 years, 20% of the respondents belong to the age group of 45 to 55 years, 16% of the respondents belong to the age group below 25 years, and 11% of the respondents belong to the age group of above 55 years in the study area.

The data explains that 57% of the respondent's head are female and 43% of the respondents is male in the study area.

The data explains that 5% of the respondents are illiterate, 17% of the respondents have completed primary school, 17.5% of the respondents have completed secondary education, 36.5% of the respondents have completed Higher Secondary, 9 percent of the respondent have completed graduation, 15 percent of the respondents have completed diploma and other courses. This table shows that majority of the respondents are higher secondary school educated.

The table 1 explains that 34% of the respondents are privately employed, 28% of the respondents are engage in agriculture, 22% of the respondents are government employees and 16% of the respondents are doing Business in the study area.

The data explains that 49.2% of the respondents have 3-5 members in their family, 37.3% of the respondents have below 3members in their family, 13.5% of the respondents have above 5 members in their family in the study area.

The data explains that 24 percent of the respondents are earning income below Rs. 5000, 13 percent of the respondent are earning income Rs 5000 to10,000, 46 percent of the respondents are earning income Rs 10,000 to 15000 and 17 percent of the respondents are earning income above Rs. 15,000 in the study area. This table shows that most of the respondents are earning income Rs 10,000 to 15000.

The data explains that 18 percent of the respondent food expenditure is below Rs 2000, 45percent of the respondent food expenditure is ranges between 2000 to 4000, 22percent of the respondent food expenditure is ranges between Rs 4000 to 6000, and 15 percent of the respondent food expenditure is above 6000 in the research area. This table reveals that most of the household's food expenses is Rs 2000 to 4000.

Table No. 2 Perception regarding food availability

The data explains that 37 percent of the respondent felt the price of food items as high and 63 percent of the respondent not agreed this statement.

The data explains36 percent of the respondent agreed that they worried about getting food because high price and unavailability of food in the research area and 64 percent of the respondent denied this statement.

The data explains that27 percent of the respondent agreed that they have shifted to low priced foods and 73 percent of the respondent not agreed this statement.

The data explains that 31 percent of the respondent borrowed money from relatives to buy food and69 percent of the respondent not agreed this statement.

The data explains that 65percent of the respondent consumed sufficient and balanced diet and remaining 35percent of the respondents denied this statement in the study area.

Table No. 3. Food consumption pattern

It is evident from the table that vegetable consumption ranked first by rural households, which indicates that easily available of vegetables in the study area. Milk and dairy products and cereals ranked second and third, which shows the availability of food products in rural area and it is followed by fish, meat and other products, fruit and other products.

Result of Hypothesis

Table: No .4: Association between socio-economic variables, poverty with respect to food consumption

The estimated result shows that the assessment of Chi-Square is significant for all the selected parameter for instance age, educational, gender as well as income of the rural households in the study area at 5 percent level of significance. Therefore, the null assumption is excluded. i.e., there is a relationship amid socio economic parameter for instance time of life, educational level, gender, income as well as poverty with respect to food consumption.

Conclusion

Food is the most essential basic need for all humans' beings. Most of the households said that the price of food items is as high this and indicates that households are worried about getting food for their daily consumption therefore households have shifted to low priced foods. Vegetable consumption ranked first by rural households, which indicates the easy availability of vegetables in the study area and it, is followed by the milk and dairy products, cereals, fish, meat, fruit and other products. There is an association between poverty and selected parameter such as per age, educational, gender as well as income with respect to food consumption. It also indicates that the poverty is a major risk driven factor for their socio- economic conditions and food consumption of the households. Imperative to attain food security, there must be sufficient food available on a regular basis, people require enough more currency otherwise extra possessions to buy or exchange foodstuff, food must be prepared and stored properly, people must be aware of good nutrition and childcare practises, and people must have access to sufficient health and sanitation services.

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Table: 1. Socio Economic Profile

Sl.No	Category	No. of Respondents	Percentage
	Age		
1.	Below 25 Years	20	16
2.	25 to 35 Years	38	30
3.	35 to 45 Years	29	23
4.	45 to 55 Years	25	20
5.	Above 55	14	11
	Total	**126**	**100**
	Family Head		
1.	Male	54	43
2.	Female	72	57
	Total	**126**	**100**
	Education		
1.	Illiterate	6	5
2.	Primary school	21	17
3.	Secondary school	22	17.5
4.	Higher secondary	46	36.5
5.	Diploma and other courses	19	15
6.	Graduation	12	9
	Total	**126**	**100**
	Occupation		
1.	Agriculture	35	28
2.	Government servant	28	22
3.	Private employee	43	34
4.	Business	20	16
	Total	**126**	**100**
	Size of household		
1.	Below 3	47	37.3
2.	3 – 5	62	49.2
3.	Above 5	17	13.5
	Total	**126**	**100**
	Income		
1.	Below 5000	30	24
2.	5000-10000	16	13
3.	10000-15000	58	46
4.	Above 15000	22	17
	Total	**126**	**100**
	Food Expenditure		
1.	Below 2000	23	18
2.	2000 – 4000	56	45
3.	4000 – 6000	28	22
4.	Above 6000	19	15
	Total	**126**	**100**

Source: Primary data

Table No. 2 Perception regarding food availability

Sl.No	Variables	No. of Respondents	Percentage
1.	**Price of food items are high**		
	Yes	47	37
	No	79	63
	Total	**126**	**100**
2.	**Worried about getting food**		
	Yes	45	36
	No	81	64
	Total	**126**	**100**
3.	**Shift to low priced food**		
	Yes	34	27
	No	92	73
	Total	**126**	**100**
4.	**Borrowing money to meet food expenditure**		
	Yes	39	31
	No	87	69
	Total	**126**	**100**
5.	**Get balanced meal**		
	Yes	82	65
	No	44	35
	Total	**126**	**100**

Source: Primary Data

Table No. 3. Food consumption pattern

Sl.No	Category	Household total score	Rank
1.	Cereals	241	III
2.	Fish, Meat and other products	233	IV
3.	Vegetables	263	I
4.	Fruits	224	V
5.	Milk and Dairy products	245	II
6.	Other	214	VI

Source: Primary Data

Table: No .4: Association between socio-economic variables, poverty with respect to food consumption

Variable	Pearson Chi-square	Df	Asymp. Sig (2- sided)
Age	23.635	4	0.099
Gender	10.498	1	0.030
Education qualification	31.105	5	0.049
Income	19.653	3	0.078
Size of household	32.107	2	0.045
Poverty	48.532	1	0.070
Food consumption	28.788	3	0.092

Industry Specific Determinants and their Effect on Workers' Productivity in Organized Manufacturing sector of India

Chandrima Ganguly[§§]

Abstract

This paper aims at identifying various industry specific determinants of labour productivity using a panel data analysis across 21 major industries in the organized sector of India over the period 2001-02 to 2019-20. While it is widely accepted that human capital is one of the major factors affecting productivity of labour, many findings focused on the elements of skill, education and wage of human capital as the key drivers of labour productivity. However, increasing flexibility in labour market regulations has led to paradigm shift in the employment pattern with growing influx of contractualization of workforce as well as changes in the production process with increasing digitalization of work in the industrial sector.

Thus, this paper explores the effect of certain industry specific determinants on the workers' productivity in the selected organized industries of India. Panel regression has been used and the results show that capital intensiveness of the industry, industry size, wage per worker, profit and welfare benefits have statistically significant positive impact on workers' productivity while trade union activity, contractualization of workforce and digitalization have negative impact on workers' productivity.

Keywords: Contractualization, Trade Unionization, Digitalization, Productivity; JEL: C23, J21, J24, O47

Introduction

Globalization of the world economy has brought about significant labour market ramifications. With greater flexibility in labour market operations, there is an observed paradigm shift in the occupational pattern with the growing influx of feminization and contractualization of workforce in the industrial sector. Another major change observed is the spread of digitalization with increasing adoption of information and communication technology in the production process. Due to the spread of the digital economy, more economic integration with complex digital network is being observed in order to meet the dynamic changes in customers' demand. With the gradual integration of the physical and virtual world through increasing digital connectivity, the conundrum for raising workers' productivity is an issue of debate. The current study tries to address the issue and tries to analyze the effect of certain industry specific factors on workers' productivity in this digital economy.

Literature Review

An extensive literature exists on labour productivity and the factors affecting it. The most common factors affecting labour productivity are capital investment, technology, capacity planning, use of intermediate factors of production, managerial skills, organizational efficiency, and improved skills of the workforce. While Solow's (1957) neo-classical growth model investigated the dependency of labour productivity on capital deepeningand total factor productivity (TFP), modern growth theories by Romer (2000) and Barro and Sala Martin (2004) highlighted that innovationand research and development (R&D) expenditure, are driving force for improvement of productivity. R&D has been identified as an important consideration for technological progress and productivity growth in the studies conducted by Grossman and Helpman, (1992)

[§§] NSHM College of Management and Technology, Kolkata. Email id-chandrima.ganguly26@gmail.com

PostSchultz's (1961), Becker's (1964) and Welch's (1970) pioneering work, a rich economic literature concluded that productivity growth is influenced by human capital. Welch (1970) proposed the worker effect or 'own productivity' effect which concludes that better educated workers exhibit greater efficiency in distributing factors of production to the production process between alternative uses. Various studies have estimated the effect of training on productivity of firms by using firm-level or establishment-level data and their results confirm a significant favourable impact of training on firm productivity (Bishop 1991, Almeida and Carneiro 2008).

Some studies have shown that use of Information and communication technology (ICT) impacts labour productivity. Mcguckin et al (1998) showed that firms and establishments exhibit a strong positive correlation in terms of the extent and intensity of use of high-end technologies and productivity. While the study conducted by Berndt et al. (1992) on selected industries of United States showed that ICT equipment negatively affects labor productivity, the studies by Lichtenberg (1993), and Papadogonas and Voulgaris (2005) established a positive impact of increased use of information and communication technology (ICT) on labor productivity.

Substantial empirical studies confirm that industry size also plays an important factor in labour productivity. Various studies on developing countries (Snodgrass and Biggs, 1995 and Biesebroeck, 2005) as well as developed countries (Van Ark and Monnikhof, 1996, Baldwin and Gu, 2003 and Leunget al.,2008) established a positive association between firm size and labor productivity.

The kinship between trade unions and productivity has garnered a lot of introspection in economic theory. Freeman and Medoff (1984) highlighted a positive correlation between labour unions and their productivity by raising wages leading employers to invest in labour-saving technology. While some recent studies support the findings of Freeman and Medoff (Wooden 2000, Tseng and Wooden 2001), the studies by Gilson and Wagar (1997), Hull and Read (2003) opine that trade unions exhibit adversarial and non participatory management relations and hence adversely affect productivity. Bester et al (2012) showed that though wage bargaining hinders firms' short–run investment motives in innovation to boost productivity, it does not affect the growth rate of the industry's competitive wage and innovation incentives in the long run.

Many studies revealed that welfare benefits can have positive effect on labour productivity. Welfare benefits play a significant role in motivating workers and thereby increasing the work performance (Oludayo2015). Olusadum & Anulika (2018) and Dina & Olowosoke (2018) observed that level of motivation of workers is a crucial factor of productivity of worker. Increased provision of the welfare schemes has a catalytic impact on the motivation of workers to better their work effort (Evelyne, 2018). A rich literature exists on the relation between labour productivity and different modes of financial returns, work incentives and benefits enjoyed by workers, however the study on the effect of remunerative welfare benefits on productivity in Indian context is still scarce.

Recent studies are focusing on the changing pattern of employment and its consequences on workers' productivity. Studies revealed that flexibility in employment resulting from increasing casualization of workforce is resulting in destabilizing and exploitative labor practices. The resultant effect has been reflected in increasing job instability, remunerative exploitation, detrimental working conditions and large-scale deprivation of the rights and benefits of standard workers which may, in turn, adversely affect their work behavior and productivity (Okafor, 2011, Udeozor 2007). Similarly, gender gaps in labor productivity have been analysed in few studies. This literature reveals that significant gender differences exist in many countries both

in terms of wage and productivity (Bardasi et al. 2011, Rijkers and Costa 2012, Hallward-Driemeier 2013, Gui-Diby et al. 2017).

Objective of the Study

The present study thus builds on existing literature and tries to analyse the effect of industry specific determinants on labour productivity in formal industrial sector of India. More specifically the paper tries to estimate the impact of Industry size, capital intensiveness, wage per worker, female worker participation, contract worker participation, labour welfare benefits, trade unionization, competitiveness, and degree of digitalization on productivity of workers in the organized Industrial sector of India.

Research Methodology

This study is primarily empirical in nature supported by theoretical arguments. The period considered for the study is from 2001 to 2020. The data used for analysis are secondary data taken from Annual Survey of Industries reports published each year by the Central Statistical Office, GOI and the reports published by Labour Bureau of Ministry of India. In this study 2-digit NIC 2008 classification of the estimates for different industrial aggregates of 21 industries has been considered. In order to make the data under different NIC classifications comparable the concordance table is used. The industries considered are: tobacco, food, beverage, wearing apparel, textile, leather and products of leather, printing and recorded media, wood and wooden products (barring furniture), paper and its products, coke and petroleum, chemical and products of chemical, machinery and equipment n.e.c, other non-metallic mineral products (eg. glass, ceramic etc), rubber and plastic products, basic metals, fabricated metal products, electrical machinery and apparatus n.e.c, electronic equipment and apparatus, motor vehicles, trailers and semitrailers manufacturing industry, industries related to other transport manufacturing, furniture and other manufacturing n.e.c.

Empirical Estimation

In order to explain the effect of industry specific factors on labour productivity, both time series and cross-sectional data has been used. Static panel data regression has been conducted using STATA12 software. Panel data identifies and controls the problems of heterogeneity and multicollinearity of data and gives higher degrees of freedom and hence eliminates the chances of biased estimates. Two approaches are used to estimate equation in panel, namely (i) fixed effects model (FEM) and random effects model (REM). Hausman specification test is applied to select between REM and FEM which accepts REM if $p>0.05$ and accepts FEM if $p<0.5$. Based on the model of Papadogonas and Voulgaris (2005) this study investigates the factors impacting labor productivity. This model can be expressed as follows:

$$LP_{it} = \beta_0 + \beta_1 FS_{it} + \beta_2 GFCF_{it} + \beta 3 WPW_{it} + \beta_4 KI_{it} + \beta_4 WB_{it} + \beta_5 TU_{it} + \beta_6 (L_c/L)_{it} + \beta_7 (FWR)_{it} + \beta_8 P + \varepsilon$$

And the second model can be expressed as:

$$LP_{it} = \alpha_0 + \alpha_1 WPW_{it} + \alpha_2 P_{it} + \alpha_3 (FS)_{it} + \eta$$

where,

LP_{it} represents the labour productivity of a firm and is defined as gross output of the firm divided by total workers. FS_{it} represents the size of the industry. It shows the number of firms operational in i^{th} firm int^{th} period. WPW_{it} represents wage per worker of i^{th} firm int^{th} period. KI_{it} represents the capital intensiveness of the firm. Capital intensiveness shows the labour-capital ratio and is measured in terms of the ratio of invested capital to total workers. Higher value of KI implies that the industry employs more capital to labour and vice versa. WB_{it}

represents provident fund and welfare benefits that the workers receive in i^{th} industry during t^{th} period. Welfare benefits considered in this study being remunerative in nature, any increase in welfare benefits will naturally increase the wage of the workers. TU_{it} represents the trade union activity in an industry. The industry-wise data on bargaining potential of trade unions is denoted by the magnitude of trade unionization in the firm. So, in order to include this variable in panel regression trade unionization is represented by proportion of man-days lost to total workers in a firm. L_c/L represents contractualization of workforce and is represented as the proportion of contractual/casual workers to total workers. FWR represents feminization of workforce. It is measured by the ratio of female workers to total workers in the i^{th} industry. $GFCF_{it}$ is gross fixed capital formation and shows *the expenditure on new or existing fixed assets by the firm*. In absence of access to statistical information, following the model of Papadogonas and Voulgaris (2005), GFCF is represents an alternative criterion for digitalization adopted in industries. Digitalization shows the extent of research and development and information and communication technology adopted by an industry. P representing profit shows the business performance of an industry and is also used as alternative criterion for the competitiveness of the industry in absence of data related to the same.

Findings and Analysis

In this section, the effect of the inter industry factors is studied using panel regression in STATA Software and the findings are shown in Table1 and Table2. 105 observations are considered in the study which has been classified into 21 groups. Both REM and FEM have been used to carry out the analysis. Hausman Test has been conducted. Model1rejects the null hypothesis and accepts FEM as the p-value is derived to be 0.046. In model 2, REMis selected as p value is 0.4158 (> 0.05).

The results of model 1show that capital intensiveness and digitalization are statistically significant at 1% while trade union activity and contractualization of workforce are statistically significant at 5% . Welfare benefits is also significant at 10%. However, industry size, wage per worker, profit and female worker participation are found to have no effect on the workers' productivity. Productivity of workers have significant positive association with the capital intensiveness of the industry. Industries where capital to labour ratio is high exhibit higher labour productivity while industries where capital to labour ratio is low show lower productivity. This is supported by traditional theories of capital deepening. The use of machinery and other forms of capital increase effectiveness of labor, so the intensity of use of capital (or "capital deepening") plays the big push for productivity of labor. Welfare benefits have shown a significant positive impact on worker's productivity. This can be justified by the already existing literature. The provision of the welfare schemes motivates human labour to upscale their work effort (Evelyne, 2018). This has a significant repercussion on labour management. Workers' productivity is found to be negatively associated with the ratio of contractual workers to total workers. Industries where contract worker recruitment is high having lower productivity. The finding conforms with the existing studies (Okafor, 2011). Increasing casualization of workforce is resulting in destabilizing and exploitative labor practices. which can adversely affect workers' commitment, motivation and productivity. Importantly, the vulnerability of weak work contract raises questions on the sustainability of employment and productivity growth driven by growth of contract workers (Sood et al., 2014). Gross fixed capital formation is found to have a negative effect on worker's productivity. The findings imply that increasing digitalization reduces workers' productivity in Indian industries. This result is consistent with existing literature (Berndt et al. 1992) and has managerial implication. Although Indian firms understand the importance of upgraded technology and use of ICT in improving efficiency and competitiveness, they seem unable to make the necessary changes due to changing pattern of employment. It may be concluded that workers need proper training to cope with new upgraded technology and increasing adoption of ICT. There exists a skill gap between

the requirements of the workers to use the technology and the training and skill set of workers. With growing casualization of workers in the Indian industries, the industries may not have upgraded properly over the time as the management/ employer may find the training cost burden of these of workers and risk of loss of industrial data privacy to be high and this acts as detrimental to the workers' productivity. Trade unionization is found to have significant negative impact on productivity of workers. The result implies that increase in trade union activities will result in reducing the workers' productivity in organized industrial sector of India. Trade union activities reduce labour turnover in terms of increased absenteeism and strikes and hence may act detrimental to workers' productivity.

The second model (Table 2) runs a panel regression of worker productivity on wage per worker, profit and firm size. The study shows that wage per worker and profit are statistically significant at 1% while industry size is statistically significant at 5%. The findings of the study reveal that wage per worker has significant positive effect on worker's productivity. Wages become effective if linked to workers' performance. Effective wage strategy is expected to contribute to maintaining a potential dedicated workforce, fulfilling vision and mission as well as achieving the work objectives of an organization (Umar 2012). This result supports the efficiency wage models which posits that a mark up on wages can help firms to increase the performance of employees**.**

Profit also shows a significant positive impact on worker's productivity. The result implies that more competitive firms have greater productivity of workers. Competitive pressure is a key driver for firms to innovate and increase efficiency. These benefits can lead to productivity growth. Industry size denoted by the number of operational factories in the industry has a negative effect. This implies that workers in larger industries are less productive than smaller ones, particularly in the manufacturing sector. This may be explained as follows: with more and more digitalization, gains from digitalization can achieved through more focused and intensive use of digital production tools and techniques in smaller industries where the training cost of skill development of workforce is comparatively less.

Policy Implication of the study

The most significant implication of this study is that labour productivity is not only the most crucial criterion for fixation of wage but the reverse way round. In fact, in conformation with the recent wage efficiency theory, wage and the statutory requirement for payment of minimum wage, provident fund, bonus, gratuity, and other benefits for labour are major concerns to boost labour productivity. So, devising effective wage strategy with strategic implementation of welfare benefits can result in better labour management. Another interesting finding is that while production efficiency of workers can be increased by encouraging investment in research and development, technical training and skill development of workers, there is strong possibility of a mismatch between technology and skills (capabilities)—between the new technological requirements and the skills of the available workforce. This calls for revaluation of the process of hiring and recruitment of the workers. The firms need to realign the adoption of technology with the skills and aptitude of the workers. Summing up, the findings of this analysis are consistent with economic logic and theoretical arguments and the results will be helpful in managerial decision making with respect to employment and productivity.

Conclusion

The study shows that capital intensiveness, welfare benefits, competitiveness and wage per worker are positive triggers to workers' productivity while firm size, degree of digitalization, increasing contractualization and trade union activity have negative impact on workers' productivity. The significance of these findings is that with relaxation of trade union activities, increasing digitalization and changing pattern of employment, the Indian organized manufacturing sector needs to rethink of increasing workers' efficiency by reengineering the capital

investments not only in enhancing the digital spread of the industry but also skill development of the workers so as to bridge the 'skill gap' that exists in the Indian industries.

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Table 1: Panel Regression Result of model 1

LP	random effect			fixed effect		
	Coefficient	**z**	**P>Izl**	**Coefficient**	**t**	**P>Itl**
WPW	-12.00993	-0.85	0.397	-11.54802	-0.61	0.543
FS	.0003203	0.48	0.634	.0012041	0.55	0.581
KI	2.606731	19.83	0.000	2.336086	12.04	0.000*
WB	.000119	1.93	0.054	0001809	1.79	0.077***
GFCF	-.0000279	-4.36	0.000	-.0000338	-3.44	0.001*
L_C/L	-.3931167	-1.14	0.255	-1.889589	-2.00	0.049**
FWR	-.3568891	-0.78	0.433	-.3430177	-0.30	0.764
TU	-1.170359	1.37	0.171	-1.474492	-0.84	0.011**
P	2.20e-06	0.64	0.520	5.06e-06	1.11	0.270
cons	26.31389	1.19	0.234	-2.680993	-2.61	0.042
R-sq: within	= 0.7563			0.7732		
between	0.9944			0.9515		
overall	0.9360			0.9056		

. hausman test - Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B) ^ (-1)] (b-B) = 12.77

Prob>chi2 = 0.0468

Accept Fixed effect model

Source: Author's own calculation

*at 1% level of significance

**at 5% level of significance

***at 10% level of significance

Table 2: Panel Regression Result of model 2

LP	random effect			fixed effect		
	Coefficient	z	P>|z|	Coefficient	t	P>|t|
WPW	83.45417	4.87	0.000*	81.96497	4.29	0.000
P	.0000153	2.78	0.005*	9.71e-06	1.77	0.080
FS	-.004896	-2.45	0.014**	-.0061818	-1.93	0.057
cons	-2.800873	-0.10	0.917	18.66438	0.76	0.451
R-sq: within	0.2976			0.3042		
between	0.5862			0.4646		
overall	0.4857			0.4207		

Hausmantest :Test: Ho: difference in coefficients not systematic

chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 1.76

Prob>chi2 = 0.4158

Accept Random effect model

Source: Author's own calculation

*at 1% level of significance

**at 5% level of significance

Linkages among Poverty and Trade Openness in BIMSTEC (South Asian Countries): A Panel Analysis

Deepakshi Sharma[***] and Qamar Alam[†††]

Abstract

This research examines the empirical link among Poverty and Trade Openness in BIMSTEC (South Asian Countries) through a comprehensive three-stage panel analysis. In the first stage, descriptive statistics, a correlation matrix, and panel unit root (First and Second Generation) tests are applied to understand the characteristics, interrelationships, and variable's stationarity of selected for analysis. The second stage employs a Panel Auto regressive Distributed Lag (Panel ARDL) model to capture both long-run and short-run dynamics between trade openness and poverty reduction. The final stage includes post-estimation tests such as the Wald heteroskedasticity test, and the Wooldridge autocorrelation test to validate model robustness. The experimental findings show a positive correlation among TO as well as poverty reduction. Specifically, in the long run, trade openness, exchange rate, inflation rate, and GDP per capita exhibit a significant influence on poverty alleviation. In the short run, trade openness, exchange rate, and GDP per capita positively influence poverty reduction.

Keywords: Poverty, Trade Openness, HDI, Economic Growth, ARDL (Autoregressive Distributed Lag) Model.

1. Introduction

Poverty is a condition in which persons are not capable to come across elementary requirements such as food, home, and clothing. It often includes restricted access to social as well as economic infrastructure, a absence of productive employment, essential skills, and resources, as well as low self-esteem, which makes it difficult to fulfil social and economic responsibilities like education, healthcare, access to potable water, and sanitation. (Arogundade, et. al, 2011). Trade openness, by contrast, involves reducing barriers to the free exchange of goods between countries, commonly known as "free trade." It encompasses the reduction of tariffs (duties and charges) and non-tariff barriers (such as licensing requirements, quotas, and regulatory constraints), and is considered a critical driver for fostering faster and more sustainable economic growth.

Despite the support for trade liberalization promote growth for economy, the impact of trade openness on poverty reduction remains uncertain. Two primary perspectives—the static and dynamic effects—attempt to explain the association among poverty and trade openness (Srinivasan and Bhagwati 2002). The Samuelson hypothesis posits that increased trade openness (TO) leads to higher real incomes, which subsequently reduces poverty. Similarly, Krueger's theory suggests that trade policies favouring the poor, particularly in developing countries where comparative advantage often lies in unskilled labour-intensive sectors, can drive poverty reduction. However, in practice, governments frequently impose substantial restrictions on labour mobility, limiting this effect (Topalova, 2007).

Poverty reduction is more likely to be sustainable when economic development is accompanied by increased efficiency, a process potentially enhanced by trade openness. Empirical studies on developing countries, such as those by Li and Wang et al. (2022), support the idea that liberalization contributes to poverty alleviation. Additionally, Gnangnon (2021) found that there is positive impact of trade openness on reduction of poverty in emerging economies. Conversely, other studies, such as those by Dollar and Kraay

[***] Research Scholar, Department of Economics, Banasthali Vidyapith, Rajasthan.
E-mail: deepakshisharma30@gmail.com
[†††] Assistant Professor, Department of Economics, Banasthali Vidyapith, Rajasthan
E-mail: alamqamar58@gmail.com

(2002) and Fambeu (2021), reveal either insignificant or no effects of trade policies on poverty, suggesting that trade policies alone are insufficient and that other complementary factors are necessary for effective poverty reduction.

1.1 Poverty Scenario of BIMSTEC (South Asian Region)

With a collective GDP exceeding US$2.5 trillion, the BIMSTEC region—comprising Bangladesh, Bhutan, India, Nepal, and Sri Lanka (South Asian regions) and Myanmar and Thailand (Southeast Asian regions)—is shelter to approximately 1.5 billion individuals. Unlike many other regional alliances, BIMSTEC has progressively expanded its focus areas. Originally founded in 1997 with an emphasis on six key sectors (trade, energy, transportation, tourism, technology, and fisheries), the organization's scope broadened in 2008 to include agriculture, culture, climate change, counter-terrorism, environment, poverty alleviation, public health, people-to-people connections, and more. Given the broad mandate, this study narrows its focus specifically to poverty alleviation and trade in the South Asian member economies of BIMSTEC.

According to the World Bank's poverty indicators database, Bangladesh has achieved great progress in poverty eradication, with poverty decreasing from 33.3% in 2000 to 13.5% in 2016, owing to sustained economic development. Bhutan is regarded the happiest country in Asia, despite its low GDP and lack of infrastructure. Food insecurity, homelessness, health problems, and a lack of education all contribute to poverty in Bhutan. Poverty rates fell from 13.4% in 2003 to 1.7% in 2012 and 0.2% in 2017. India, a developing country, has made great progress in poverty reduction since the 2000s. Poverty rates decreased from 39.9% in 2004 to 32.9% in 2009, 22.5% in 2011, and 11.4% in 2019. However, extreme poverty remains a major concern. Nepal, one of the world's least developed countries, experienced a rapid decrease in poverty rates from 55.2 percent in 1995 to 8.2 percent in 2010, despite a terrible earthquake in 2015 that killed 9000 people and left three million homeless. Sri Lanka, a lower-middle-income economy with residents of 21.8 million, experienced a poverty decrease from 54.9 percent in 1973-74 to about 320 million. Poverty rates have significantly declined, reducing from 5.6% in 2006 to 3.5% by 2009.

This research uses the HDI as a proxy indicator to measure poverty, as the multidimensional poverty index and headcount ratio data are insufficient for panel data analysis. The HDI measures success, while the multidimensional poverty index measures deprivation of human development. Success in sector of education, health, and living standard reduces poverty rates as the percentage of deprived people decreases. Initiatives, projects, or programs aimed at reducing poverty directly impact the HDI. For example, effective national health programs can reduce poverty rates by improving society's health status and increasing life expectancy, which is a key indicator of the HDI. [Ahmad (2012), Fauzel, (2016), Onakoya, (2019) as well as Workneh (2020)].

This study purposes to analysis the continuing discussion on the role of policies related to trade for promoting economic growth as well as reducing poverty rates in emerging economies. The remaining structure of the research is described below: 2ndPortioncoversthe appropriate review of literature; 3rdPortion outlines the sources of data as well as methods of analysis. Portion 4 concurrent the results as well as analysis. Portion 5 concludes the suggestions of the research.

2. Literature Review

The literature provides a foundation for the theoretical and empirical framework of this study by examining existing research on the association among TO as well as reduction of poverty in emerging economies. Mahesh and Pradhan (2014) analyzed the influence of TO as well as poverty reduction using panel data from

a group of emerging nations, investigating the links between poverty and various trade components, including imports, exports, and industrial trade. They found a significant inverse association among poverty and aggregate trade, suggesting that trade liberalization plays a vital role in poverty reduction. They also noted that human capital (e.g., education) exacerbates poverty, while infrastructure and health improvements contribute to higher per capita GDP. Kelbore (2015) explored the impact of TO and reduction in poverty rate, finding that while trade openness initially exacerbates poverty, it later contributes to economic transformation. The study also highlighted a bidirectional relationship between trade openness and structural change. Using fixed effect, random effect, and panel vector auto regression (PVAR) models to test robustness, Kelbore concluded that sustained economic growth benefits the poor, suggesting that policies promoting long-term growth should be part of poverty-reduction strategies. Nathapornpan (2015) examined the empirical association among FDI as well as poverty alleviation, finding a significant positive link between FDI inflows and reductions in poverty rates. The study revealed that GDP growth, trade openness, and foreign debt exhibited positive and substantial associations with poverty reduction. In contrast, financial and infrastructure factors showed significantly negative impacts, while the effects of political factors were ambiguous. The research concludes that FDI plays a crucial role in alleviating poverty, emphasizing that the spatial FDI poverty model can be advantageous for both business sectors and policymakers aiming to promote investment. Bayar and Sezgin (2017) conducted a panel data analysis to determine the interplay between TO, poverty alleviation, as well as inequality. Their findings indicated that, in the long run, TO and financial progress has inverse effects on both inequality as well as poverty; however, inequality itself positively influences poverty levels. The empirical and theoretical analyses of the association among (TO), inequality, and declining poverty yielded mixed results. The research highlights that the association among TO as well as inequality as well as poverty reduction show a discrepancy significantly depending on the socioeconomic context of different economies. Through economic progress, TO and development in financial sector, both inequality as well as poverty have been reduced. Various empirical studies support the assertion that liberalization of trade as well as the growth of the economic sector has influences in alleviating both poverty as well as income inequality. Ezzat (2018) examined the association among TO and multidimensional poverty by an estimated dynamic panel model based on macroeconomic data. The study confirms the hypothesis that trade openness positively influences efforts to diminish both the intensity and dimensions of multidimensional poverty. However, while trade openness affects various aspects of individual welfare, the effects on these additional dimensions of poverty have not been extensively explored in either theoretical or empirical research. Key obstacles to reducing multidimensional poverty include high unemployment rates, low GDP per capita growth, initial multidimensional poverty levels, high poverty intensity, and inadequate education spending. Kunofiwa (2018) analyzed the connection among FDI and reduction in poverty through panel data analysis. The study highlights that regions rich in natural resources offer significant employment opportunities, enabling many unemployed individuals to secure jobs and escape poverty. The findings indicate that FDI and natural resource wealth contribute to poverty reduction. Therefore, to sustainably eradicate poverty, governments should implement policies that attract foreign investors to the natural resource sector. Future research should also explore other macroeconomic factors that may influence poverty before drawing conclusions about the impact of FDI. Adegbemi and Ogundajo (2019) analyzed the association among TO and decline in the rate of poverty by various econometric tests, including checks for autocorrelation and heteroscedasticity. Their results indicate a direct association between FDI and inflation rates with the HDI (Human Development Index), while the relationships between rate of exchange as well as trade liberalization with poverty were not significant. Workneh (2020) identified high gender inequality as a significant contributor to poverty by examining the relationship between gender inequality, governance, and poverty—measured by the HDI—

using panel data. The findings recommend that effective supremacy can performance a crucial part in poverty alleviation. The study concludes that gender inequality adversely affects living standards, while effective governance can enhance social security, healthcare, and education services, leading to improved living conditions. Omojolaibi and Yameogo (2020) explored the interconnections among poverty, trade openness (TO), and growth in economy using the Panel ARDL models. Their empirical outcomes indicate that negatively affects growth in economies in the short run, TO and FDI contribute positively to economic growth. This research acclaims that governments reassess their poverty reduction strategies to align with sustainable development goals. Quynh et al. (2021) employed a fixed effects spatial model to analyze panel data and investigate the link among FDI as well as poverty reduction. Their findings suggest that FDI indirectly contributes to poverty alleviation by (i) enhancing human capital through job creation for unskilled workers, (ii) improving local education, and (iii) driving economic growth that creates employment opportunities. The study advocates for shifting FDI policies toward export-oriented investments that generate more jobs, emphasizing the importance of macroeconomic stability and low inflation to foster FDI inflows and reduce poverty. Lastly, Sackey and Barfi (2021) assessed the impact of the pandemic on poverty alleviation through econometric panel analysis, utilizing the HDI (Human Development Index) as an estimate to reduction in poverty. Their report suggests that governments should invest in health and education improvements while fostering economic growth to create jobs that promote widespread growth. The study underscores the need for policies focused on enhancing human capital and establishing sufficient monetary flexibility through fiscal and monetary measures to stimulate growth in economy.

The literature reviewed shows that the effect of TO on reduction in poverty fluctuates across different economies, often yielding ambiguous results. This study aims to analyze the association among trade openness, poverty alleviation, as well as growth in the economies of the BIMSTEC (South Asian countries) region. By exploring these connections, the research seeks to provide insights into how trade policies can effectively contribute to poverty reduction and foster economic development within these emerging economies.

3. Data Sources and Methodology

The main emphasis of this research will be to analyse the link among TO and rate of poverty of BIMSTEC) South Asian Countries). For this research, yearly time series data since 2000 to 2020 has been collected from different secondary sources are shown in Table 1.

Table1 Definitionof variables, data sources and their expected sign

Variables	**Definition**	**Data Source**	**Expected Sign.**
Dependent variable			
HDI	Value of Human development Index	United Nations Development Programme (UNDP)	+
Independent variable			
TO*XM* *G.D. P*	{(Import+ Export) / GDP} Import as current currency Export as current currency G.D.P as current currency		+
FDI	Foreign direct investment as net inflows		+

ER	Official exchange rate (LCU per US$, period average)	World Development Indicators (WDIs)	+
IR	Inflation rate as annual percentage		-
PGDP	GDP per capita as annual Percentage of growth		+

Source: Authors' computation

3.1 Model Specification

The regression equation employed in this study is based on the Solow production function, as adapted from the research conducted by Johnson, Onakoya, and Ogundajo (2019). This modification allows for a more nuanced investigation of the association among TO as well as poverty within the framework of economic growth.

$$\mathcal{HDI}_{it} = a_0 + \sum_{i=1}^{p} b_{it}\ \mathcal{TRADEOP}_{i(t-1)} + \sum_{i=1}^{p} c_{it}\ \mathcal{FDI}_{i(t-1)} + \sum_{i=1}^{p} d_{it}\ \mathcal{EXRATE}_{i(t-1)} + \sum_{i=1}^{p} e_{it}\ \mathcal{IFR}_{i(t-1)} + \sum_{i=1}^{p} f_{it}\ \mathcal{PGDP}_{i(t-1)} + \sum_{i=1}^{p} \mathcal{ECT}_{i(t-1)} + \in_{it}$$

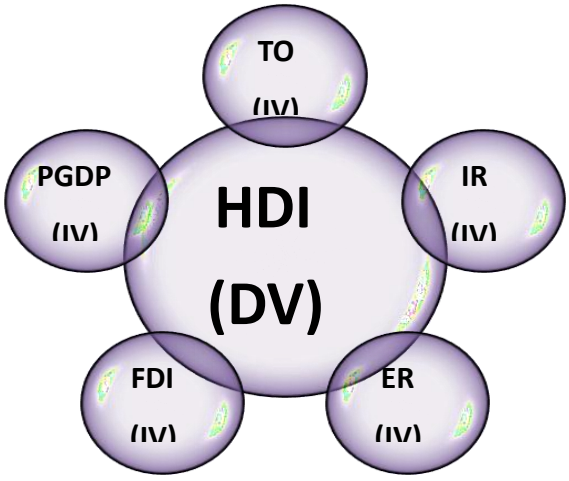

Figure1 shows variables [Dependent Variable-DV*and Independent Variable–IV*]used in this study

3.2 Methodology

This study analyzed the association among TO and the reduction of poverty using a three-step modelling approach:

In the first stage, a descriptive analysis of the variables was conducted to understand their nature and distribution. A correlation matrix was then created to examine the autocorrelation among the dependent variable (DV)as well as independent variables (IV). A panel unit root test was used to evaluate the data's stationarity. Prior to this, a CD test was executed as recent studies indicated that panel data might exhibit such dependence due to unobserved components such as frequent shocks (Pesaran, 2004). When the null hypothesis was accepted, panel unit root tests of first-generation were applied, which presupposes that the panels are symmetrical. Conversely, when the null hypothesis was rejected, unit root test of second-

generation were utilized.

In next stage, the Panel ARDL test was implemented to investigate both long as well as short-run correlations between variables. In the final stage, to ensure robustness, several post-estimation tests were conducted, including tests for heteroscedasticity and autocorrelation.

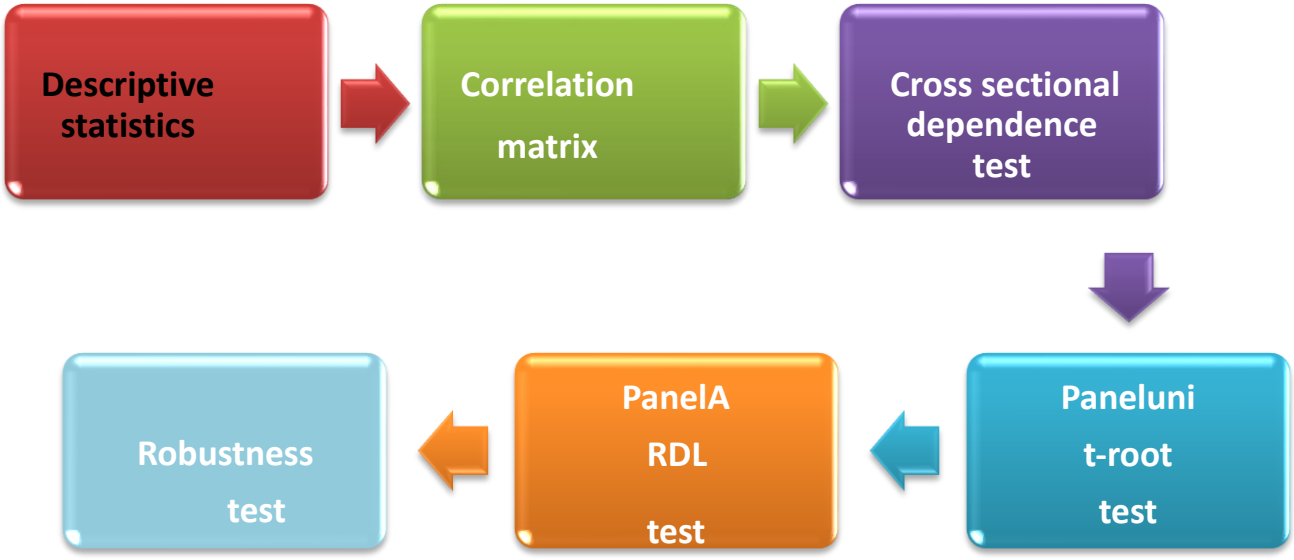

Figure2 Methodological procedure used for analysis in this study

4. Results and Analysis

Table 2 presents the outcomes of the descriptive statistics, revealing notable disparities in the movements of the variables over the study time-period.

Table2: Results of Descriptive Statistics

	HDI	TO	FDI	ER	IR	PGDP
Mean	0.6000	0.5397	1.0630	4.1168	6.5334	4.8525
Median	0.5870	0.4615	0.8825	4.0275	6.1735	5.0325
Maximum	0.78	1.165	6.321	6.556	22.564	16.91
Minimum	0.452	0.259	0.005	2.858	2.007	0.471
Std.Dev.	0.0858	0.2326	0.9360	0.8680	3.2151	2.2940
Skewness	0.4909	1.4323	2.6438	0.7902	1.6075	1.5433
Kurtosis	2.3263	4.0313	13.9271	2.9114	8.1394	9.5474

Source: Authors computation

The substantial disparity between the minimum and maximum values indicates significant fluctuations in the data series. All selected variables exhibited a positive skewness, suggesting that a larger proportion of values clustered at the lower end of the distribution. Additionally, the kurtosis values for all variables were less than 3, indicating that the distributions were platykurtic in nature. This characteristic signifies that the series had lighter tails compared to a normal distribution, suggesting less extreme variability.

Table 3 determines the outcomes of the correlation matrix, which provided insights into the relationships among the variables. The correlations revealed low degree associations among TO as well as poverty reduction, supporting the hypothesis that increased trade activities contribute positively to alleviating

poverty levels. The analysis of the correlation matrix facilitated a deeper understanding of the interdependencies between the variables, thereby reinforcing the overall findings of the study.

Table3: Results of Correlation Matrix

	LHDI	LTO	LFDI	LER	LIR	LPGDP
LHDI	1					
LTO	0.0364	1				
LFDI	0.3683	0.1336	1			
LER	0.4003	0.3022	-0.0433	1		
LIR	0.1603	0.0097	0.2616	-0.2474	1	
LPGDP	0.0521	0.1839	0.2707	-0.0200	0.1272	1

Source: Authors computation

The outcomes of the correlation matrix existing in Table 3 indicated a moderate correlation of approximately 35-40% between the HDI, FDI, and the Exchange Rate (ER). This moderate level of correlation suggests a meaningful relationship among these variables. In contrast, the association between the Human Development Index and the Inflation Rate was observed to be relatively low, with a correlation of 15-20%. Furthermore, the correlations between Trade Openness and PGDP with the other variables were observed to be very low, highlighting weaker relationships in those cases.

Table 4 displays the outcomes of the cross-section dependence test, which assessed whether the panel data exhibited any interdependence among the countries in the study. This analysis was crucial for understanding the potential impact of unobserved factors and common shocks across the cross-sectional units, thereby informing the subsequent econometric tests employed in the research.

Table 4: Results of Cross-section Dependence (CD) test

Test	Stat.	P.
Breusch-Pagan LM	22.377	0.0132
Pesaran CD	-0.8890	0.3739
Pesaranscaled LM	2.7677	0.0056

Source: Authors computation

The results of CD test indicated a dependency among the countries, suggesting that the variables were not independent but rather correlated, as supported by Khan et al. (2023). Tables 5 and 6 present the outcomes of the panel unit root of first as well as second-generation.

Table5: Results of Panel Unit root test (First Generation): LLC and IPS

Variables	LLC				IPS			
	I(0)		I(1)		(0)		I(1)	
	t.	P.	t.	P.	t.	P.	t.	P.
LHDI	-2.92	0.00	-0.36	0.35	-0.53	0.70	-3.00	0.00
LTO	-0.35	0.35	-2.01	0.02	-0.39	0.34	-3.30	0.00
LFDI	-3.40	0.00	-4.97	0.00	-2.07	0.01	-5.11	0.00
LER	2.50	0.99	-4.72	0.00	4.40	1.00	-4.32	0.00
LIR	-2.13	0.01	-5.24	0.00	-2.70	0.00	-5.07	0.00
LPGDP	-4.69	0.00	-3.92	0.00	-3.60	0.00	-5.16	0.00

Source: Authors computation

Table6: Results of Panel Unit root test (Second Generation): CADF and CIPS

Variables	CADF				CIPS			
	I(0)		I(1)		I(0)		I(1)	
	t-stat.	P.	t-stat.	P.	t-stat.	P.	t-stat.	P.
LHDI	-1.60	0.60	-2.22	0.01	-1.75	-2.33	-3.69	-2.33
LTO	-1.84	0.40	-2.45	0.05	-2.31	-2.33	-3.71	-2.33
LFDI	-2.47	0.05	-3.00	0.00	-1.81	-2.33	-3.83	-2.29
LER	-1.39	0.76	-3.22	0.00	-1.69	-2.33	-4.00	-2.23
LIR	-3.18	0.00	-4.39	0.00	-3.81	-2.33	-4.73	-2.29
LPGDP	-3.28	0.00	-3.57	0.00	-3.21	-2.33	-4.66	-2.29

Source: Authors computation

The results from the LLC test revealed that the HDI, FDI, Inflation Rate (IR), and Per Capita GDP (PGDP) were stationary at I(0), while Trade Openness (TO) and Exchange Rate (ER) were stationary at I(1). Similarly, the Im, Pesaran, and Shin (IPS) test indicated that FDI, IR, and PGDP were stationary at I(0), whereas HDI, TO, and ER were stationary at I(1). The results from the CADF test confirmed that FDI, IR, and PGDP were stationary at I(0), and HDI, TO, and ER were stationary at I(1). The Cross-sectionally Augmented IPS (CIPS) test further indicated that IR and PGDP were stationary at I(0), while HDI, TO, FDI, and ER were stationary at I (1). Table 7 presents the outcomes of the Panel Autoregressive Distributed Lag (ARDL) tests.

Table7 Results of Panel ARDL Model

Dependent Variable: LHDI				
Variables	**Coeff.**	**Std. Err.**	**z-value**	**p-value**
Long run				
LTO	0.0947	0.0391	2.42	0.016
LFDI	0.0009	0.0112	0.08	0.935
LER	0.3559	0.0147	24.16	0.000
LIR	0.0438	0.0174	2.51	0.012
LPGDP	0.0381	0.0107	3.53	0.000
Short run				
LTO	0.0213	0.1292	1.65	0.009
LFDI	0.0013	0.0023	0.56	0.578
LER	0.0539	0.0254	2.12	0.034
LIR	0.0024	0.0017	1.38	0.167
LPGDP	0.0022	0.0009	2.47	0.014
CointEq(-1)*	-0.1248	0.0639	-1.95	0.051

Source: Authors computation

The results indicated a positive association among HDI and trade openness, rate of exchange, inflation rate, and GDP per capita in long time period. The coefficients for TO, ER, and PGDP showed a statistically significant impact on HDI at the 5% significance level, while Foreign Direct Investment (FDI) and IR exhibited an insignificant impact on HDI in the short run.

Figure3 represents the summary of HDI's long-term outcomes.

Note: Green-G, red-R arrow specifies significant or impact and insignificant or no impact

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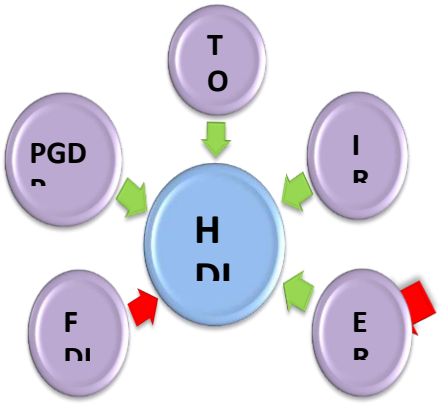

Figure 4 represents the summary of HDI's long-term outcomes.

Table:8 Results of Robustness Tests

Heteroskedasticity (Wald)Test			
Wald $chi^2(5)$	57.70	Prob>chi^2	0.0000
Autocorrelation (Wooldridge)Test			
F(1, 4)	39.742	Prob>F	0.0032

Source: Authors computation

Table 8 demonstrates the outcomes of robustness test. The results of the heteroskedasticity test (Wald test) indicated a p-value less than 1%, demonstrating the presence of heteroskedasticity in the regression model. Additionally, the autocorrelation test (Wooldridge test) confirmed the presence of autocorrelation in the model, as the p-value of the F-stat. was also less than 1%.

5. Conclusion and Suggestions

This research aimed to analyze the association between TO and reduction in poverty**,** particularly in BIMSTEC's South Asian member nations. The results show that trade openness (TO) have a beneficial long-term influence on poverty reduction, as analysed by increases in the HDI. In the long-term model, trade openness (TO) exchange rates, inflation rates, and GDP per capita all have statistical significance. These findings are consistent with earlier research that suggests trade openness might boost economic growth and alleviate poverty by increasing economic efficiency and encouraging the allocation of resources to more productive sectors (Bhagwati & Srinivasan, 2002; Bayar & Sezgin, 2017). The long-term positive relationship between trade openness and HDI shows that trade policies that lower barriers and increase integration into the global economy can improve human development in emerging nations. This research found that the effects of TO on reduction of poverty rate are more variable and less robust. FDI and inflation rate have a small influence on HDI, although trade openness, exchange rates, and GDP per capita have considerable effects. The short-term instability that has been seen is consistent with Kelbore's (2015) results, which emphasize that trade openness can initially make poverty worse by altering the economy's structure. Furthermore, the panel ARDL results further demonstrate that enhancing policies that address other development determinants including governance, social infrastructure, and macroeconomic stability are necessary for effective poverty reduction through trade openness in the BIMSTEC area. The results support the notion that TO alone is not sufficient to reduce poverty; instead, a diverse approach that includes financial development, effective government, and spending in education and health is necessary (Ezzat, 2018; Yameogo &Omojolaibi, 2020). The findings underscore the importance of formulating trade policies that encourage labor-intensive industries, promote productive job opportunities, and facilitate the participation of marginalized groups in economic development. Policies that encourage worker mobility and lower regulatory obstacles might also lessen the short-term disruptions brought on by trade liberalization. These results are in alignment with Quynh et al. (2021), who support reorienting FDI policy to industries that increase employment and raise local educational standards in order to maximize the advantages of TO.

In conclusion, this study contributes to the ongoing debate on how trade policy affects development of economy as well as reduction in the rate of poverty in developing economies. Although trade openness can greatly lower poverty in the South Asian countries of BIMSTEC region, its success depends on the overall state of the economy and the adoption of supporting measures. Therefore, in order to accomplish sustained poverty reduction, policymakers should use a comprehensive strategy that combines trade policies with social and economic development strategy.

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An Empirical Analysis of the Impact of Sectoral Transformation on Population Growth: Evidence from India

Kajal Gupta* & Suman Makkar±

Abstract

Population which plays a dual role as both means and ends of economic activities, is viewed as a crucial factor in country's economic development. For any country aiming to become a developed nation, it is imperative to give careful attention to population growth, as it can both promote or retard growth, depending on a nation's economic conditions. In this context, the Indian strategy for 'Viksit Bharat' focus on addressing the difficulties of managing population growth while ensuring fair distribution of economic benefits among a large proportion of population (Budget, 2024-25). Though absolute poverty is influenced by a country's economic conditions and government poverty alleviation programmes, understanding how inequality changes over time with growth, driven by sectoral transitions is equally crucial. If income is concentrated among the wealthiest, the poorest may not gain significantly from economic growth, thus "reinforcing inequality and slowing poverty reduction" (Ravallion, 2004). In this context, it is significant to analyse the dynamics of structural transformation and population growth and effects on income distribution using share of lower 50% population. For this, the current study employs Pesaran's ARDL model. Findings conclude that at current level of development, economic growth is negatively associated with population growth and structural shifts towards services influences population growth. However, growth driven by services and widening productivity gaps across sectors have not provided adequate income benefits to bottom 50%, leading to decline in their income share. This in turn represents a significant challenge to the goal of Viksit Bharat.

Keywords: Bottom 50; Population; Sectoral Transformation; Productivity Gap

1. Introduction

The nexus between population and economic growth has long been a source of debate in development economics, dating back to Malthus' population theory proposed in 1798. Malthus asserted: while population rises at a geometric rate, food supply expands at arithmetic rate. This ultimately causes fall in income to subsistence level, followed by hardship and poverty. While Malthus was criticised for disregarding the importance of technology and subsequent economic transformations in driving population growth, Demographic Transition Theory later explained population trends in terms of economic development. Due to industrialization and urbanization, a nation moves from a state of low population growth (high birth and death rates) to one where population stabilises at low level (low birth and death rates).Thus, "Malthusian Population Trap, also known as Low-Level Equilibrium Trap, can be avoided through changes in country's economic and social structure, which pushes population growth downwards" (Todaro & Smith, 2012).Kuznets observed that "changes in sectoral structure influences income distribution, creating conflicts among population, initially benefiting high-income earners due to productivity differences. Over time, however, this disparity tends to decline" (Kuznets, 1955). Thus, he not only emphasized "the importance of structural transformation in modern economic growth and its demographic implications" (Kuznets, 1966, 1971), but also pointed the significance of "evolving economic and social structures in limiting family size, noting population growth to be negatively correlated with economic status. This dynamic not only hampers economic progress of disadvantaged groups but also exacerbates inequality" (Kuznets, 1967).

Though absolute poverty is affected by a country's economic conditions and government's direct intervention through poverty alleviation programmes (employment generation and food security), understanding how

* Assistant Professor, GGDSD College, Chandigarh, Kajalgupta024@gmail.com

± Professor, Department of Evening Studies, Panjab University, makkarsuman@pu.ac.in

inequality changes over time with growth, driven by sectoral transitions is equally crucial. In India, declining poverty rates may not reflect equitable distribution of growth benefits. If income is concentrated among the wealthiest, the poor may not gain significantly from economic growth, thus "reinforcing inequality and slowing poverty reduction" (Ravallion, 2004). Hence, growth with inclusive development that "delivers social benefits, addresses inequalities, and ensures fair distribution of resources among all people" (Inclusive Growth Network, CPP, 2024) —is essential for India to achieve its goal of becoming a developed nation (Viksit Bharat). It rightly focuses on '*Sabka Saath, Sabka Vikas*'— transforming the nation through all-inclusive development with emphasis on 'poor' as one of its pillars.

India recognized as one of the fastest-growing economies, is also the most populous nation, wherein majority relies on agriculture for a living and resides in rural areas. "It has experienced continuous changes in sectoral output since 1950s, though the rate accelerated after 1980s" (Papola, 2012): with shifts from agriculture to services, which made up 50.08% in 2019, while agriculture still accounted for 40.65% of employment, widening productivity gaps. Population growth also increased substantially between 1950-1980 but slowed thereafter, hovering around 2.10% from 1980-2000 and averaging 1.40% from 2001-2019[‡‡‡].As 1980s saw changes in both economy's structure and population growth, it is necessary to investigate any potential relationships between the two and understand the impact on income share of bottom 50% population, which helps assess economy's progress towards Viksit Bharat.

2. Review of Literature

Literature on population-growth relationship has produced mixed results: Tsen and Furuoka (2005) found no straightforward link in Asian economies, whereas, Savas (2008) observed a strong positive relationship in Central Asian economies. Similarly, Singha and Jaman (2012) found no evidence of a causal relationship in India, while, Singariya (2014) found population size to be negatively associated with agriculture's GSDP and insignificant with industry and services for Indian states and UTs. Egbulonu and Dim (2018) found population growth adversely affecting industrial output in Nigeria, supporting the idea of national population and sectoral policies. Similarly, Degu (2019) proposed anti-natal policies due to negative impact of population on economic growth in Ethiopia, while, Befikadu (2024) found insignificant impact.

Further, structural change also causes significant reduction in poor's income (Leimbach et al., 2024) providing challenges for some and opportunities for others (Aizenman et al., 2012). Poor being predominantly employed in agriculture (where population growth rates are high) are unable to benefit from growth due to lack of necessary skills. Consequently, reducing inequality is crucial as it not only lowers fertility and mortality rates, as noted by Heerink (1994), but also results in decline in population growth (Rodgers, 1983). Thus, structural changes can impact inequality, as proposed by Kuznets (1955) and confirmed by Andersson and Palacio Chaverra (2016); Baymul and Sen (2020) depending on development process and subsequent productivity gaps.

Though, literature presents evidence of a link between growth and population, there has been insufficient focus onanalyzing the dynamics of structural transformation and population growthand its impact on income share of bottom 50% populationwithin India. The study, thus examines these relationships using time series data from Indian economy.

3. Data and Model Specification

To examine the influence of population growth on economic growth and sectoral shifts on population growth, time series data from 1980-2019 (Time-I) has been used andfor impact of sectoral shifts and productivity gap

[‡‡‡]*Source: WDI*

on bottom50 income share (in order to better understand income disparities over time), data from 1992-2019 (II) has been used. The variables are detailed in Table 1. Productivity Gap (%)(Kuznets, 1966) is calculated by dividing productivity of non-agricultural sectors (industry & services) by productivity of agriculture (productivity is sector's value-added percentage divided by employment percentage).

The models listed below have been utilized to explore the relationships as per theoretical review:

M-I: $lnGDPC_t = a_0 + a_1 Pop._t + \varepsilon_{a1t}$
M-II: $Pop._t = b_0 + b_1 Agre._t + b_2 Sers._{I_t} + \varepsilon_{b2t}$
M-III: $Pop._t = d_0 + d_1\, Indry._{I_t} + d_2\, Sers._{I_t} + \varepsilon_{3dt}$
M-IV: $p50_t = f_0 + f_1\, Indry._{II_t} + f_2\, Sers._{II_t} + \varepsilon_{4ft}$
M-V: $p50_t = n_0 + n_1\, Q_{Gap_t} + \varepsilon_{5nt}$

Models II-IV align with Dastidar's (2012) approach that analyzed the effects of sectoral shifts on income inequality across a range ofdeveloping and developed countries. Percentages are used to indicate sectoral patterns, andat any given time, combined value added (in %) of three sectors equals 100, i.e.:

$$Agre._t + Indry._t + Sers._t = 100 \qquad (1)$$

Thus, "excluding industry's share in II model, $b_1$captures the effect of agriculture-industry transition on population growth, interpretated as decline in agriculture (keeping services shareconstant), with an offset increase in industry and $b_2$representsindustry-service transition, understood as increase in services (keeping agriculture constant) with a balancing decline in industry. Similarly, in models III and IV,d_1 andf_1 denotes impactof agriculture-industry transition (constant services) on population growth and bottom 50, respectively, whiled_2 and f_2 signifies impact of agriculture-service transition (constant industry share)" (Dastidar, 2004, 2012).

4. Empirical Findings

To analyze longitudinal changes in a country, annual time series data is most appropriate and has thus been employed. However, presence of "common trends among series may lead to spurious regression, whereby a significant relationship appears without any genuine association. Therefore, establishing stationarity of variables through unit root tests is essential prior to regression analysis. Stationarity, defined as a series with constant mean and variance demonstrate superior forecasting properties, in contrast to non-stationary series, which exhibit time-varying mean and variance, producing unreliable and spurious results, with minimal forecasting value" (Gujarati et al., 2009).

Thus, stationarity was first confirmed by applying Augmented Dickey-Fuller, Phillips-Perron and Kwiatkowski-Phillips-Schmidt-Shin unit root tests. Findings reveal a mixed integration order with some stationarity at level, I(0) and others requiring first differences to achieve stationarity, I(1)[§§§].Accordingly, Autoregressive Distributed Lag (ARDL) approach by Pesaran et al. (2001) is employed to analyze the cointegrating relationships outlined in models I–V.

After validating variables integration order, we assess the long-run relationship, known as cointegration. "Regressing a non-stationary series on another with a common trend may not result in spurious regression if their linear combination is stationary, thereby eliminating stochastic trends" (Gujarati et al.,

[§§§]*Detailed results are available on demand*

2009). Although, different co-integration techniques are available but for small sample size and regardless of series' integration order, I(0)/ I(1), ARDL method can only be suitably applied. First, presence of co-integration is examined using F-bounds test, which examines the following equation:

$$\Delta v_t = \gamma_0 + \sum_{i=1}^{f} \xi_{\beth i} \Delta v_{t-i} + \sum_{i=1}^{k} \Re_{\tau i} \Delta q_{t-i} + \varrho \Delta q_t + \Xi v_{t-1} + \eth q_{t-1} + \varepsilon_t (2)$$

v_t and $q_t$represents series of dependent and independent variables with varying lag lengths determined by Akaike Information Criterion. "F-tests evaluates null hypothesis of no long-run relationship ($\Xi = \eth = 0$) against alternative ($\Xi \neq \eth \neq 0$) of a significant long-run link between variables. Null hypothesis is rejected if computed F exceeds critical value of I(1) and retained if it falls below lower bound, I(0)" (Pesaran, 2015).Hence, in Table2, for all models', computed F is more than I(1), thus rejecting the null of no long-run link between variables.

The long-run coefficients are then estimated alongside short-run estimates using Error Correction Mechanism, presented below.

$$\Delta v_t = \rho_0 + \sum_{i=1}^{f} \forall_{\Omega i} \Delta v_{t-i} + \sum_{i=1}^{k} \mathbb{C}_{\omega i} \Delta q_{t-i} + \zeta \Delta q_t + \nexists ec_{t-1} + \varepsilon_t (3)$$

"Ifec_{t-1} has a stable coefficient then ARDL model exhibits mean reversion" (Pesaran, 2015). This implies, despite "existence of an equilibrium relationship, short-term deviations may occur causing model to deviate from equilibrium. Hence, ∄ indicates how quickly the model returns to its equilibrium path if v_t is above or below its long-run equilibrium value. Thus, necessitating ∄to be negative and statistically significant to ensure long-run equilibrium" (Gujarati et al., 2009). Also, the years required for convergence is calculated by dividing ∄ by 1.

Table 3 presents the findings. It demonstrates that, in long run, economic growth is negatively associated with population growth (M-I), and, in terms of sectoral transformation, agriculture-industry transition (M-II &M-III) has no significant impact on population growth (both agriculture and industry have statistically insignificant coefficients). In contrast, transition towards services (M-II & M-III, from industry or agriculture) negatively impacts population growth. Thus, structural shifts significantly influence population as noted by Singariya (2014) and Degu (2019). These shifts also determine how population benefits from growth, making income distribution a critical factor in the process. Hence, the results[****]indicate that shift towards services (M-IV) causes decline in income share of bottom 50% by 0.85 percentage point. Furthermore, as services dominate output while agriculture still dominate employment, widening productivity gap has further contributed to 0.04 percentage point decrease in income share of *p50* (M-V).

Further, in all models', coefficient of $ect_{t-1}$is negative and statistically significant at 1% level. This ensures adjustment to long-run equilibrium following a random short-run shock with varying adjustment rates: M-I at 14.1% (roughly 7.09 years), M-II at 22.3% (4.48 years), M-III at 15.2% (6.58 years), M-IV at 8.8% (11.36 years) and M-V at 13% (7.69 years). Evaluation for serial correlation and heteroskedasticity, through LM Test of Breusch-Godfrey and Breusch-Pagan-Godfrey also shows robust results, as all models yield insignificant p-values.

According to2023 UN Population Projections, despite a declining growth rate, "India has surpassed China as most populous nation with 1.428 billion people. It faces challenges in creating employment beyond agriculture

[****]*A 2015 dummy variable has been included to control for specific data characteristics (Chancel, 2020).*

and requires increased investment in education and health to sustain its economy" ("India overtakes China", 2023). The benefits of population growth are not evident in India at current development stage, as 64.13% population is rural and 42.86% work in agriculture (as of 2022) and thus, remain excluded from larger share of growth benefits, driven by services, by passing manufacturing. Although services have led to decline in population growth, their impact seems minimal given the current figures.

According to latest Inequality Trends "bottom 50% in India holds a smaller share of national income compared to top 10%, a reversal observed since 80s-90s. This decline in bottom 50%'s income share is attributed to growth in services and lack of employment opportunities outside agriculture" (Bharti et al., 2024). Thus, our findings align with this study, indicating that services-led growth and widening productivity gaps among sectors have contributed to diminishing income share of bottom 50%. Though shifts from agriculture to low productivity sectors and government intervention has reduced poverty, but recent growth in high productivity sectors, especially services, has primarily benefited a small segment of the population. This uneven distribution of growth has widened income disparities, which in turnrestricts accessto health and education for the poor—presenting a significant challenge towards inclusive and sustainable goal of Viksit Bharat. For India to progress, it is essential to provide more productive opportunities for a broader segment of the population, thereby reducing inequalities. This involves uplifting the poor, enabling them to access better jobs and share the benefits of growth equitably.

5. Conclusion and Policy Recommendations

India's aspiration of a developed economy depends on successfully utilizing its demographic dividend, limited by provision of productive opportunities. However, "any attempt to address population growth without addressing poor's economic situation will likely fail. Instead, a frontal attack on poverty is necessary to address population problem, requiring both social and economic transformations" (Puri & Misra, 2013). Considering this, current study explored the dynamics of structural transformation and population growth, finding that while shift toward services helps reduce population growth, it hasn't delivered adequate income benefits for bottom 50%. Declining income shares have further been worsened by widening productivity gaps between sectors. Hence, due to decreasing income shares and insufficient skills, population is negatively impacting India's overall growth.

Policy makers can use study's findings to identify barriers limiting increase in income share for bottom 50% and create an atmosphere allowing advantages of structural change to reach grassroot level. In this context, enhancing workforce quality through improved skills and education is crucial. While promoting transition from agriculture to non-farm jobs is necessary, it can only succeed if adequate income and educational facilities are provided. Without these, population growth may hinder development, limiting poor's ability to benefit from and contribute to economic growth. Neither economic nor social measures have been recognised as elements of India's population policy, hence, viewing it through lens of sectoral transformation could be beneficial.

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Table 1 Variables Description

Definition	Abbreviation
*log real GDP per capita (2015 US $) **	*lnGDPC*
*Population, annual growth rate (%) **	*Pop.*
*Agriculture, value added (GDP %) **	*Agre.*
*Industry, value added (GDP %) **	$Indry._{I}$, $Indry._{II}$
*Services, value added (GDP %) **	$Sers._{I}$, $Sers._{II}$
Productivity gap between non-agriculture & agriculture	Q_{Gap}
*Share, Bottom 50% national income (%) ***	*p50*

*Note: *, Source: World Bank & **: World Inequality Database*

Table 2 Bounds Test

Model	F- Value	Significance level	CV: I(0)	CV: I(1)
I	9.3809	1%	5.763	6.48
II	10.0766	1%	6.382	7.408
III	9.6396	1%	4.948	6.028
IV	4.836	5%	3.538	4.428
V	11.624	1%	7.593	8.35

CV: Critical Value (Narayan, 2005)

Source: Author's calculation

Table 3 Cointegration Findings

Model	I	II	III	IV	V
Long-run coefficients					
Pop.	-1.437*** [0.173]				
Agre.		-0.002 [0.007]			
$Indry._{I}$			0.014 [0.009]		
$Sers._{I}$		-0.053*** [0.013]	-0.098*** [0.004]		
$Indry._{II}$				-0.8887* [0.453]	
$Sers._{II}$				-0.849*** [0.234]	
Q_{Gap}					-0.039* [0.018]
Constant	9.628*** [0.570]		5.208*** [0.300]	76.289*** [18.933]	
Trend		-0.018*** [0.004]			-0.464*** [0.120]

Short-run estimates (ECM)					
$\Delta Sers._{I}$		-0.005*** [0.002]	-0.006*** [0.002]		
$\Delta Indry._{II}$				-0.041 [0.028]	
ΔQ_{Gap}					0.001 [0.000]
ect_{t-1}	-0.141*** [0.025]	-0.223*** [0.032]	-0.152*** [0.022]	-0.088*** [0.018]	-0.130*** [0.020]
D_{15}				0.143** [0.050]	0.173*** [0.049]
Constant		0.947*** [0.141]			4.812*** [0.783]
Diagnostic Tests					
LM (χ^2)	4.376 (0.357)	4.576 (0.469)	1.568 (0.905)	7.289 (0.121)	2.867 (0.580)
$BPG(\chi^2)$	2.156 (0.827)	14.078 (0.368)	10.493 (0.572)	2.007 (0.980)	10.649 (0.385)

Figures in ( )&[] display standard errors & p-values, respectively

*Significance at 10%, **5%, ***1% level

Source: Author's calculation

Role of Entrepreneurship in India's Journey Towards Becoming a Developed Nation

Menaka Biswal*

ABSTRACT:

India's journey towards becoming a developed nation is closely tied to the growth and dynamism of its entrepreneurial ecosystem. Entrepreneurship serves as a critical engine for economic development, fostering innovation, creating jobs, and facilitating inclusive growth. This research explores the role of entrepreneurship in India's socio-economic transformation, analyzing the contributions of both traditional small businesses and high-growth Start-ups. By examining key government initiatives like Start-up India, Make-in India and various MSME schemes, the study highlights the policy landscape that supports entrepreneurial development. Additionally, it investigates the challenges faced by entrepreneurs, including access to finance, infrastructure and skill gaps and it evaluates how overcoming these barriers can accelerate India's growth path. The research underscores the potential of entrepreneurship as a transformative force for reducing poverty, bridging urban-rural divides and enhancing India's global competitiveness. Ultimately, the findings aim to provide insights into how a vibrant entrepreneurial culture can move India closer to its vision of becoming a developed nation.

Keywords: Entrepreneurship, start-up, innovation, growth and development.

1. INTRODUCTION:

India's aspirations to become a developed nation involves sustained economic growth, social progress, entrepreneurial involvement and technological advancement. The main areas include education, health care, innovation and infrastructural development. Entrepreneurship plays an important role in India's journey towards becoming a developed nation. It is likely to enhance economic growth, creating job opportunity involved in new innovation and also contributing to overall development of a country. Entrepreneurs raises productivity, create more opportunity introduce new technologies as well as enhances India's global competitiveness. Entrepreneurs also empower individuals, encourages cultural self-reliances and address socio-economic challenges and which lays the foundation of sustainable development as well as contributes to gross domestic product, increasing standard of living of the people which brings positive social change. Individuals who start their own businesses are driven by self-motivation and seek to create something innovative and distinct. By recognizing prospects organizing essential resources and bearing the associated risks. These entrepreneurs meet consumer demands and generates job opportunities for themselves and those in their vicinity.

Entrepreneurship entails turning ideas into businesses by bringing innovative products, services and technologies to the marketplaces. It is essentially a different type of business regarded as a key engine for the progress of society and the national economy. The advantage of entrepreneurship extends beyond the individual entrepreneur, positively impacting organizational development and the economy as a whole. This emerging business model involves considerable risk taking.

2. OBJECTIVES OF THE STUDY:

1. To analyse the contribution of entrepreneurship to India's economic growth.
2. To evaluate the role of entrepreneurship in job creation and employment generation.
3. To evaluate the effectiveness of government policies and support for entrepreneurship development.

* Associate Professor, HLM Group of Institutions, Ghaziabad, UP, India. Email: menakabiswal@yahoo.in

3. RESEARCH METHODOLOGY:

The research methodology for a paper examining the role of entrepreneurship in India's journey towards becoming a developed nation should be carefully structured to provide comprehensive valid and reliable insights. Use a combination of qualitative and quantitative methods to gain a nuanced understanding of the topic. This can involve collecting both statistical data and detailed insights from different web sites, entrepreneurs, policy experts and beneficiaries. The study should aim to describe existing trends and explore various dimensions of entrepreneurship's impact on development. Organize focus groups with young entrepreneurs, women entrepreneurs and rural entrepreneurs to understand their unique experiences and challenges. The data have been from government databases (such as the Ministry of Commerce and Industry, NITI Aayog and the Ministry of Micro, Small & Medium Enterprises), World Bank, IMF and other economic research institutes. I have tried to examine government policy documents and reports on initiatives like Start-up India, Make-in India and Digital India to evaluate the support system and regulatory framework for entrepreneurship. This data will help in analyzing trends in gross domestic product (GDP) contribution, job creation and innovation driven by entrepreneurship.

4. REVIEW OF LITERATURE:

According to Sharma (2018), entrepreneurship is essential for economic growth, especially in emerging economies like India. Entrepreneurs create job opportunities, spur innovation and contribute to GDP growth, helping shift the economy from agrarian to industrial and service oriented.

Khosla (2019) argues that entrepreneurship in India has a unique role, as it leverages India's demographic dividend, engaging the younger population in productive venture and thereby contributing national income.

Research by Chatterjee and Sinha (2020) discusses about the Start-up India initiative and it's the program's role in reducing bureaucratic hurdles, offering tax exemptions and providing funding support, making it easier for new businesses to establish and grow.

According to Aggarwal (2021), government initiatives like *Make-in India* and *Digital India* have provided a framework to support entrepreneurship, inconsistent policy implementation across states remains a barrier to maximizing these program's impact.

Several studies focus on successful Indian entrepreneurs who have had a positive impact on the economy. Saxena (2020) analyzes Flipkart and Paytm as examples of technology-driven Start-ups that have redefined consumer markets and encouraged investment in Indian tech ventures.

Social entrepreneurship has also been highlighted in the literature. Singh and Kumar (2022) examine Amul as a case of cooperative entrepreneurship that not only improves rural income but also addresses social issues such as empowerment and poverty reduction.

Scholars like Joshi and Patel (2021) suggest that India's entrepreneurial ecosystem must focus on fostering digital entrepreneurship and sustainability, aligning with global economic trends and addressing pressing environmental challenges.

As highlighted by Kapoor (2023), the expansion of entrepreneurial education, mentorship, and networking will be crucial in helping Indian entrepreneurs compete on a global scale. The author emphasizes that creating an environment conducive to innovation can drive India towards its development goals.

5. BECOMING ANINNOVATOR OF YOUR FIELD:

The process of developing new concepts, goods, services, techniques that significantly enhance current issues of find creative solution to them is referred to as innovation. It entails using imagination to create more valued, efficient and successful solutions. Being the first to bring something new to the market, such as excellent service or technology, enables business owners to build market demand and confidence. As a result, you end of being regarded as an innovator in the field. Beingan industry, the entrepreneur can keep innovating and bringing new items to the market for as long as he wants by consistency seeking for and seizing chances.

Entrepreneurs play a crucial role in the Indian economy and have a significant impact on various aspects of economic development and growth. Here are some of the key roles played by entrepreneurs in the Indian economy:

1. Employment Creation: Entrepreneurs are frequently the impetus behind the establishment of Start-ups and new companies. The nation's unemployment and underemployment rates are lowered as a result of these new businesses creating job possibilities.

2. Technology and Innovation: At the vanguard of technological development and innovation are entrepreneurs. They launch new goods, services and business plans that can boost competitiveness and productivity across a range of sectors.

3. Enhanced Productivity: Entrepreneurs frequently look to streamline their processes, which can boost their industry's output and effectiveness. Consequently, this may benefit the economy as a whole.

4. Export and International Trade: A large number of business owners participate in international trade, which supports economic globalization and increases the nation's export capacity. A nation like India whose economy depends heavily on exports, should pay special attention to this.

5. Rural Development: Entrepreneurship can play a vital role in rural development by promoting small and micro-enterprises in rural areas. This can help reduce the urban-rural economic divide and improve the living standards of people in rural communities.

6. Infrastructure Development: Entrepreneurs channel their resources into infrastructure initiatives, including transportation, energy and telecommunications, which are crucial for economic advancement. Such investments can enhance connectivity and access positively impacting different areas of the economy.

7. Creation of wealth: In addition to generating money for themselves, prosperous businesspeople also help the country as a whole. Economic growth can be further stimulated by reinvesting these riches in new companies.

8. Reducing Dependency on Government: Because entrepreneurs can establish their own means of means of subsistence and financial security, they lesson the population's reliance on government employment and assistance programs.

9. Encouraging a mindset of Risk-Taking: Entrepreneurs are recognized for making strategic risks, which can result in the establishment of a culture that supports risk taking and creativity, ultimately benefiting the overall economy.

10. Social Influence: Certain entrepreneurs prioritize addressing societal issues via their enterprises, resulting in social influence in fields like education. Health care and environmental sustainability

Entrepreneurs empower individuals to create business, driving various sectors and contributing to the national GDP, Entrepreneurs even often address social challenges, enhances the overall quality of life. As India continues to journey towards development, a vibrant 89entrepreneurial ecosystem spur innovation attract towards investment and pave the way for sustained economic progress. Now a days, Make-in India and Start-ups can address social challenges and fostering cultural self-reliance. It brings new ideas in the market and also contribute their efforts in the critical sectors such as technology health care and renewable energy. Business owners rely on innovation that leads to the mass production of goods and services at reduced costs making the product accessible. Consequently, access to quality products at reasonable prices inherently elevates the living standards of individuals in the community. Therefore, a thriving entrepreneurial ecosystem is very essential for India's economic transportation and global competitiveness.

6. RECENT EFFORTS OF ENTREPRENEURIAL ACTIVITIES IN INDIA:

The Indian government has lunched various initiatives to promote entrepreneurship, especially in the last decade. Programs like Start-up India and Make-in India aim to create conductive environment for business creation and innovation. Initiatives like "Make-in India" campaign and various Start-ups accelerate and these have been fostering entrepreneurial efforts for development of India. The Start-up India initiative is a very popular government scheme in India. It's aim to provide tax benefit to entrepreneurs over the five years. Government schemes to support Indian Start-ups:

- Atal Innovation Mission
- Multiplier Government Scheme
- Daily Entrepreneurship Development Scheme
- Make-in India Initiative
- Start-up India Initiative.

Our country is going through the era of Start-ups. India is called "Start-up Hubs". It has more than 99000 Start-ups and 107 Unicorn (Source: Business Standard) companies worth 30 billion Dollar. Prime Minister Mr. Narenda Modi has started several initiatives to help young entrepreneurs. Government provides them subsidies, financial and technical support, help to grow and make their existence in the global business domain. As of now, the government has recognized3,90,512Start-ups by Department for Promotion of Industry and International Trade (DPIIT).

6.1 ANALYSIS OF STATE WISE ENTREPRENEURIAL STARTUPS IN INDIA IN THE YEAR 2023:

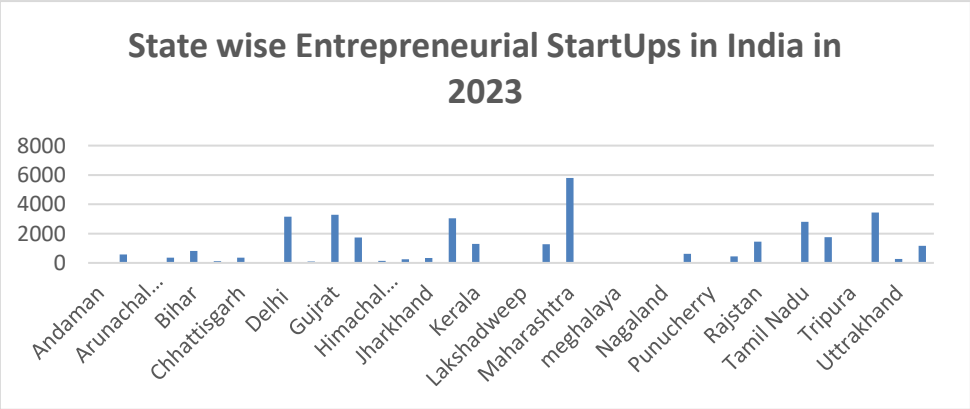


Fig:1 Source: Ministry of Commerce & Industry.

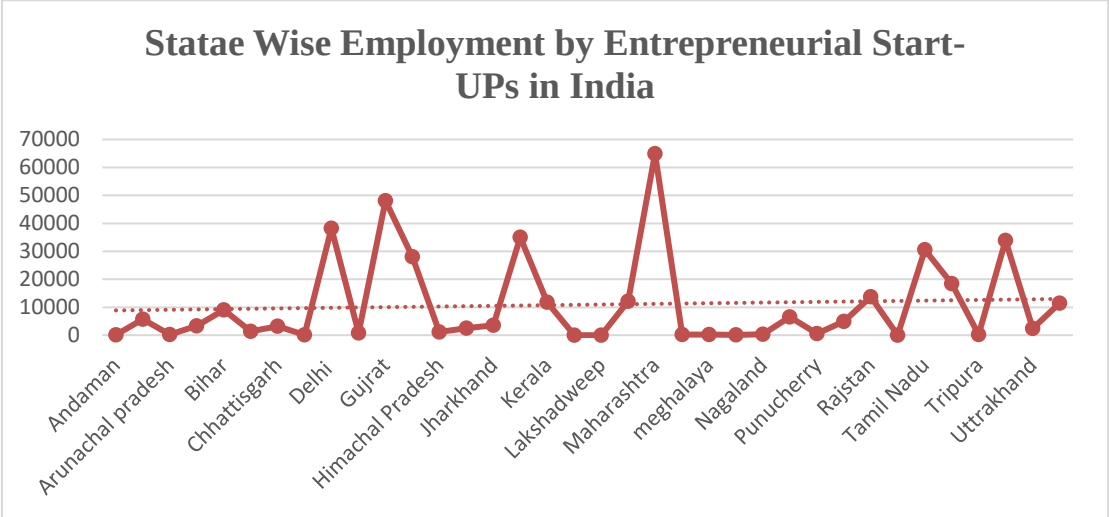
In the above Figure1 Maharashtra has highest share followed by Uttar Pradesh, Gujrat and Delhi respectively. Maharashtra has a significant number of startups due to a combination of favourable infrastructural, cultural and economic factors. Mumbai is the financial capital of India .it also put positive impact on it.

6.2 ANALYSIS OF STATE WISE GENERATION OF EMPLOYMENT THROUGH START-UPS IN INDIA:

Table: 1, Source: Ministry of Commerce & Industry

S.no	States /UTs	Employment on November 2023
1	Andaman	97
2	Andhra Pradesh	5669
3	Arunachal Pradesh	185
4	Assam	3350
5	Bihar	9057
6	Chandigarh	1328
7	Chhattisgarh	3189
8	Dadra & Nagar Haveli	138
9	Delhi	38280
10	Goa	824
11	Gujrat	48138
12	Haryana	28021
13	Himachal Pradesh	1079
14	Jammu & Kashmir	2452
15	Jharkhand	3525
16	Karnataka	35066
17	Kerala	11737
18	Ladakh	29
19	Lakshadweep	31
20	Madhya Pradesh	12070
21	Maharashtra	64974
22	Manipur	195
23	Meghalaya	157
24	Mizoram	79
25	Nagaland	268
26	Odisha	6532
27	Puducherry	568
28	Punjab	4935
29	Rajasthan	13724
30	Sikkim	8
31	Tamil Nadu	30536
32	Telangana	18378
33	Tripura	193
34	Uttar Pradesh	33831
35	Uttarakhand	2401
36	West Bengal	11468
Total		390512

Fig:2 Source: Ministry of Commerce & Industry.



The above figure2, it can be understood that there is massive growth in employment opportunity across the nation. The six states Maharashtra Gujrat, Delhi, Karnataka, Tamil Nādu and UP gives increasing trend in the employment opportunity. Maharashtra has highest employment share followed by Gujrat & Delhi.

6.3 YEAR WISE COMPARISONGENERATION OF EMPLOYMENT THROUGH START-UPS IN INDIA FROM (2019-2023):

Table 2: Source: Ministry of Commerce & Industry

Year	Total no of Jobs created through startups	year of contribution	Growth rate
2019	123071	10.93%	
2020	151196	13.43%	22.87%
2021	194565	17.28%	28.67%
2022	266461	23.67%	36.96%
2023	390512	34.69%	46.55%
Total	1125805	100.00%	

From the above table2, it is observed that the total no of jobs by DPIIT Entrepreneurial startups has been considerable growth over the years. The number of Jobs created 1,23,071 in the year 2019to 3,90,512in 2023 representing substantial growth rate. This shows a significant and consistent contribution to employment ecosystem. The contribution of each year towards job creation has been increasing gradually. The highest contribution observed in 2023where the number of jobs created accounted for 34.69% of the total job.

By May 2019, 356 million new bank accounts were created due to financial inclusion efforts such as the Prime Minister Jana Dhana Yojana (PMJDY). The relaxation of foreign direct investment (FDI) has positively impacted India's EODB Index. Higher FDI inflows will create investments, funds and employment opportunities. Significant efforts through initiatives such as Bharatmala and Sagarmala, along with various railway infrastructure development projects, have been launched to enhance connectivity and infrastructure.

The Government of India launched Bharat Net, a telecom infrastructure service, to enhance digital networks in the country's rural regions. This is possibly the largest rural broadband initiative globally. India holds the

6th position worldwide in solar power generation and 4th position globally in wind power generation. In terms of installations, India ranks 5th place worldwide.

7. SOME COMPREHENSIVE BLUEPRINT OF ENTREPRENEURIAL INITIATIVES:

Several recent entrepreneurial initiatives are making notable contributions to India's development across various sectors, particularly through technology, sustainable practices, health care and infrastructure. In 2022, entrepreneurs added Rs139 billion to the national GDP marking a 9.6% rise compared to 2021. They also experience significant business expansion in 2022, with Indian merchants generating Rupees 300 billion in economic activity, an increase from 9.8%in 2022 (Source: Business Standard). India is positioned in the top 30 worldwide for the impact of entrepreneurs to the economy.

1. ESG Exchange- Founded by Yuvraj and Chirag Sheth, this platform promotes sustainable practices by helping small and medium enterprises (SMEs) with environmental, social and governance (ESG) compliance. Their work facilitates access to technology and investment for climate-friendly projects, promoting economic resilience and environmental responsibility.
2. Indosup - Co-founded by Akshaj Sharma and revolutionizes the construction sector by streamlining building material procurement, leveraging partnerships with over 400 merchants and aiming for a substantial annual revenue increase by 2026. This innovation helps reduce costs and enhances supply chain transparency, boosting infrastructure development.
3. Responsible Whatr - Ankur Chawla's company tackles single-use plastic by packaging Himalayan Spring water in recyclable aluminum cans. This approach not only promotes sustainable consumption but also aligns with broader environmental goals, reducing waste in India's beverage sector.
4. Kaapi Machines - Led by Abhinav Mathur, this company supports the coffee industry with innovative equipment and consulting, thereby enhancing both local and international coffee markets. This initiative contributes to skill development and employment, aligning with India’s push for industry innovation and global competitiveness.

These entrepreneurs show the diverse ways in which innovation and dedication are driving India’s economic and social development, often with a focus on sustainability and inclusive growth.

8. CONCLUSION:

Entrepreneurs serve as the catalyst for economic expansion, employment generation and innovation within the Indian economy. Their actions result in enhanced productivity, wealth generation and better living conditions for many, establishing them as an essential part of India’s economic growth. Entrepreneurship is crucial for India's progress towards becoming a developed country. By promoting innovation, generating employment and stimulating economic expansion, entrepreneurs act as significant agents of change. They tackle urgent social and economic issues by bringing forth new products, services and technologies while boosting productivity and global competitiveness. Government programs such as Start-up India, Make-in India and Digital India have further strengthened entrepreneurs, encouraging a culture of self-sufficiency and resilience. As India strives for a strong and inclusive growth path, ongoing support for entrepreneurship is vital, as it not only aids economic advancement but also drives social development, bringing India closer to its goal of becoming a developed nation.

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Assessing the Impact of Lending Through Kisan Credit Cards Scheme on the Beneficiaries: A Case Study of District Shopian

Tosib Alam[*], Naseer Ahmad Hajam[#] & Liaqat Gulzar[Φ]

Abstract

Studies on farmers' socio-economic conditions are vital for developing good policy solutions. The Shopian district of Kashmir is an agriculturally dominated area. About 64% of the workers work in the primary sector, but the agricultural sector is currently facing a range of issues, including financial, irrigation, HYVs, and other capital equipments. The Kisan Credit Card scheme aims to eliminate farmer exploitation by providing loans at cheaper interest rates, contributing to the expansion of the agriculture sector. KCC is an exceptionally important initiative for the growth of rural economy because it is the sole provider "of short-term credit for agriculture". The initiative was adopted "by public sector commercial banks, RRBs (Regional Rural Banks), and cooperative banks" across the country since its inception in 1998-99. This study shows the socio-economic condition and impact of the Kisan Credit Card Scheme on beneficiaries associated with agricultural/horticulture related activities in Shopian district of Jammu and Kashmir. The study identified the scheme's primary challenges and recommended better techniques for its implementation. The primary data were collected from the 74 KCC beneficiaries in the Shopian district's Block Kanjiullar. The study's findings revealed a substantial association between land holdings, loan amount, and beneficiaries' economic status, but an insignificant association between education and age.

Keywords: Socio-economic, Kisan Credit Card, Lending, Impact, Development and Policy

Introduction

The Kisan Credit Card (KCC) Scheme has indeed been an important instrument in improving the horticulture sector in India by providing affordable and timely credit to farmers (Prasad et al., 2022). The KCC scheme provides access to capital for farmers engaged in horticulture production (Chhoidub & Pathania ,2017). By providing timely credit during crucial phases like planting and harvesting seasons, the scheme ensures that farmers have the necessary funds to buy the required resources and equipments, in order to enhance productivity (Wongnaa et., 2023). Through the KCC scheme, farmers gain control over financial resources, allowing them to make informed decisions about resource allocation, crop selection, and investment in modern agricultural practices (Tripathi et., 2023). This control enables farmers to optimize their horticulture production and improve their livelihoods (Mudda et., 2017). One of the main aims of the KCC scheme is to reduce the dependency of Indian farmers on informal sources of credit, such as moneylenders(Kumar & Murthy,2023).By providing formal credit at reasonable interest rates, the scheme helps farmers avoid the debt trap associated with informal borrowing and fosters financial inclusion in rural areas (Tripathy & Singh, 2022).The KCC scheme streamlines the credit process by minimizing documentation requirements and simplifying the loan application and approval procedures(Patil et., 2023). This reduces bureaucratic hurdles and delays, making it easier for farmers to access credit when needed (Prasad et., 2016). While challenges such as lack of information among rural people about the benefits of the KCC scheme exist, efforts are made to increase awareness and outreach through various channels, including financial literacy programs, farmer training sessions, and government initiatives (Mason & Wilson,2000). Increasing awareness helps ensure that more farmers avail themselves of the benefits offered by the scheme. By providing cost-effective credit tailored

[*] Assistant Professor, Department of Economics, Central University of Kashmir, Ganderbal
[#] Research Scholar, Department of Economics, Central University of Kashmir, Ganderbal.
[Φ] Master Student, Department of Economics, Central University of Kashmir, Ganderbal

to the specific needs of farmers engaged in horticulture, the KCC scheme promotes sustainable agricultural practices and facilitates the adoption of latest technologies and inputs, thereby improving productivity and income levels (Das Gupta & Dey, 2016; Para & Alam, 2024). Overall, the KCC Scheme has emerged as a crucial tool for empowering farmers in the horticulture sector by addressing their credit needs and promoting inclusive growth in rural India (Madhavan, 2014).

The Literature Reviews Related to Theoretical Background: Kallur, M. S. (2005) examined the effect of KCC on the availability of credit and the cost of repayment in a backward district of Karnataka state. The study found that the amount of money KCC holders could borrow depended on the crops they grew and how much land they owned. The study also showed that a farmer's ability to get a loan for a bigger amount went up as the size of his land holdings increased. “Kumar. A, et al. (2010) reported that the use of Kisan cards showed a positive relationship with the size of land holding”. Their study concluded that the percentage of card holders using the Kisan Credit Card scheme (KCCs) was “35 per cent among small farm households and 81 per cent among large households”. Parmar et al. (2009) investigated the “repayment behaviour of Kisan Credit Card scheme” recipients in Madhya Pradesh's Sehore block. Their research found that the majority of the beneficiaries, comprising 44.17 per cent, held a negative attitude toward the Kisan credit card programme. “This was followed by33.33 per cent of the beneficiaries holding a medium attitude and 22.50 per cent holding a positive attitude”. Prakash (2013) A research paper titled "Kisan Credit Card influence on the agricultural economy: a case study of Tamil Nadu's Krishnagiri district" published in 2013. According to the findings of the study, the farmers who benefited from it in the Krishnagiri district have seen the highest output “in groundnut (38 per cent), followed by paddy (23 per cent), and then sugarcane (22 per cent)”. Anshujaet al. (2021). Attempted to examine the Loan Repayment Behavior of farmers who have availed KCC.It was found that 39% of those had paid off their debts in a timely manner. Regular and closed accounts together, make up 55 per cent of the total. Furthermore, “they concluded that irregular and default, accounts for 34.5 and 10.5 per cent of the total respectively”. Suryawanshi et al. (2021) conducted research in villages within the “Amravati and Bhatkuli Panchayat Samiti in Amravati District”. It was found that a higher proportion of people who participated “in the marginal land holding category” (52.78 percent) had mostly used the credit amount, while a similar pattern was seen among participants in the “low land holding category (65.72 percent)”.

Need of the Study:

KCC Scheme is one of the credit distribution developments; it is developed to provide farmers with timely and adequate credit, with a versatile and simplified procedure. By adopting ‘Whole Farm Approach’, in this the form of credit included the “short-term credit, medium term and long-term credit needs of the borrowers for agriculture and allied activities and along with a reasonable component for consumption needs of the farmers”. Qualifying farmers will be provided a “Kisan Credit Card, a Pass Book or Pass Book cum-card, and a cash credit facility”, with the ability to withdraw and return any amount within the restrictions. Credit cap will be set based on the farmers' actual land holdings, crop patterns, and financial scale. This study shows the socio-economic condition and impact of the “Kisan Credit Card Scheme” on beneficiaries associated with agricultural/horticulture related activities in Shopian district of Jammu and Kashmir. The study identified the main obstacles of the scheme and suggested the important methods to implement this proramme. This study will help academicians and researchers to carry out further studies in this regard.

Objectives of the Study: The study will be focusing mainly on the following objectives.

1. To examine the Socio-Economic Status of beneficiaries of KCC.
2. To analyze the Impact of KCC scheme on “the Socio-Economic Status of the beneficiaries”.

c. To analyze the Role of KCC scheme in the growth of horticulture/Agriculture sector.

Methodology and Data Sources:

The current study's research subjects were farmers from the Shopian area of Jammu and Kashmir. The sampling boundaries were determined using a district map. That is, only farmers who were legitimate landowners and whose property records were recorded on paperwork issued by the local Patwari in Shopian district were classified as subjects. Therefore, for the present research, the district boundaries of Shopian district's Block Kanjiullar serve as the sample frame, with the farmers within the sampling frame serving as the study's subjects. Out of the district's 232 villages, only seven were purposefully chosen from Block Kanjiullar of Tehsil Shopian: Vehil, Shamshipora, Ramnagri, Check-e-Mirzapora, Chodrigund, Chatawattan, and Nowgam. Ten respondents were chosen from each of the seven villages, with the exception of Vehil, where 14 samples were gathered using **Exponential non-discriminative snowball sampling,** with beneficiaries of Kisan Credit Card schemes serving as the sampling element. In this approach, the sample size for the current study was 74. To fulfil the current study's objectives, a well-designed interview schedule and questionnaire were developed.

Application of Statistical Tools

The acquired data has been compiled and analysed using relevant statistical procedures such as percentages, "descriptive statistics, and the Chi-square test" to estimate and determine the outcome.

Results and Discussion

Table: 1 Socio-economic Characteristics of Beneficiaries.

Variable	Characteristic	APL	BPL	PHH	AAY	TOTAL
Gender	Male	31 (41.9%)	30(40.5%)	7 (9.5%)	5(6.8%)	73 (98.6%)
	Female	0	0	1(1.4%)	0	1 (1.4%)
	Total	***31 (41.9%)***	*30(40.5%)*	***8 (10.8%)***	***5(6.8%)***	***74 (100%)***
Caste	Unreserved	27 (36.5%)	9 (12.2%)	7 (9.5%))	1(1.4%)	44 (59.5%)
	ST	3 (4.1%)	11 (14.9%)	0	4 (5.4%)	18 (24.3%)
	OBC	1 (1.4%)	10 (13.5%)	1 (1.4%)	0	12(16.2%)
	Total	***31 (41.9%)***	***30 (40.5%)***	***8 (10.8%)***	***5 (6.8%)***	***74 (100%)***
Occupation	Horticulture/Agriculture	26 (35.1%)	29 (39.2%)	8 (10.8%)	5(6.8%)	68 (91.9%)
	Business	2 (2.7%)	1 (1.4%)	0	0	3 (4.1%)
	Govt. service	3 (4.1%)	0	0	0	3 (4.1%)
	Total	***31 (41.9%)***	***30 (40.5%)***	***8 (10.8%)***	***5 (6.8%)***	***74 (100%)***
Education	Illiterate	7 (9.5%)	10 (13.5%)	5 (6.8%)	2 (2.7%)	24 (32.4%)
	Upper Primary	10 (13.5%)	7 (9.5%)	1 (1.4%)	2 (2.7%)	20 (27.0%)
	Secondary	7 (9.5%)	4 (5.4%)	2 (2.7%)	0	13 (17.6%)
	Higher Secondary	5 (6.8%)	4 (5.4%)	0	1 (1.4%)	10 (13.5%)
	Graduated	2 (2.7%)	5 (6.8%)	0	0	7 (9.5%)
	Total	***31 (41.9%)***	***30 (40.5%)***	***8 (10.8)***	***5 (6.8%)***	***74 (100%)***
AGE	26-35	5 (6.8%)	4 (5.4%)	0	1 (1.4%)	10 (13.5%)
	36-45	4 (5.4%)	6 (8.1%)	3 (4.1%)	0	13 (17.6%)
	46-55	11 (14.9%)	12 (16.2%)	3 (4.1%)	3 (4.1%)	29 (39.2%)
	56-	8 (10.8%)	6 (8.1%)	2 (2.7%)	1 (1.4%)	17 (23.0%)
	66-75	3 (4.1%)	2 (2.7%)	0	0	5 (6.8%)
	Total	***31 (41.9%)***	***30 (40.5%)***	***8 (10.8%)***	***5 (6.8%)***	***74 (100%)***
	1 – 4.5 Kanal	3 (4.1%)	17 (23.0%)	3 (4.1%)	5 (6.8%)	28 (37.8%)
	4.5 – 9 Kanal	9 (12.2%)	7(9.5%)	1 (1.4%)	0	17 (23.0%)

Land holding	9 – 13.5 Kanal	12 (16.2%)	6 (8.1%)	3 (4.1%)	0	21 (28.3%)
	Above 13.5 kanal	7 (9.5%)	0	1 (1.4%)	0	8 (10.8%)
	Total	***31 (41.8%)***	***30 (40.5%)***	***8 (10.8%)***	***5 (6.8%)***	***74 (100%***

Source: field survey 2022

Table 1 highlights the socio-economic character of the beneficairaies.98.6% of responders are male, while only 1.4% are female. Out of the total 98.6% male population, 41.9% are in the APL economic status, 40.5% are in the BPL category, 9.5% are in the PHH category, and just 6.8% are in the AAY economic position. As a result, we can conclude that the APL category accounts for the majority of KCC beneficiaries.

The second Socio- economic characteristic in the table (4.1) shows caste of the beneficiaries. 59.5% of respondents are unreserved, 24.3 percent are ST, with 14.9 percent being BPL, 4.1% being APL, and only 1.4% being AAY. The biggest percentage in the unreserved category comes from APL (36.5%), followed by BPL (12.2%), 9.5 percent PHH, and the lowest from AAY (1.4%). The BPL group has the largest beneficiaries among OBCs (13.5%). As a result, we can deduce that the majority of KCC beneficiaries are unreserved and belong to the APL category.

The respondents' occupations are classified into three categories (4.1): horticulture/agriculture, business, and government service. The APL category contributed the most (35.1%), followed by the BPL category (39.2%), PHH (10.5%), and AAY (6.8%). Approximately 3.1 percent of respondents were found to be in business, while another 3.1 percent were government employees who took out this loan. As a result, we can conclude that the KCC's most significant beneficiaries were involved in horticulture.

It can be seen from the table (1.1) that the majority of responders (39.2%) are between the ages of 46 and 55. Among them, the highest proportion of respondents is from the BPL category which constitutes 16.2 per cent, while the lowest proportion comes from the AAY category is 1.4 per cent. After this, 23.0% of responders are between the ages of 56 and 65. Thus, we can highlight that majority of the respondents who avail this scheme belonged to the above poverty line. The last variable provides statistics on the beneficiaries' land holdings across four economic categories. According to the study's sample size, the majority of beneficiaries (37.8%) owned land ranging from 1 to 4.5 kanals, followed by 9 to 13.5 kanals (28.3%), and 4.5 to 9 kanals (23.0%). It was found that just 9.5% of APL beneficiaries and 1.4 percent of PHH recipients had land holdings more than 13.5 kanals. The majority of BPL beneficiaries owned land ranges from 1 to 4.5 Kanals (23.0%).

Association between the Socio-economic Status of Beneficiaries of KCC

Table:1.1 Association between Education and Age

	Value	**Df**	**p-value**
Pearson Chi-Square	11.415	16	.783

Authors calculation using SPSS Software.

H_o = There is no significant association between education and age of the beneficiaries.

In the table 1.2 the chi square value is 11.415 and p value is .783. Since p value is greater than 0.05. Therefore, we cannot reject the null hypothesis and conclude that education level of the beneficiaries has no impact on the age of the beneficiaries. This shows that increasing educational level does not affect the age of the respondents. Thus, we could state that there is no relationship between the schooling and age of the respondents.

Table 1.2 Association between Land Holding and Economic status of beneficiaries

	Value	Df	p-value
Pearson Chi-Square	27.781	9	.001

Authors calculation using SPSS Software.

H_o= There is no significant association between land holdings and economic status of the beneficiaries.

The Chi-Square analysis given in table 1.3, gives a chi-square value of 27.781 and p-value of .001. Since p-value is less than 0.05, therefore we can reject the null hypothesis and conclude that there is a significant association between the land holdings and economic status of the beneficiaries. This shows that people having large landholdings results in the betterment of their economic status and vice- versa. So, there is a positive correlation between the land holding and economic status of the beneficiaries.

Table 1.3: Association between Economic status and Amount of Loan taken by the Beneficiaries of KCC

	Value	Df	p-value
Pearson Chi-Square	13.646	6	.034

Authors calculation using SPSS Software.

H_o= There is no significant association between economic status and amount of loan taken by the beneficiaries.

The Chi-Square analysis given in table 1.4, gives a chi-square value of 13.646 and p-value of .034. Since p-value is less than 0.05, therefore we can reject the null hypothesis and suggest that there is significant association between the economic status and amount of land taken by the beneficiaries. This highlights that economic status does affect the amount of loan taken. So, we can conclude that economic status positively affects the amount of loan taken by the beneficiaries.

Table 2: Information of the Respondents about KCC

Variable	Characteristic	APL	BPL	PHH	AAY	TOTAL
When you have taken this loan?	1 Year Before	2 (2.7%)	4 (5.4%)	2 (2.7%)	0	8 (10.8%)
	2 – 3 Year before	9 (12.2%)	7 (9.5%)	0	0	16 (21.6%)
	3 – 4 Year before	12 (16.2%)	10 (13.5%)	2 (2.7%)	2 (2.7%)	26 (35.1%)
	More than 4 years before	8 (10.8%)	9 (12.2%)	4 (5.4%)	3 (4.1%)	24 (32.4%)
	Total	31 (41.9%)	30 (40.5%)	8 (10.8%)	5 (6.8%)	74 (100%)
From whom you came to know about KCC loan?	Bank Officials	10 (13.5%)	5 (6.8%)	0	0	15 (20.3%)
	Beneficiaries who had already availed the KCC Loan	16 (21.6%)	25 (33.8%)	3 (4.1%)	5 (6.8%)	49 (66.2%)
	Agriculture or Allied Departments	3 (4.1%)	0	3 (4.1%)	0	6 (8.1%)
	News Paper	1 (1.4%)	0	2 (2.7%)	0	3 (4.1%)
	Friends and relatives	1 (1.4%)	0	0	0	1 (1.4%)

	Total	***31 (41.9%)***	***30 (40.5%)***	***8 (10.8%)***	***5 (6.8%)***	***74 (100%)***
Name of the bank from where the KCC loan has been taken?	Jammu and Kashmir Bank	31 (41.9%)	30 (40.5%)	8 (10.8%)	5 (6.8%)	74 (100%)
Reason for taking this Loan?	Low-interest Rate	29 (39.2%)	30 (40.5%)	8 (10.8%)	5 (6.8%)	72 (97.3%)
	Easy documentation process	2 (2.7%)	0	0	0	2 (2.7%)
	Total	***31 (41.9%)***	***30 (40.5%)***	***8 (10.8%)***	***5 (6.8%)***	***74 (100%)***
How much time did you wait for the Loan?	Less than 1 month	6 (8.1%)	1 (1.4%)	0	0	7 (9.5%)
	1 – 2 month	19 (25.7%)	18 (24.3%)	4 (5.4%)	4 (5.4%)	45 (60.8%)
	2 – 3 Month	2 (2.7%)	7 (9.5%)	3 (4.1%)	1 (1.4%)	13 (17.6%)
	Above 3 months	4 (5.4%)	4 (5.4%)	1 (1.4%)	0	9 (12.2%)
	Total	***24 (35.8%)***	***11 (16.4%)***	***32 (47.8%)***		***67 (100%)***
Collateral securities deposited against the Loan.	Papers of Land holding/Government employee as a guarantor	25 (33.8%)	27 (36.5%)	7 (9.5%)	4 (5.4%)	63 (85.1%)
	Papers of Land holding	3 (4.1%)	2 (2.7%)	1 (1.4%)	1 (1.4%)	7 (9.5%)
	Nothing	3 (4.1%)	1 (1.4%)	0	0	4 (5.4%)
	Total	***31 (41.9%)***	***30 (40.5%)***	***8 (10.8%)***	***5 (6.8%)***	***74 (100%)***

Source: field survey 2022

The table 2 shows the respondents' information on the KCC Loan. When asked when they took the KCC loan, the majority of 35.1% of the recipients stated that they took the loan during the last 3-4 years. The beneficiaries (35.1%) who took out the loan within the last 3-4 years were primarily from the APL category, with the lowest percentages coming from the AAY and PHH categories. The second variable is the information that respondents got about the KCC initiative. Respondents were asked what source of information they had about the KCC programme. It was found that approximately 20.3% of respondents learned about KCC from bank officials, 66.2% from respondents who had already taken a loan, 8.1% from Agriculture and Allied departments, 4.1% from newspapers, and only 1.4% from friends and relatives. So, we conclude that the majority of respondents have learned about the plan through the recipients of the loan. The third variable contains information about the bank from which respondents obtained their loans. The respondents were asked form which financial unit they had taken the KCC loan and it was found that all of the respondents had taken the loan from the Jammu and Kashmir bank, due to the existence of J&K banks in the region. The fourth variable is about why respondents chose the KCC loan over other options. According to the findings of the survey, 97.3 percent of respondents obtained a KCC loan because of the cheap interest rate paid under this scheme, and 2.7 percent did so due of the KCC loan's ease of documentation. The fifth variable shows how long the beneficiaries waited for the KCC loan approval. It was found that 9.5% of respondents waited less than one month to get their KCC

loan approved, 60.8% waited for 1 to 2 months, 17.6% waited for 2 to 3 months, and 12.2% waited for more than 3 months. Therefore, we may assume that the majority of the recipients waited 1-2 months for loan approval. The sixth variable in the table above refers to the collateral securities that recipients deposited against their KCC loan. It was found that 85.1% of the beneficiaries had mortgaged their papers of land ownership, with the government employ as a guarantee, of which 36.5% belong to the BPL category. 33.8% from APL, 9.5% from PHH, and 5.4 from AAY. On the other hand, 9.5% of beneficiaries have only mortgaged their land ownership papers, with 4.1% belonging to the APL category, 2.7% to the BPL category, and 1.4% to the PHH and AAY categories. 5.4% of the beneficiaries had no mortgage against their KCC loan.

Table 3: Observation of the Beneficiaries while Availing the KCC Loan

Variable	Characteristic	APL	BPL	PHH	AAY	TOTAL
Did you face any problem while applying for this loan?	Yes	3 (4.1%)	7 (9.5%)	2 (2.7%)	1 (1.4%)	13 (17.6%)
	No	28 (37.8%)	23 (31.1%)	6 (8.1%)	4 (5.4%)	61 (82.4%)
If y es, please specify	Lack of knowledge	1 (7.7%)	1 (7.7%)	0	0	2 (15.4%)
	Visited many times to bank	2 (15.4%)	5 (38.5%)	1 (7.7%)	1 (7.7%)	9 (69.27%)
	Bribe, fee and fines	0	0	1 (7.7%)	0	1 (7.7%)
	Branch had sanctioned more amount but clerk credited less amount	0	1 (7.7%)	0	0	1 (7.7%)
	Total	***2 (15.4%)***	***9 (69.2%)***	***1 (7.7%)***	***1 (7.7%)***	***13 (100%)***
Express your opinions about the reason for delay in advancing loans, if any	Non-co-operative attitude	1 (3.7%)	6 (22.2%)	1 (3.7%)	3 (27.3%)	11 (40.7%)
	Un-necessary queries	6 (22.2%)	7 (25.9%)	1 (3.7%)	1 (3.7%)	15 (55.6%)
	Fees and fines charged	0	1 (3.7%)	0	0	1 (3.7%)
	Total	***7 (25.9%)***	***14 (51.9%)***	***2 (7.4%)***	***4 (14.8%)***	***27 (100%)***

Source: field survey 2022

The table number 3 indicates the observation of the beneficiaries while availing the loan.82.4% of respondents said they had no difficulty while applying for a KCC loan, whereas 17.6% said they faced difficulty in applying the loan. Respondents who experienced difficulty were asked to describe the issues they had encountered while applying for KCC; 69.27% of respondents reported difficulty due to the number of times they had to visit the bank, 15.4% reported a lack of knowledge about the scheme, and 7.7% claimed a problem in the form of bribes, fees, and charges. Even 7.7 percent of respondents indicated that the branch sanctioned more, but the clerk credited less. The third question in table was asked to those respondents who had experienced delays in KCC loan advances; the number of such respondents was 27% in the study, and 55.6% of them said it was due to bank staff's uncooperative attitude, 40.7% said it was due to unnecessary queries raised by bank staff, and only 3.7% out of 27 respondents reported the delay due to bank fees and fines.

Table 3.1 Problems Faced by Respondents from the Banks

Opinion	Frequency of Respondents	Frequency Percentage (%)	Cumulative Percentage (%)
Yes	13	17.6	17.6
No	61	82.4	100
Total	74	100	

Authors calculation using SPSS Software.

Chart 1 Shows Problems Faced by Respondents from the Banks

From the above table 3.1 it is evident that 82.4 (61 respondents) per cent of respondents have not faced any other kind of problems from bank with respect to Kisan Credit Card Scheme and only 17.6 (13 respondents) per cent of respondents have faced other kind of problems from banks for raising finance from Kisan Credit Card Scheme.

Table 4 The Loan Amount Taken and its Purpose

Variable	**Characteristic**	**APL**	**BPL**	**PHH**	**AAY**	**TOTAL**
What was the amount you had applied for?	22500 – 1 lakh	9 (12.2%)	16 (21.6%)	2 (2.7%)	3 (4.01%)	30 (40.5%)
	1 – 2 lakh	9 (12.2%)	12 (16.2%)	4 (5.4%)	2 (2.7%)	27 (36.5%)
	2 – 3 lakh	13 (17.6%)	2 (2.7%)	2 (2.7%)	0	17 (23.0%)
	Total	***31 (41.9%)***	***30 (40.5%)***	***8 (10.8%)***	***5 (6.8%)***	***74 (100%)***
For what purpose you have taken this Loan?	Agriculture/Horticulture	28 (37.8%)	27 (36.5%)	7 (9.5%)	5 (6.8%)	67 (90.5%)
	Business	2 (2.7%)	2 (2.7%)	1 (1.4%)	0	5 (6.8%)
	House building	1 (1.4%)	1 (1.4%)	0	0	2 (2.7%)
	Total	***31 (41.9%)***	***30 (40.5%)***	***8 (10.8%)***	***5 (6.8%)***	***74 (100%)***
Was that amount of KCC loan sufficient for your purpose?	Yes	25 (33.8%)	19 (25.7%)	6 (8.1%)	4 (5.4%)	54 (73.0%)
	No	6 (8.1%)	11 (14.9%)	2 (2.7%)	1 (1.4%)	20 (27.0%)
If the KCC loan was not sufficient, from where did you collect the fund?	Personal sources	4 (5.4%)	10 (13.4%)	2 (2.7%)	1 (1.4%)	17 (23.0%)
	Family and friends	2 (2.7%)	1 (1.4%)	0	0	3 (4.1%)
	Total	***6 (8.1%)***	***11 (14.9%)***	***2 (2.7%)***	***1 (1.4%)***	***20 (27.0%)***

Source: field survey 2022

The table number 4 provides the information about the loan amount taken and its purpose. When asked how much KCC amount of loan they had applied for, 40.5% of respondents stated that they had applied for 22500 to 1 lakh rupees, with the highest number of beneficiaries (21.6%) coming from the BPL category, followed by APL (12.2%), AAY (4.1%), and PHH (2.7%). 36.5% of respondents said they had applied for 1 to 2 lakh rupees, while 23% said they had applied for 2 to 3 lakh rupees. Out of these, 17.6% were from the APL category, 2.7% from the BPL and PHH categories, and none from the AAY. The second question in the table contains the purpose of the KCC loan taken. When asked why they took the loan, 90.5% of respondents said it was for horticulture/agriculture purpose. Out of these, APL category had the most respondents (37.8%), followed by the BPL category (36.5%), PHH (9.5%), and AAY (6.8%). On the other hand, 6.8% of respondents used the loan for business other than horticulture/agriculture purpose and 2.7% of respondents said they utilised the loan to build a house. The final question in the table was addressed to persons (27 percent) who stated that the amount of money gained through the KCC loan was insufficient for their intended purpose. When asked where they acquired the residual cash if the KCC was insufficient, around 23.0% of respondents claimed they obtained the money from personal sources, with 5.4% coming from the APL category, 13.4% from the BPL category, 2.7 from PHH, and 1.4% from the BPL category. The remaining 4.1% of respondents said they borrowed the remaining money from relatives and friends.

Table 4.1 Association between Caste and Amount of loan taken by the beneficiaries of KCC

	Value	Df	p-value
Pearson Chi-Square	16.717	4	.002

Authors calculation using SPSS Software.

H_o= There is no significant influence between Caste and amount of loan taken by the beneficiaries of KCC

The Chi-Square analysis given in table 4.1, gives a chi-square value of 16.717 and p-value of .002. Since p-value is less than 0.05, therefore we reject the null hypothesis and suggest that there is a strong associaton between caste and amount of loan taken by the beneficiaries. This shows that caste is the significant factor that affects the amount of loan taken by the beneficiaries. It also highlights that people belonging to the different castes have taken the loan. It also shows that people belonging to backward casts have availed theme scheme more frequently than those belonging to the unreserved categories. So, we can conclude that there is a positive association between the caste and amount loan taken by the beneficiaries.

Table 5 Rating of the Beneficiaries to KCC Scheme

Variable	Characteristic	APL	BPL	PHH	AAY	TOTAL
Have you received the interest subsidy	Yes	23 (31.1%)	25 (33.8%)	5 (6.8%)	3 (4.1%)	56 (75.7%)
	No	8 (10.8%)	5 (6.8%)	3 (4.1%)	2 (2.7%)	18 (24.3%)
Have you got the required training facilities to support your scheme?	Yes	8 (10.8%)	7 (9.5%)	3 (4.1%)	0	18 (24.3%)
	No	23 (31.1%)	23(31.1%)	5 (6.8%)	5 (6.8%)	56 (75.7%)
How do you rate the interest rate charged under this scheme?	Worst	1 (1.4%)	0	2 (2.7%)	1 (1.4%)	4 (5.4%)
	Not good	6 (8.1%)	2 (2.7%)	0	2 (2.7%)	10 (13.5%)

	Neutral	7 (9.5%)	7 (9.5%)	2 (2.7%)	0	16 (21.6%)
	Good	7 (9.5%)	16 (21.6%)	3 (4.1%)	2 (2.7%)	28 (37.8%)
	Very good	10 (13.5%)	5 (6.8%)	1 (1.4%)	0	16 (21.6%)
	Total	*31 (41.9%)*	*30 (40.5%)*	*8 (10.8%)*	*5 (6.8%)*	*74 (100%)*
How do you rate the documentation procedure of your bank?	Worst	1 (1.4%)	1 (1.4%)	1 (1.4%)	1 (1.4%)	4 (5.4%)
	Not Good	0	5 (6.8%)	1 (1.4%)	0	6 (8.1%)
	Neutral	7 (9.5%)	4 (5.4%)	4 (5.4%)	0	15(20.3%)
	Good	12 (16.2%)	16 (21.6%)	2 (2.7%)	4 (5.4%)	34 (45.9%)
	Very Good	11 (14.9%)	4 (5.4%)	0	0	15 (20.3%)
	Total	*31 (41.9%)*	*30 (40.5%)*	*8 (10.8%)*	*5 (6.8%)*	*74 (100%)*
How do you rate the sanctioning procedure of your bank?	Worst	0	2 (2.7%)	0	1 (1.4%)	3 (4.1%)
	Not Good	1 (1.4%)	2 (2.7%)	1 (1.4%)	0	4 (5.4%)
	Neutral	6 (8.1%)	5 (6.8%)	3 (4.1%)	0	14 (18.9%)
	Good	9 (12.2%)	20 (27.2%)	3 (4.1%)	4 (5.4%)	36 (48.6%)
	Very Good	15 (20.3%)	1 (1.4%)	1 (1.4%)	0	17 (23.0%)
	Total	*31 (41.9%)*	*30 (40.5%)*	*30 (40.5%)*	*5 (6.8%)*	*74 (100%)*

Source: field survey 2022

According to the table 5, the first variable reveals whether or not KCC beneficiaries have received any interest subsidies. It was determined that 75.7 percent have received interest subsidies, while just 24 percent of respondents reported that no subsidy had been provided to them. The second variable is whether the beneficiaries received any training after receiving the loan or not. It was discovered that just 24.3 percent had received some instruction on how to use the complete amount of loan, with 75.7 percent having received no training to support the scheme. The third variable shows the rate of interest charged under this programme; just 5.4% of respondents regarded the interest rate as the worst. Approximately 13.5% of respondents assessed the interest amount as "not good." 21.6% of beneficiaries viewed the interest rate as neutral. 37.8 percent of KCC holders assessed the interest as "excellent," with 21.6 percent of beneficiaries falling into the BPL group, 9.5 percent in the APL category, and only 2.7 percent in the AAY category. The overall proportion of 21.6 beneficiaries were those who found the interest rate "quite good" as compared to other loans available with higher interest rates; 13.5 percent were from APL, 6.8 percent from BPL, and just 1.4 percent were from the PHH category.

The fourth variable indicates the bank's documentation procedure rate under this method, which runs from "worst" (poor documentation procedure) to "very excellent" (acceptable documentation procedure). Only 5.4% of respondents evaluated the paperwork method as the worst. Approximately 6.8% of respondents assessed the documentation method as "not good," with 6.8% from BPL and only 1.4 percent from AAY categories.20.3 percent of recipients regarded the bank's paperwork procedure as neutral. 45.9 percent of KCC holders considered the paperwork method "good." The overall proportion of 20.3 beneficiaries were those who rated the bank's rate documentation method as "very good," which means extremely satisfactory. Thus, we can conclude that the large number of beneficiaries were satisfied with the document procedures by the bank. Variable sixth represents the bank's sanctioning procedure rate using this approach, which ranges from "worst" (poor sanctioning procedure) to "very outstanding" (satisfactory sanctioning procedure). Only 4.1% of respondents rated the penalty procedure as the worst. Approximately 5.4 percent of respondents rated banks' sanctioning procedures as "not satisfactory," with 2.7 percent from the BPL and only 1.4 percent from each of the APL and PHH categories.18.9 percent of beneficiaries saw the bank's sanctioning procedure as impartial. 48.6 percent of KCC holders rated the sanctioning system as "excellent," with 27.2 percent of beneficiaries falling into the BPL category, 12.2 percent falling into APL, 5.4 percent falling into AAY, and only 4.1 percent falling into the PHH category.

Table 6 shows the Utilization of KCC Loan amount and its Impact

Variable	Characteristic	APL	BPL	PHH	AAY	TOTAL
Have you utilised the loan credit for Horticuture /agriculture and its allied activities?	Yes	30 (40.5%)	29 (39.2%)	6 (8.1%)	4 (5.4%)	69 (93.2%)
	No	1 (1.4%)	1 (1.4%)	2 (2.7%)	1 (1.4%)	5 (6.8%)
If yes, how much you you have utilised on horticulture/agriculture and its allied activities?	Fully utilised	17 (23.0%)	11 (14.9%)	4 (5.4%)	0	32 (43.2%)
	Partially utilised	14 (18.9%)	19 (25.7%)	4 (5.4%)	5 (6.8%)	42 (56.8%)
	Total	31 (41.9%)	30 (40.5%)	8 (10.8%)	5 (6.8%)	74 (100%)
If not used fully on Hagriculture and allied activities, then for what purpose did you use your KCC loan amount?	Social-Ceremonies	2 (2.7%)	2 (2.7%)	1 (1.4%)	0	5 (6.8%)
	Sun-lending	0	0	0	1 (1.4%)	1 (1.4%)
	Others Business	9 (12.2%)	16 (21.6%)	1 (1.4%)	3 (4.1%)	29 (39.2%)
	Salting old Debt	2 (2.7%)	4 (5.4%)	1 (4.5%)	0	7 (9.5%)
	Building of house	7 (9.5%)	2 (2.7%)	0	1 (1.4%)	10 (13.5%)
	Compelling family consumption	1 (1.4%)	5 (6.8%)	1 (1.4%)	0	7 (9.5%)
	Total					
	Yes	23 (31.1%)	22 (29.7%)	5 (6.8%)	3 (4.1%)	53 (71.6%)

Have you seen any progress in your annual turnover after taking this loan?	No	8 (10.8%)	8 (10.8%)	3 (4.1%)	2 (2.7%)	21 (28.4%)
Have you seen any progress in your Agriculture/Horticulture?	very good progress	2 (2.7%)	2 (2.7%)	0	0	4 (5.4%)
	Good progress	18 (24.3%)	21 (28.4%)	5 (6.8%)	2 (2.7%)	46 (62.2%)
	Low progress	11 (14.9%)	7 (9.5%)	3 (4.1%)	3 (4.1%)	24 (32.4%)

Source: field survey 2022

The table 6 highlights the utilization of loan credit for agriculture/horticulture allied activities by the KCC beneficiaries belongs to APL, BPL, PHH and AAY. Total number of respondents who utilized the loan credit on agriculture and horticulture were 93.2 percent and 6.8 percent were those who utilized it on other activities, among 93.2 percent the highest 40.5 percent loan were utilized by APL category followed by 39.2 percent by BPL category and lowest utilization was of the AAY category which contains only 5.4 percent. Total percentage of respondents who used the loan totally was 43.2 percent, while 56.8 percent used it partially in agriculture or horticulture. Respondents who used the loan for different objectives 6.8 percent of those who borrowed money used it for social events. 39.2 percent of respondents used it for business purposes other than agriculture/horticulture, with the majority falling into the BPL group. The overall number of respondents who used their loan to pay off past debts was 9.5, with 5.4 percent coming from BPL, 2.7 percent from APL, and the remaining 4.5 percent coming from PHH category. A total of 13.5 percent of respondents used this loan amount to build dwellings, with 9.5 percent from the APL category, 2.7 percent from the BPL category, and only 1.4 percent from the AAY category. Additionally, 9.5 percent of respondents used their credit to induce family spending. Out of the total, 71.6 percent of beneficiaries reported seeing progress in their annual turnover after taking this loan. The highest annual turnover was seen in the APL category (31.1 percent), followed by the BPL category (29.7 percent), and only 4.1 percent of beneficiaries in the AAY category reported the lowest annual turnover after taking this loan. However, 28.4 percent of respondents, including 10.8 percent from both the APL and BPL categories, 4.1 percent from PHH, and only 2.7 percent from other categories, reported no increase in their annual turnover.

The percentage of KCC holder who responded that they have seen very good progress in their Agriculture/Horticulture productivity were 5.2 percent, those who have seen good progress were 62.2 percent and 32.4 percent respondents recorded low progress after taking the loan.

Table 6.1 Association between Loan Utilization and Progress Achieved in terms of Annual Turnover by beneficiaries

	Value	**Df**	**p-value**
Pearson Chi-Square	7.030	1	.008

Authors calculation using SPSS Software.

H_o= There is no significant association between utilization of loan and progress achieved by beneficiaries

The Chi-Square analysis given in table 6.1, gives a value of 7.030 and p-value of .008. Since p-value is less than 0.05, hence null hypothesis can be rejected. Hence there is strong association between utilisation and progress achieved by the beneficiaries. This highlights that loan has been properly utilised for the productive activities and there has been no misuse of the loan taken. So, loan utilisation has helped to increase the progress in

terms of annual turnover. Therefore, we can conclude that loan utilisation and progress achieved are positively associated.

Table 6.2 shows the Progress in the Annual Turnover after Taken the Loan

Opinion	Frequency of Respondents	Valid Percentage (%)	Cumulative Percentage (%)
Yes	53	71.6	71.6
No	21	28.4	28.4
Total	74	100	100

Authors calculation using SPSS Software.

Figure 2 Shows the Progress in the Annual Turnover after taken the Loan

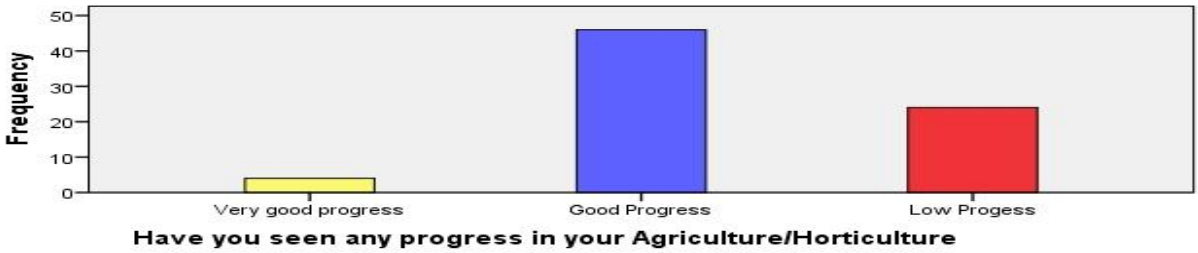
According to the table, 71 .6(53%) of the beneficiaries reported progress in their annual turnover as after availing KCC, while 28.4(21%) reported no improvement in their annual turnover after taking the loan, due to low returns from agriculture/ horticulture activities or beneficiaries have misuse the loan granted to them under this scheme. But the net impact of the KCC scheme is favourable because the majority of the beneficiaries show an increase in their annual turnover.

Table 6.3 shows the Progress in Agriculture/Horticulture Production

Opinion	Frequency of Respondents	Frequency (%)	Cumulative (%)
Very Good Progress	4	5.4	5.4
Good Progress	46	62.2	67.6
Low Progress	24	32.4	100
Total	74	100	--

Authors calculation using SPSS Software.

Chart 3 shows the Progress in Agriculture/Horticulture Production



From the above table (6.3) it is evident that 5.4 (4 respondents) per cent of beneficiaries have responded that they had seen very good progress in their horticulture production due to the Kisan Credit Card Scheme, and 62.2 (46 respondents) per cent of respondents recorded satisfactory improvement in horticulture production after availing the loan, and 32.4 (24 respondents) have recorded low progress in their horticulture production after obtaining the loan. The overall impact of the KCC is favourable, as the majority of respondents reported increased annual horticulture production.

Table 7 shows whether any Assets Generated after Obtaining the Loan

Variable	Characteristic	APL	BPL	PHH	AAY	TOTAL
Assets generated after obtaining the loan (if any)?	Improved horticulture & agriculture implements	15 (20.3%)	20 (27.0%)	5 (6.8%)	1 (1.4%)	41 (55.4%)
	Tube wells/wells/pump	1 (1.4%)	0	0	1 (1.4%)	2 (2.7%)
	Traditional implements	1 (1.4%)	0	1 (1.4%)	0	2 (2.7%)
	Total	17 (22.9%)	20 (27.0%)	6 (8.1%)	2 (2.7%)	45 (60.8%)

Source: Field survey 2022

Table 7 illustrates the assets generated as a result of the KCC loan. The total proportion of beneficiaries who have generated assets was 60.8%. Out of a total of 55.4 percent respondents who had improved horticulture and agriculture implements; the highest percentage was recorded in the BPL category (27.0 percent), followed by APL (20.3 percent). After receiving this loan, only 2.7% of respondents (1.4% from APL and 1.4% from AAY) installed tube wells/hand pumps. Only 2.7% of respondents reported having improved traditional implements (1.4% from APL and 1.4% from PHH categories).

Table 8 shows whether any Livestock is Generated after Obtaining the Loan.

Variable	Characteristic	APL	BPL	PHH	AAY	TOTAL
Livestock generated after obtaining loan,	Cow	1 (1.4%)	1 (1.4%)	1 (1.4%)	1 (1.4%)	4 (5.4%)
	Sheep	1 (1.4%)	3 (4.1%)	1 (1.4%)	0	5 (6.8%)
	Total	*2 (2.7%)*	*4 (5.4%)*	*2 (2.7%)*	*1 (1.4%)*	*9 (12.1%)*

Source: Field survey 2022

The table 8 shows the livestock generated after availing the KCC loan. The total percentage of beneficiaries who have generated livestock were 12.1 %. Out of this, 5.4 percent respondents had bought cows and 6.8 % respondents had bought sheep (1.4 % from APL and 4.1 % BPL and 1.4 % from PHH category) after taking this loan.

Table 9 shows the Repayment Behaviour of Beneficiaries

Variable	Characteristic	APL	BPL	PHH	AAY	TOTAL
Have you repaid the total amount of loan?	Yes	4 (5.4%)	0	2 (2.7%)	0	6 (8.1%)
	No	27 (36.5%)	30 (40.5%)	6 (8.1%)	5 (6.8%)	68 (91.9%)
Do You Renew your loan continuously?	Yes	23 (33.8%)	25 (36.8%)	6 (8.8%)	5 (7.4%)	59 (86.8%)
	No	4 (5.9%)	5 (7.4%)	0	0	9 (13.2%)
Are you paying interest only?	Yes	27 (39.7%)	30 (44.1%)	6 (8.8%)	5 (7.4%)	68 (100%)
	NO	0	0	0	0	0

Source: Field survey 2022

The table 9 depicts loan repayment, renewal, and interest payments made by KCC loan beneficiaries. Out of the (APL, BPL, PHH and AAY) categories, 91.9 percent of respondents had not repaid their loan. Out of this total, BPL category had the greatest percentage of loan non repayment, accounting for 40.5%, followed by APL at 36.5%, PHH at 10.8%, and AAY at 6.8%. Only 8.1 percent of respondents had repaid the entire loan amount, with 5.4 percent coming from APL and 2.7 percent from PHH. Beneficiaries continued to renew their loans annually, accounting for 86.8 percent of the total out of this, BPL category had the greatest renewal rate (36.8 percent), followed by APL (33.8 percent), and the lowest (7.4 percent) by AAY. The 13.2 percent respondents were those who were irregular/not renewing the loan annually. The highest 44.1 percent of KCC holders who were paying interests annually on continuous basis was found in BPL category followed by 39.7 percent from APL category, 8.8 percent from PHH and only 7.4 percent from AAY category.

Table 10 shows the Sources for Repayment of the Loan.

Variable	Characteristic	APL	BPL	PHH	AAY	TOTAL
How many sources do you have for repayment of the loan?	"Returns from agriculture/Horticulture and its ancillary activities"	25 (36.8%)	28 (41.2%)	4 (5.9%)	5 (7.4%)	62 (91.2%)
	Income from secondary occupation/family members	2 (2.9%)	1 (1.5%)	1 (1.5%)	0	4 (5.9%)
	Borrowing from relatives/Friends	0	1 (1.5%)	1 (1.5%)	0	2 (2.9%)
	Total	27 (39.7%)	30 (44.1%)	6 (8.8%)	5 (7.4%)	68 (100%)

Source: Field survey 2022

Table 10 displays the sources via which the beneficiaries of KCC loans repay/renewed their loan amount. 91.2 percent of respondents renewed their loan based on agricultural/horticultural returns, with 41.2 percent falling into the BPL group, 36.8 percent falling into the APL category, and only 5.9 percent falling into the PHH category. It has been found that 2.9 percent of APLs, 1.5 percent of BPLs, and PHHs have renewed their loan amounts using supplementary sources or money obtained by family members. Only 1.5 percent of BPL and PHH borrowers have renewed their loans by borrowing from relatives or friends.

Table 11 Represents Reasons behind Non-repayment of the Loan.

Variable	Characteristic	APL	BPL	PHH	AAY	TOTAL
Reasons behind non-repayment of the loan	Low returns from agriculture and its ancillary activities	16 (23.5%)	20 (29.4%)	3 (4.4%)	3 (4.4%)	42 (61.8%)
	Compelling family consumption	5 (7.4%)	8 (11.8%)	2 (2.9%)	1 (1.5%)	16 (23.5%)
	investing income in other purposes	5 (7.4%)	2 (2.9%)	1 (1.5%)	1 (1.5%)	9 (13.2%)
	Repayment of old debts	1 (1.5%)	0	0	0	1 (1.5%)
	Total	*27 (39.7%)*	*30 (44.1%)*	*6 (8.8%)*	*5 (7.4%)*	*68 (100%)*

Source: Field survey 2022

Table (11) highlights the reasons behind non repayment of the total amount of loan.61.8 percent from the total percentage of respondents have responded that low return from horticulture and agriculture are the reason behind their non-repayment of loan. The 23.5 percent beneficiaries of KCC loan had recorded that compelling family consumption is the reason for not paying the loan amount back and it includes 11.8 percent from BPLs, 7.4 percent from APL, 2.9 percent PHH and only 1.5 percent belongs to AAY category. 13.2 percentage of respondents who spent their loan for purposes other than horticulture and agriculture were also not able to repay the total amount of loan, and 1.5% of the respondents from APL category who used the amount of loan on repayment of old debt were also unable to pay the total amount of loan.

Major Findings of the study

While calculating the socioeconomic status of KCC beneficiaries, it was discovered that the majority of respondents who availed of this scheme were males, with only 1.4 percent belonging to the female category, with the highest percentage of loans disbursed among APL respondents and the lowest among AAY respondents. While analyzing the caste of the respondents it was found that 36.5 percent of unreserved category were belonging to APL. In terms of occupation majority of the respondents were found those who were engaged in horticulture activities, and very low percentage were engaged in other activities. it was found that highest number of beneficiaries were illiterate comprises of 32.4 percent and 27 percent were those who had pursued upper primary and only 9.5 percent of the respondents had pursued graduation. It was found that the highest KCC beneficiaries who availed this loan belongs the 46-55 age. It was found that the 66.2 percent of the respondents came to know about the scheme by the beneficiaries who had already availed the KCC loan and it was found to be the major source of awareness other than friends and relatives, newspapers and agriculture and allied departments. All the respondents have availed the loan from Jammu and Kashmir bank because of the lack of availability of other banks in the region. The reason for availing the KCC scheme found and was responded by the beneficiaries was the low interest rate of the loan as compared to CC, CD or any other loan available in the market. Large amount of the loan taken by the beneficiaries ranges from 22500-1 lakh and majority among them belong to BPL category reason behind the low holdings of land and highest amount of the loan ranges from 2-3 lakh was taken by the APL category because of the large holdings of land. Most of the card holder's 93.2 percent claimed that they have utilized the total amount of loan for horticulture purposes remaining other card holders utilized it on other activities like social ceremonies, business, salting old debt, building of houses and compelling family consumptions. It is noticed that 55.4 percent of the beneficiaries had generated assets after obtaining the loan, they have improved horticulture implements and 5.4 percent of the beneficiaries claimed that they have generated assets in the form of tube wells and traditional implements. Some respondent's 12.1 percent claimed that they had generated livestock in the form of cows and sheep. The beneficiaries 86.8 were those who were renewing their loan continuously on annually basis and only few remaining were those who did not make to renew the loan on continuous basis annually. Major sources for card holders to repay the loan amount was their returns from agriculture/horticulture activities remaining other sources were the income from family members and borrowings from relatives.

Suggestions of the Study

Following suggestions are recommended for the Banking institutions, Administrators, Farmers and regulatory authorities:

- The participation of females in horticulture activities in district Shopian is comparatively less than male. It is very important part of Jammu and Kashmir banks to encourage females of the study area to avail KCC scheme so that it could help the family to invest more on horticulture activities and ultimate will help to increase the annual turnover from these activities.

- Deprived communities like ST category's participation are poor in the utilization of KCC scheme in the village check-e-Mirzapora of tehsil Shopian. More emphasizes should be given to the deprived communities by introducing attractive schemes.
- Most of the beneficiary's 41.9 percent who have responded are illiterates and very less percentage of farmers have studied schooling and graduation and post-graduation. The farmers need to be educated and encourage them about innovative credit delivery system.
- There is a need to conduct some awareness programme by the banker of J&K bank branch Vehil Shopian about the new and modern technology and KCC Scheme, in order to bring more nuclear family towards agricultural/horticultural activities.
- The 17% of farmers has faced problems of availing loans from the banks under the KCC scheme. The banks should make available required credit to the farmers such a way that the farmers should not face any kind of problem during the time of availing the benefits of KCC scheme.

Conclusion

District Shopian, the study region, is renowned for its high-quality apples and horticulture, earning it the nickname "Apple Bowl" of the state. The district's economy now heavily depends on horticulture. Apples make about 82.5% of the horticultural crop area. Shopian is the third largest apple growing district in Jammu & Kashmir, following Baramulla and Kupwara. The production of apples in Shopian went up from 190477 metric tonnes in 2007-08 to 248044 metric tonnes in 2015-16. The study indicated that thedecreased productivity of Apple orchards in recent years has been one of the reasons for not paying the loan amount back particularly in district Shopian. This study examined various agricultural/horticulture credit facilities provided by several banks in the state of Jammu and Kashmir which has been effective for promote the growth of Horticulture sector in district Shopian, ashas this helped the farmers in various ways. They can buy the Horticulture/agriculture equipments and inputs for these activities from this credit. Hence from the research it is cleared that Kisan KCC has been an important instrument in increasing the horticulture production has made a huge impact on the share of Apple production the district Shopian. From the present study it was found that 91.9 percent of the respondents have not repaid the total amount of the loan due to the appearance of certain diseases and pests in epidemic form has badly affected apple production in recent years. The occurrence of pre-mature leaf drops and apple scab disease has been a constant challenge for apple growers over the previous five years. Apple production and meteorological data over the last nine years reveal that unexpected environmental circumstances during flowering and winter chilling requirements play a significant effect in diminishing apple productivity. It can also be concluded from the present study that low return from agriculture, compelling family consumption and repayment of old debts are the reasons why the beneficiaries were not able to repay the principal amount of the KCC scheme. Therefore, the financial institutions need to understand this and extend the amount of loan under the KCC Scheme and credit should on the basis of farming ability and average yield of the farmers. The State governments should take some initiativein order to popularize this scheme. The government should also take some steps in the rural branch expansion policy to allow farmers to easily drive their credit facilities and reduce their transaction costs of using institutional credit.

Policy Implications

- Banks should take steps to speed up the KCC loan approval process by cutting down huge paper works and make it easy for beneficiaries to avail the scheme.
- To attract more beneficiaries, the borrowing limit per account should be increased.
- By Simplifying the bank account opening process, the participation of the people will enhance.
- More resources must be introduced in order to advance the cooperative banking system in rural areas.

- The enhancement of marketing infrastructure will enable timely supply of high-quality inputs like as seed, manure, plant protection products, insecticides, pesticides, and fungicides. This would allow recipients to fully use their KCC loan.

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CAUSAL RELATIONSHIP BETWEEN INDUSTRIAL SECTOR AND ECONOMIC GROWTH OF THE INDIAN ECONOMY

Nisha Singla[♣] and Suman Makka[♣♣]

Abstract

A strong Industrial sector in an economy plays a crucial role in establishing infrastructure, raising production capacity, creating employment opportunities ultimately leading to growth of economy. India with various initiatives since 1991 has made efforts to drift the economy from state-led domestic oriented economy to market friendly capital goods driven industrialized economy. The present study has analyzed the impact of industrial sector on the growth of Indian Economy in the post reform period 1990-91 to 2021-22 using Autoregressive Distributed Lag (ARDL) Bounds Testing Approach. Ever since the Indian economy got independence, the industrial growth has been somehow stagnant due to lack of capital formation, sub-sectoral structural change effect, improper utilization of resources, lack of comprehensive and integrated planning, lack of infrastructural & credit facilities and many more and because of this, the present study did not find any long-run impact of lnIND on lnGVA but a short-run uni-directional causality is found to be running from lnIND to lnGVA as deduced by VAR Granger Causality/Block Exogeneity Wald Tests.

Key Words: Economic Growth, Industrial Sector, Post Reforms, Indian Economy, Value Added

Introduction

The wheels of India's potential economic growth are driven by its globally competitive manufacturing sector. It places India at the 3rd position in the world for attaining most suitable location for global manufacturing under Global Manufacturing Risk Index (MRI) report 2020. Potential of harnessing skills, greater employment prospects, infrastructure development, power growth are components of Industrial sector. The Economic reforms of 1991 have brought a transformational change in Indian industrial sector. From removing import restrictions, bringing in foreign competition, allowing privatization of certain public sector industries, liberalizing the FDI regime and improving infrastructure, India's Industrial sector now accounts nearly 28% of the GDP and employs 14% of the total workforce. Since inception of industries, metal industries have positioned well in India. Being 2nd largest steel producer, 2nd largest cement producer, 2nd largest aluminum producer and 4th largest automobile manufacturer in the world (CIA- World Fact book, 2022) industrial sector contributes to the growth of the economy. India stands out in terms of raw materials availability, industrial expertise, and entrepreneurship. With technology sparking creativity, manufacturing sector is now shifting towards automation and process driven manufacturing to raise the efficiency and enhance production capacity of the manufacturing industry. Prof. Mahalanobis proposed the Mahalanobis Growth Model which focused on devoting major part of investment outlay towards basic heavy industries to achieve a rapid and sustained long-term rate of growth in the economy. Similarly, Prof Hirschman, highlighted "If economy is to keep moving ahead, the task of development policy is to maintain, tension, disproportions and disequilibria." He stressed on creating long term growth through path of investment via SOC to DPA.

Recognizing the importance of Industrial sector in driving economic growth a review of literature conducted after the economic reforms of 1991, which has been presented below.

[♣] Assistant Professor in Economics, Dev Samaj College for Women, Sector 45, Chandigarh.
Email: nishasingla158@gmail.com

[♣♣] Professor of Economics, DES, Multi-Disciplinary Research Centre, Panjab University, Chandigarh.
Email: makkarsuman@pu.ac.in

Review of Literature

Goldar, B. (2004) considered employment growth and manufacturing sector output since the mid-1990s to measure industrial sector impact on economic growth. The results depict negative trend in employment post reforms from 1997-98 to 2001-02annually at around –3.3 percent and low rate of growth in the real GDP at around 0.5 percent. Declining agriculture growth and limited capital utilization represented a low Total Factor Productivity in the manufacturing industries in the post-reform era.

However, according to Kniivilä, M. (2007) the reforms of the early 1990s impacted manufacturing firms based on their location and technological level. Liberalization policy led to innovation, profits and growth of industries which used technology, while it reduced these in other industries due to foreign competition. Similarly, Gupta, P., Hasan, R., & Kumar, U. (2008) considers heterogeneity among industries due to limited availability of infrastructure, external finance and adoption of capital saving techniques. The share of manufacturing sector in GDP has been stagnant since early 1990s despite reforms. Likewise, study of Gupta, P., & Kumar, U. (2010) revealed that growth of industrial sector to be modest in post reforms in comparison to growth of service sector. It identifies various causes of stagnant contribution of industrial sector to GDP such as prevalence of dual economy i.e. formal and informal, small size of manufacturing units and lack of skilled labor-intensive industries. It also considers rigid labor market regulations, infrastructure bottlenecks, financial constraints and difficulty in the acquisition of land responsible for slow manufacturing sector growth.

On the other hand, Bhaumik, S. K., & Kumbhakar, S. C. (2010) considers that the growth in GVA is due to greater usage of the factor inputs. Post reform period in manufacturing sector reflected marginal productivity of labor to be greater that marginal productivity of capital owing to over capitalization of plant and production units during the nineties. Similarly, Sahoo, K., & Sethi, N. (2012) state that Industrial sector has a positive impact on the growth rate of the Indian economy however its impact on economic development presents ambiguous results. Further, the effect of agriculture sector and industrial sector on the economic growth concluded that impact of industrial sector is much higher than agricultural sector on the economic growth during the study period.

Likewise, study of Hussin, F., & Yik, S. Y. (2012) presented role of economic sectors on the economic growth of Chinese and Indian using ARDL approach and concluded that 1% value addition in manufacturing sector of India leads to rise in real GDP per capita by 0.116963%. The contribution of different economic sectors differs in the two nations due to differences in productivity level, state of technology, human capital and policies. However, Sharma, R. K. (2014) considered Industrial sector to grow with fluctuations and inconsistency for the post reform period (1991-92 to 2010-11). With mining, manufacturing and electricity as components of industry it represented a rising trend since 1992-93 and attaining peak in 1995-96. Since then, the industrial growth rate has been fluctuating. The study analyzed lack of investment, infrastructure constraints, rising foreign competition post reforms, limited exports and contraction in consumer demand as factors leading to unsatisfactory industrial performance. While Solanki, S., Inumula, K. M., & Chintnis, A. (2020) showed that 1% change in industrial sector contribution leads to an increase of 3.42% in the economic growth. The liberalization era (1980-2004) presented a steady growth in the structural transformation of the economy from agriculture to industrial sector.

Gaps in Literature

The existing literature considers different factors contributing to growth of economy based on economic performance. Inconclusive and limited research exists specifically focusing on contribution of industrial sector to GDP in the post-reform period and also identifying potential of industrial sector growth.

Objectives of the Study

i) To examine the long-run and short-run relationship between economic growth of Indian economy for the period 1991-2022.

ii) To suggest policy measures for the growth of industrial sector and its contribution to economic growth.

Data Source and Methodology

Time-series data have been extracted from the "Handbook of statistics for Indian economy" by the "Reserve Bank of India" for the period 1991-2022. Base year was shifted from old base year i.e. 2004-05 to the new base year i.e. 2011-12 by using the statistical tool named, splicing and shifting of base year.

The study has used the Bounds testing approach to study the long-term relationship between the two variables. The estimation procedure involves the succeeding steps. Firstly, to test the presence of unit root is checked by using ADF, PP and KPSS tests. Based on the results, in the next step, ARDL Bound testing approach has been used to analyse the long-term relationship between the variables and in the last step, Granger's causality test in a multivariate VAR framework has been applied to deduce short-run relationship and direction of causality by using E Views software.

Model Specification and Econometric Analysis

Economic growth is expressed as Gross Value Added at Basic Prices (GVA) and the Industrial Sector (IND) combines many discrete sub-sectors such as mining & quarrying, manufacturing and industries of electricity, gas, water supply & other Utility Services. The regression model of the study is as follows:

$GVA = f(IND)$ (1)

Transforming the equation (1) into linear equation i.e.

$GVA_t = \alpha_o + \alpha_1 IND_t + \varepsilon_{1t}$ (2)

Where, α_o, β_o are constants, α_1 is a coefficient of GVA and ε_{1t} is the error term of the model in the equations. Both the variables are converted to their natural logarithms. The description of the model is presented in the equation 3 stated below:

$lnGVA_t = \alpha_o + \alpha_1 lnIND_t + \varepsilon_{1t}$ (3)

The present study has used ADF and PP to check the presence of unit root. The null hypotheses depict that lnGVA and lnIND have unit root thus, the series is non-stationary. The results are exhibited in Tables 1 and 1.1:

It shows that lnGVA is stationary at I(1) by using both ADF and PP criterions as shown in the table 1. Whereas, lnIND is stationary at I(0) by using the same criterions as depicted in the table 1.1 thus the results qualify for the usage of ARDL model. In the next step, long term effect of industrial sector on the growth of Indian economy will be examined by using Bounds test. Following are the ARDL equations:

$$\Delta lnGVA_t = \alpha_0 + \sum_{j=1}^{n} b_j \Delta ln(GVA)_{t-1} + \sum_{j=0}^{n} c_j \Delta ln(IND)_{t-j} + \delta_1 lnGVA_{t-1} + \delta_2 lnIND_{t-1} + \varepsilon_{1t}$$

Where δ_1 and δ_2 are the long-term multipliers, whereas, b_j and c_j are the short run coefficients of the ARDL model. Null hypothesis of non-existence of cointegration (H_{01}: $\delta 1 = \delta 2 = 0$) is tested against the alternative hypothesis of the presence of cointegration ((H_{11}: $\delta 1 \neq \delta 2 \neq 0$). Table 2 displays the final outcomes of the Bounds testing approach.

As per the guideline, if the value of F-statistics is below I (0) bound, null hypothesis cannot be rejected and if it is greater than the I(1) bound then the alternate hypothesis of the existence of long-run relationship will be accepted and if the value falls between the two bounds, then the result will be is inconclusive. In our results, since the value is lower than I(0) Bound in both this case i.e. 1.244442 < 4.04 thus, our study advocates the non-existence of long-term impact of the industrial sector on the economic growth of the Indian economy. Lastly, short term causality will be analysed by using Granger Causality test.

Short-run Analysis

Following is the short-run equation of the model:

$$\ln GVA_t = \alpha_0 + \sum_{i=1}^{n} \alpha_t \ln SS_{t-i} + \sum_{j=1}^{m} \delta_j \ln GVA_{t-j} + e_{1t}$$

As per the econometric guidelines, null hypothesis of no short-term causality is rejected, if the value of p-statistic is less than 5% level of significance. Before applying the model, lag-length of the model has been checked and the results are presented in the table 3 which clearly concludes that 1-1 is the optimum lag-length for the existing model as majority of the criterions are in this favor.

In the next step, Granger Causality has been used to find the short-term causal relationship between the variables. Table 4 clearly shows that a uni-directional causality is running from the industrial sector to the economic growth at 10% level of significance thus, we can say that the industrial sector GVA but not the other way round.

Residual Testing

In the last step, residual testing of the model has been done and the results are presented in table 5 and 6. Since the p-value in both the cases is above 5% level of significance thus, it is concluded that the model is fitted well and there is no problem of serial correlation and heteroskedasticity.

Conclusion and Policy implications

The present study did not find any long-run influence of industrial sector on the economic growth of Indian economy by using ARDL Bounds testing approach but a short-run uni-directional causality is found to be running from lnIND to lnGVA as deduced by VAR Granger Causality/Block Exogeneity Wald Tests.

Ever since the Indian economy got independence, the industrial sector has been somehow stagnant due to lack of capital formation, sub-sectoral structural change effect, improper utilization of resources, lack of comprehensive and integrated planning, lack of infrastructural & credit facilities and many more. The situation worsened after the major economic reforms of 1990s as the industrial goods were available to the general public at a cheaper rate which gave the tough competition to the infant industries of the economy. Since, improvement in working of the industrial sector involves addressing various aspects such as efficiency, sustainability, innovation, workforce development and overall development of the economy. Therefore, it is imperative for the government and industrial sector to take up stringent actions in this direction to overcome all the obstacles by forming appropriate policies for the faster growth of the industrial sector in the long-run. Thus, it is suggested that Indian Economy must:

- The Indian economy needs to adopt Industry 5.0 technologies such as the Internet of Things (IOT), Artificial Intelligence (AI), Robotic Technology, Simulation models and machine learning to boost efficiency and production.
- In order to meet the scarcity of energy intensity and ensure its continual expansion, the industrial sector must invest in eco-friendly sources of renewable energy and reduce its reliance on non-renewable resources.
- As per the changing needs of the economy, the industrial sector should impart training to its employees from time to time in order to keep them up to date on the latest technology and build a culture of learning and innovation.
- The technology should be such that it must reduce the lead times, simplify the supply chain and improve overall efficiency in order to enhance the visibility and coordination.

- Industrial groups and forums should be developed for the collaboration among the industrial businesses, research institutions, and government organisations in order to share information and resources.
- Strong quality control methods should be implemented to ensure that products meet industrial criteria through regular auditing and improving quality assurance processes.
- The industrial sector needs to look for government policies that are supportive of investment, innovation, and environmentally friendly practises.
  Additionally, they ought to collaborate with lawmakers to create a regulatory environment t hat promotes corporate growth.
- To diversify and adjust to changing market demands, the industrial sector should search for new markets and product lines in order to react to changes in customer tastes.
- There must be protocols for safety controls for creating conducive work environments and offering mental health support services. The employers must conduct meetings with their employees to get their opinions and suggestions for the overall improvement in the work culture.

By addressing these issues, the industrial sector can improve its overall performance, support economic growth, and more effectively adjust to the demands of the contemporary corporate environment.

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Tables and Figures:

Table 1: Unit Root Table: ADF and PP (Schwarz Info Criterion); lnGVA as Dependent Variable		
Tests	**ADF**	**PP**
Level (Intercept)	-0.300657 (0.9138)	-0.300537 (0.9138)
Level **(Trend and Intercept)**	-1.308216 (0.8657)	2.159089 (0.4945)
1st Difference (Level)	-2.033619 (0.2716)	-6.115333 (0.0000)***
1st Difference (Level and Intercept)	-5.097857 (0.04781)**	-
Note: 1. The results have been computed by using ADF test using EViews software 9. 2. *, ** and *** represents significance at 10, 5 and 1 percent levels of significance respectively. **Source:** Computed		

Table 1.1: Unit Root Table: ADF and PP (Schwarz Info Criterion); lnIND as Dependent Variable		
Tests	**ADF**	**PP**
Level (Intercept)	0.570707 (0.9865)	0.463337 (0.9825)
Level **(Trend and Intercept)**	-3.680816 (0.0390)**	-3.636748 (0.0428)**
Note: 1. The results have been computed by using ADF test using EViews software 9. 2. *, ** and *** represents significance at 10, 5 and 1 percent levels of significance respectively. **Source:** Computed		

Table 2: F- Bounds test, When lnGVA is a Dependent Variable		
Significance	I(0) Bound	I(1) Bound
10%	4.04	4.78
5%	4.94	5.73
2.5%	5.77	6.68
1%	6.84	7.84
F-Statistic 1.244442		
Source: Computed		

Table3: Lag-length structure						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	19.72971	NA	0.001051	-1.181981	-1.088567	-1.152097
1	122.1181	184.2992*	1.49e-06	-7.741209	-7.460969*	-7.651558*
2	126.4175	7.165685	1.47e-06*	-7.761170*	-7.294104	-7.611751
Source: Computed						

Table 4: VAR Granger Causality/Block Exogeneity Wald Tests			
Dependent variable: lnGVA			
Excluded	Chi-sq	df	Prob.
D(LNIND)	2.890896	1	0.0891
All	2.890896	1	0.0891
Dependent variable: D(LNIND)			
LNGVA	0.199293	1	0.6553
All	0.199293	1	0.6553
Source: Computed			

Table 5: VAR Residual Serial Correlation LM Tests		
Lags	LM-Stat	Prob
1	4.602359	0.3306
Source: Computed		

Table 6: VAR Residual Heteroskedasticity Tests		
Chi-sq	df	Prob.
13.36180	12	0.3433
Source: Computed		

Agricultural Trade between India and Pakistan via Wagah Border

Davinder Kumar Madaan♣ and Richa Sharma♣♣

Abstract:

India and Pakistan were highly dependent on each other for agricultural products at the time of partition in 1947. However, they minimized their trade dependence on each other due to Kashmir dispute. There was an embargo on mutual trade between India and Pakistan during 1965-74 after their war in 1965. The operationalization of SAFTA in 2006 boosted the intra-trade ties between the two countries. The share of agricultural trade in total trade between India and Pakistan was 35 per cent during 2007-24. Wagah border is located at 29 km from Amritsar district of Indian Punjab and 25 km from Lahore in Pakistani Punjab. India-Pakistan trade via Wagah border started with truck movement w.e.f. 1st October 2007. Though Pakistan switched over from the Positive List of 1963 items to Negative List of 1209 items in 2012 for import trade with India, yet on Wagah border trade it imposed a positive list of 138 items. The share of Wagah border trade was one-fifth of the total trade during 2007-20. Pulwama terror attack on 14 February 2019 and withdrawal of special status to the Jammu and Kashmir State on 9 August 2019 caused stoppage of Wagah border trade between the two countries. However, there are vast trade potentials through this route due to their geographical proximity. The route has thrived business and brought unity between the people of two Punjabs. Therefore, there is a need to re-open Wagah border trade for economic boost. At least, need based trade in agricultural items should be started via Wagah border immediately.

Introduction

International trade and economic growth are deeply interconnected and form a self-reinforcing cycle that powers the global economy. Hence trade acts as an incentive for growth by integrating nations into global value chains, allowing them to specialize in specific stages of production and boost efficiency. By connecting local producers to international markets, trade unlocks larger consumer bases, enabling businesses to scale and expand. Agricultural trade is generally not based on comparative advantage but on climatic factors triggering production fluctuations in the destination country. India's agricultural exports to Pakistan have been diversified over the period of time. During 2023-24, the Indian agriculture and allied sector accounted 18.2 per cent in the country's GDP at current prices and provided livelihood support to about 42.3 per cent of the population (Govt of India, 2024). Pakistan has also diversified economic base with the agriculture sector, contributing 24 per cent in GDP and 37.4 per cent in employment during the same period (Govt of Pakistan, 2024). Hence agriculture sector plays a major role in both the countries. The partition of Indian sub-continent into India and Pakistan on 14 August 1947 changed the intra-regional trade into international trade. Both the countries were highly dependent on each other for agricultural products at the time of partition. However, they minimized their trade dependence on each other due to Kashmir dispute* which led to four wars of 1947-48, 1965, 1971 and 1999 between them. With the implementation of the South Asia Free Trade Agreement (SAFTA) in 2006, agricultural exports from India to Pakistan continued higher than those from Pakistan to India. However, agricultural imports from Pakistan were small and did not fluctuate as much as exports to Pakistan (Chand & Saxena, 2014).

♣ Professor, Dept of Economics, Punjabi University, Patiala

♣♣ Research Scholar, Dept of Economics, Punjabi University, Patiala

Objectives & Methodology:

The paper is an attempt to deliberate on historical trade cooperation between India and Pakistan, particularly through Wagah border, and analyse bilateral agricultural trade between them in terms of volume and composition. It also suggests for their advancement in trade relations. This paper is based on secondary data sourced from Export Import Data Bank of the Ministry of Commerce, and Attari Land Port under the Land Ports Authority of India, Department of Border Management, Ministry of Home Affairs.Government of India. The period of study has been taken from 2007 onwards with the start of Wagah border trade between India and Pakistan.

Historical Trade Cooperation between India and Pakistan:

At the time of partition, India's share in Pakistan's global imports and exports was 50.6 per cent and 23.6 per cent, respectively (Ghuman & Madaan, 2006). During 1947-66, bilateral trade relations were largely governed by around 12 trade/payment agreement between India and Pakistan. However, bilateral trade faced a diminishing trend. There was an embargo on mutual trade between India and Pakistan during 1965-74after their 40 days war during August-September 1965. The signing of bilateral trade agreement on 23 January 1975 led to the resumption of trade between India and Pakistan at government levels. In July 1982, Pakistan declared a list of 40 items, which can be importable from India. This list gradually expanded to 1963 items as on 28th Dec 2011. Though India has accorded Most Favoured Nation (MFN**) status to Pakistan in 1996, yet Pakistan could not reciprocate this gesture. India stopped trade via land and air routes during 2001-04, following the attack on Indian Parliament in December 2001. As a result, both the countries were forced to import many items from the world market at much higher prices. The operationalization of SAFTA in 2006 boosted the intra-trade ties between the two countries. India and Pakistan have preserved 614 and 936 sensitive items, respectively, for each other w.e.f. 1stJan 2012. As a result, India' share in Pakistan's global imports increased from 2.7 per cent in 2005-06 to 4.3 per cent in 2013-14 (Gill & Madaan, 2015). On 20 March 2012, Pakistan switched over from this Positive List of 1963 items to Negative List of 1209 items that cannot be imported from India. Thus, more than 7500 items became importable from India. This was the very historic decision of Pakistan (Madaan, 2018). In fact, sea route is the dominant mode of transport for trade between India and Pakistan. In 2016-17, thesea route accounted for 69 percent of total bilateral trade (Taneja et al 2018).

The unfortunate killing of 40 Central Reserve Police Force personnel on 14 February 2019by asuicide bomberat Pulwama on the Jammu-Srinagar National Highwayled to India's withdrawal of theMFN status accorded to Pakistan, andthe imposition of 200 per cent customs duty on all goods imported by India from Pakistan w.e.f. 16 February 2019 (Ghuman & Singh 2021). The Pulwama attack was claimed by the Pakistan-based Jaish-e-Mohammed (JeM) jihadist group. On 26 February 2019, the Indian Air Force retaliated bycarrying out an airstrike on a Jaish-e-Mohammed training camp in the Balakot region at Khyber Pakhtunkhwa province of Pakistan. Trade between the two countries further constrained w.e.f. 9 August 2019, when Indian Parliament revoked special status of the Jammu and Kashmir State, and passed the Jammu and Kashmir Reorganisation Act, 2019 by indirectly amending Article 370 and 35 (A) of the Indian Constitution. The Act reconstituted Jammu and Kashmir State into two Union Territories, called Jammu and Kashmir, and Ladakh. As a result, Pakistan suspended trade with India. However, marginal bilateral trade has continued been in practice.

Volume of Total Bilateral Trade:

Table I shows the volume of India's trade with Pakistan at current prices during 2007-24. India's exports to Pakistan fluctuated between US$ 327 mn in 2020-21 to US$ 2274mn in 2013-14. On the other hand, India's imports from Pakistan ranged between US$ 2mn in 2020-21 to US$ 542mn in 2012-13. The maximum total

trade turnover between India and Pakistan was US$ 2701 mn during 2013-14. During the entire period of 2007-24, India's exports to Pakistan were more than her imports, and hence balance of trade was favourable to India. It may be noted from this table that during post SAFTA period, bilateral trade increased continuously from US$ 2239 mn in 2007-08 to US$ 2561 mnduring 2018-19. With the Pulwama terror attack in Feb 2019, it dwindled drastically. However, it increased to US$ 1192mn in 2023-24.

Volume of Agricultural Trade:

Table 2 shows the volume of India's agricultural trade with Pakistan at current prices during 2007-24. India's agricultural exports to Pakistan fluctuated between US$ 18mn in 2023-24 to US$ 1390mn in 2015-16. On the other hand, India's agricultural imports from Pakistan ranged between US$ 0.7mn in 2022-23 to US$ 229mn in 2013-14. The maximum total agricultural trade turnover between India and Pakistan was US$ 1390mn during 2015-16. During the entire period of 2007-24, India's agricultural exports to Pakistan were more than her imports, and hence balance of trade was favourable to India. It may be noted from this table that bilateral trade increased continuously from 2007-08 to 2015-16, and thereafter it dwindled to US$ 18 mn in 2023-24 due to Pulwama terror attack in Feb 2019. It is very interesting to note from this table that the share of agricultural trade in total bilateral trade was 35.1 per cent, and ranged between 1.5 per cent and 53.2 per cent during 2007-24.

Wagah Border Trade Cooperation between India and Pakistan:

The partition of India and Pakistanin 1947 established two Punjabs, as the Punjab Province of British India was divided on a religion basis. Thus, East Punjab with an area of 29.8 per cent of the whole Punjab Province became part of India. Similarly, West Punjab with an area of 70.2 per cent of the whole Punjab Province became part of Pakistan. Both Punjabs are basically agricultural economies. They share land common border of 554 km. Wagah border is located at 29 km from Amritsar district of Indian Punjab and 25 km from Lahore in Pakistani Punjab. Wagah border trade was operational during 1948-65. Wagah trade point between the two countries re-started w.e.f. July 2005. So-far, bilateral trade was through Mumbai-Karachi ports, which forced the Indian traders to transport goods from Delhi to Mumbai Port and then to Karachi (2274 Kms). Bilateral trade between the two countries via Wagah border started with truck movement w.e.f. 1stOctober 2007. The integrated check post (ICP) at Wagah-Attari was inaugurated on 13 April 2012 with provisions to extend facilities for fast and cost-effective land route trade. The ICP introduced efficiency to the movement of goods between the two countries.Though Pakistan switched over from this Positive List to Negative List in 2012, making more than 7500 items became importable from India, yet on Wagah border trade it imposed a positive list of 137 items w.e.f. 8 March 2013 and increased it to 138 items w.e.f. 28 January 2014.Pulwama terror attack on 14 February 2019 and withdrawalof special status to the Jammu and Kashmir State on 9 August 2019 resulted into stoppage of Wagah border trade between India and Pakistan.As such, trade between India and Pakistan via Wagah border has not been taking place since 2019. Nevertheless, imports from Afghanistan still continue through this border.***

Volume of Wagah Border Trade between India and Pakistan:

Table 2 shows the volume of India's trade with Pakistan via Wagah border. Wagah border trade between the two countries started from 1st October 2007. After the passing of Jammu & Kashmir Reorganization Act on 9 August 2019, Pakistan suspended the trade with India from Wagah border. Therefore, this table shows volume of trade via Wagah border for the period 2007-08 to 2019-20. India's exports to Pakistan via Wagah border varied between US$ 31mn in 2019-20 to US$ 561mn in 2012-13. On the other hand, India's imports from Pakistan via Wagah border ranged between US$ 83mn in 2009-10 to US$ 387mn in 2014-15. The maximum

total trade turnover occurred during 2013-14, when trade between India and Pakistan reached US$ 899mn.During 2008-14, India'sexports to Pakistan were more than her imports, and hence balance of trade was favourable to India. However, it was unfavourable during 2007-08 and 2014-20. It may be noted from this table that bilateral trade increased continuously from 2007-08 to 2013-14, and thereafter it diminished to US$ 149mn in 2019-20 due to deterioration of political relations between India and Pakistan. It is very exciting to note from this table that the share of Wagah border trade in total bilateral trade was 20.3 per cent, and ranged between 5.8 per cent and 33.9 per cent during 2007-20. Hence more than one-fifth of the total bilateral trade was from Wagah border. It means this route was very much significant for both the countries due to their geographical proximity. It may also be noted from this table that number of truck movement for India's exports to Pakistan was at peak (46039) during 2013-14 and thereafter it diminished to 837 during 2019-20. Similarly, the number of truck movement for India's imports from Pakistan was at highest (460653) during 2014-15 and thereafter it reduced to 5818 during 2019-20.

Composition of Bilateral Trade via Wagah Border:

India's agricultural exports to Pakistan via Wagah border were potatoes, tomatoes, onions, cotton, meat, ginger, garlic, peas, garlic, carrots, radishes, beans, cucumber, soyabean, green chillies, soyabeans, fruits, etc. Other items included were newsprint, polypropylene, carbon dioxide in liquid form, etc. Table 4 shows that India's major export items to Pakistan via Wagah border during 2013-20. Vegetables, cotton and soyabean were the three major items, exported by India to Pakistan via Wagah border. However, there was declining trend in the exports of these items. Total exports also declined from US$ 560 mn in 2013-14 to US$ 31 mn in 2019-20. After 2019-20, bilateral trade has been completely stopped from Wagah border.

Similarly, Indian agricultural imports from Pakistan via Wagah border were dry fruits, dry dates, dry dates, sesamum seeds, sugar, etc. However, other items imported were cement, chemicals, gypsum, float glass, soda ash, marble stone salt, sand, aluminium, etc. Table 5 shows India's major import items via the Wagah border from Pakistan during 2013-20. The total import value diminished from US$ 387 million in 2014-15 to US$ 117 million in 2019-20. Dry fruits followed by dry dates remained the largest category. Sugar was imported by India in 2013-14 and 2018-19. Gypsum was the regular items from 2013-14 to 2018-19. However, its imports fell from US$ 21 in 2014-15 to US$ 11 in 2018-19. There was an increasing trend in the import of soda ash from 2015-16 to 2018-19. Overall, India imported so many items from Pakistan via Wagah border.

There are 47 agricultural items in Pakistan's sensitive list for India and 246 items in India's sensitive list for Pakistan, which have no tariff reduction. Both the countries have a comparative advantage by complementing each other for agriculture sector. There are vast potentials of many diversified items for increasing bilateral trade via Wagah border. In fact, Pakistan had a Positive List that allowed only 138 items for import via Wagah border. These items include livestock, meat, vegetables, raw jute, cotton yarn, pineapple, black pepper, raw cane & beet sugar, oil cake, cement & clinker, pure terephthalic acid, polyethylene, polypropylene, newsprint, paddy harvesters, etc. Pakistan's cotton import from India is very important for the textile millers located in Northern Pakistan in view of the compatibility and the lesser cost of transportation. The items like newsprint, paddy harvesters, dryers, fruits & vegetable, cotton, etc., could benefit Indian Punjab.

Concluding Remarks:

There are huge trade potentials between India and Pakistan via Wagah border land route. Geographical proximity of the two countries can save a lot in terms of transportation costs. Unfortunately, bilateral trade from this route has been completely stopped since August 2019. In fact, trade relations between India and Pakistan have always been governed by political interests rather than by economic interests. As a result, both countries have suffered massive economic losses over the period of time. Further, informal trade routed

through third countries like Afghanistan, Dubai, Hong Kong, Singapore, Colombo and Gulf States; costs both India and Pakistan dearly in terms of foreign exchange outflows as well as third party trading commissions. In fact, Wagah border trade has thrived business and brought unity between the people of two Punjabs. Therefore, there is a need to re-open Wagah border trade with Pakistan, which can boost Amritsar and Lahore district economies of the two countries, and can generate more employment opportunities. Moreover, two Punjab economies are highly dependent of agriculture, and can gain well from higher levels of agricultural trade cooperation. So, India and Pakistan should sit together to start at least need based trade in agricultural items via Wagah border. Trade in perishable agricultural goods should also be explored for mutual economic gains. In this way, the people of both the countries will gain. Sustainable agricultural development and sharing of research on water, land, agricultural machines, and other best practices can make them more efficient. Meanwhile, Pakistan's positive list of 138 importable items specifically for Wagah land border should be replaced with negative list implemented for sea and air routes trade with India. This could open a gateway of opportunity for Punjab and other northern states of India. Strengthening mutual trade relations could act as aninfluential tool for tumbling political tensions and nurturing trust between India and Pakistan. Thus, the resumption of normal trade relations between two countries could bring peace and deliver them long terms gains.

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Endnotes:

***** The Kashmir dispute is a land dispute between India and Pakistan over the Kashmir region. According to 'Indian Independence Act 1947', 562 Indian princely states were left to choose whether to join India or Pakistan or to remain independent. The then ruler of Jammu and Kashmir, Maharaja Hari Singh signed the 'Instrument of Accession' to India under the 'Indian Independence Act 1947' on 25 October 1947 and executed on 27 October 1947. India claims the entire erstwhile princely state of Jammu and Kashmir based on an 'Instrument of Accession' executed in 1947. However, it administers approximately 43% of the total region (236,226 Sq.Km.) including most of Jammu, the Kashmir Valley, Ladakh, and the Siachen Glacier. Pakistan claims all areas of the erstwhile state except for those claimed by China, and controls approximately 36.5% of Kashmir, namely Azad Kashmir and the northern areas of Gilgit and Baltistan. China claims 20.5% of Kashmir, namely, the Shaksgam Valley and Aksai Chin (since 1962 of Sino-India war). The Shaksgam Valley or Trans-Karakoram Tract is 5800 Sq. Km area, which Pakistan gave to China on 3rd March 1963.

****** Article 1 of General Agreement on Tariffs and Trade (GATT), 1994, requires every World Trade Organization (WTO) member country to accord MFN status (or preferential trade terms with respect to tariffs and trade barriers) to all other member countries. Accordingly, India accorded MFN status to all WTO member countries, including Pakistan, from the date of entry into force of the so-called Marrakesh Agreement, establishing the WTO.

******* Afghan-Pak Transit Trade Agreement (APTTA) has been established w.e.f. 18 July 2010. Under this agreement, Afghanistan has been permitted to carry their transit export cargo to Wagah border for destinations in India. However, Indian goods for Afghanistan were not allowed to transit through this border.

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Table 1: India's Trade with Pakistan during 2007-24

(Value in US$ million)

Year (Apr-Mar)	Exports	Imports	Balance of Trade	Total Trade Turnover
2007-08	1951	288	1663	2239
2008-09	1440	370	1070	1810
2009-10	1573	276	1297	1849
2010-11	2040	333	1707	2372
2011-12	1542	398	1144	1939
2012-13	2065	542	1523	2607
2013-14	2274	427	1847	2701
2014-15	1857	497	1360	2354
2015-16	2171	441	1730	2612
2016-17	1822	454	1367	2276
2017-18	1924	489	1436	2413
2018-19	2067	495	1572	2561
2019-20	817	14	803	831
2020-21	327	2	324	329
2021-22	514	3	511	516
2022-23	627	20	607	647
2023-24	1189	3	1186	1192

Source: Govt. of India, Export Import Data Bank of India, Ministry of Commerce

Table 2: India's Agricultural Trade with Pakistan during 2007-24

(Value in US$ million)

Year (Apr-Mar)	Agri Exports	Agri Imports	Balance of Trade	Total Agri Trade Turnover	Share of Agri Trade in Total Trade (%)
2007-08	738	126	612	865	38.6
2008-09	372	107	264	479	26.5
2009-10	454	118	336	572	30.9
2010-11	1095	126	969	1221	51.5
2011-12	554	171	384	725	37.4
2012-13	886	197	689	1083	41.5
2013-14	953	229	724	1182	43.8
2014-15	674	221	454	895	38.0
2015-16	1229	161	1068	1390	53.2
2016-17	817	191	626	1007	44.3
2017-18	429	128	300	557	23.1
2018-19	495	130	365	624	24.4
2019-20	103	2.1	101	105	12.7
2020-21	67	1.2	66	69	20.9
2021-22	144	1.4	142	145	28.1
2022-23	45	0.7	44	45	7.0
2023-24	17	0.9	16	18	1.5
Average	**534**	**112**	**421**	**646**	**35.1**

Source: Govt. of India, Export Import Data Bank of India, Ministry of Commerce

Table 3: India's Trade with Pakistan via Wagah Border during 2007-2020

(Value in US$ million)

Year (Apr-Mar)	Exports		Imports		Balance of Trade	Total Trade Turnover	Share of Trade via Wagah in Total Trade (%)
	No. of Trucks	Value	No. of Trucks	Value			
2007-08	n.a.	43	n.a.	86	-43	129	5.8
2008-09	n.a.	96	n.a.	93	3	189	10.4
2009-10	17000	168	1563	83	85	251	13.6
2010-11	32000	257	3598	99	158	356	15.0
2011-12	38917	287	19087	201	86	488	25.2
2012-13	41248	561	34366	322	239	883	33.9
2013-14	46039	560	39365	339	221	899	33.3
2014-15	33067	346	46653	387	-41	733	31.1
2015-16	14580	203	39823	369	-166	572	21.9
2016-17	14224	159	46085	257	-98	415	18.2
2017-18	3303	115	44890	267	-152	383	15.9
2018-19	2767	105	46335	248	-142	353	13.8
2019-20	837	31	5818	117	-86	149	17.9
Average	**18768**	**226**	**25199**	**221**	**5**	**446**	**20.3**

Source: Govt. of India, ICP Customs, Amritsar, Ministry of Commerce

Table 4: India's Major Export Items to Pakistan via Wagah Border

(Value in US$ million)

S.No	Name of the Commodity	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
1	Vegetables	129	128	42	54	0	94	26
2	Cotton	137	41	138	81	103	12	5
3	High Density Poly Ethylene (HDPE)	0	0	0	18	10	0	0
4	Soyabean De Oiled Cake	265	141	10	1	0	0	0
5	Meat	0	0	0	0	0	0	0
6	Others	30	36	13	4	2	0	0
	Total	**560**	**346**	**203**	**159**	**115**	**105**	**31**

Source: Govt. of India, ICP Customs, Amritsar, Ministry of Commerce

Table 5: India's Major Imports from Pakistan via Wagah Border

(Value in US $ million)

S. No.	Name of Commodity	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
1	Dry Fruits	264	307	196	54	64	0	50
2	Dry Dates	0	0	74	113	97	97	0
4	Sugar	13	0	0	0	0	47	0
5	Gypsum	16	21	18	17	18	11	0
6	Glass	0	0	5	7	5	2	0
7	Soda Ash	0	0	11	11	10	19	0
8	Chemicals	10	13	1	0	0	16	0
9	Lime Stone, Salt & Aluminium Or	0	0	16	18	22	4	0
10	Others	36	45	48	37	51	52	67
	Total	**339**	**387**	**369**	**257**	**267**	**248**	**117**

Source: Govt. of India, ICP Customs, Amritsar, Ministry of Commerce

Assessing Challenges and Strategies for Sustainable Solid Waste Management Infrastructure in Uttarakhand

Radha Tripathy[♣], Kapil Lakhera[♣♣], Devna Jindal Sharma[♣♣♣] and Rachna Dixit[♣♣♣♣]

ABSTRACT

The growing global challenge of Municipal Solid Waste (MSW) disposal creates urgent necessity to take a closer look at infrastructural developments. Despite India's progress in various aspects, Solid Waste Management (SWM) systems lack significant infrastructure enhancement. This study investigates into the comprehensive assessment of the Solid Waste Management process in Uttarkashi town by evaluating current infrastructure and various challenges met while practicing sustainable solid waste management in the area. The absence of robust SWM has led to untreated garbage accumulation in the Tambakhani Tunnel, contaminating the Bhagirathi River and endangering local health. The study stresses the need for infrastructural improvements, including proper waste disposal, increased public and government support, and awareness. Expanded infrastructural support, such as vehicles, technical equipment, human resources, and composting facilities, is crucial for efficient Solid Waste Management. The study advocates substantial infrastructural development for an effective SWM system in Uttarkashi, ensuring environmental protection, public health and local economic growth.

Keywords: MSW, SWM, infrastructural development, efficient, contamination, effective, substantial

INTRODUCTION

The global challenge of municipal solid waste management requires a focused examination of infrastructure development as a pivotal element in addressing the issue. In 2020, the world generated a staggering 2.24 billion tonnes of solid waste, averaging 0.79 kg per person daily. A concerning World Bank Report from 2020 predicts a substantial 73% increase, estimating annual trash volume to reach 3.88 billion tonnes by 2050. This surge is primarily attributed to rapid global population growth and ongoing urbanization trends (Bundela et al., 2010). India's rapid urbanization and economic growth have propelled it into the ranks of the world's top 10 municipal solid waste (MSW) producers, generating 62 million tons annually. However, only 43 million tons are collected and a mere 12 million tons undergo treatment, leaving a significant 31 million tons untreated and disposed of unsustainably. The country also grapples with substantial amounts of hazardous waste (7.9 million tons), plastic waste (5.6 million tons), e-waste (1.5 million tons) and biomedical waste (0.17 million tons). Looking ahead, the Indian Central Pollution Control Board (CPCB) anticipates an increase in annual waste generation to 165 million tons by 2030, emphasizing the urgent need for comprehensive waste management strategies (International Trade Administration). According to the CPCBs 2018 report, Uttarakhand is among the country's weakest performers in solid waste management, facing substantial challenges. The state lacks a functional solid waste management plant and a sanitary landfill, leading to the non-processing of the daily 1,406 tons of solid waste. Additionally, only 29 out of 912 wards achieve 100% waste segregation at the source,

[♣] Research Scholar, Affiliated to HNB Garhwal University (A Central University) Srinagar – Garhwal, Uttarakhand, Email: radhatripathy1998@gmail.com

[♣♣] Assistant professor, Department of Humanities and Liberal Arts, DIT University, Dehradun.

[♣♣♣] Professor, Department of Economics, D.A.V (P.G.) College, Dehradun.

[♣♣♣♣] Professor, Department of Economics, D.A.V (P.G.) College, Dehradun.

and 21% of wards (715) lack a comprehensive house-to-house solid waste collection system (CPCB, 2018). In 2017, the Uttarakhand Environment Protection and Pollution Control Board (UEPPCB) documented that Uttarkashi town, with a population of 17,475 (2011 Census), generates a daily waste volume ranging from 7 to 9 tons. Municipal waste was indiscriminately dumped in Tekhla, a local waterway. However, this practice was halted in October 2018 through the intervention of the High Court. Subsequently, the Uttarkashi Nagar Palika Parishad (NPP) resorted to waste disposal at Ramlila Maidan, which also faced legal scrutiny. At present, due to the absence of a well-structured SWM system, untreated garbage accumulates in Uttarkashi town and waste is openly discarded in the Tambakhani Tunnel, the town's entry point. This unregulated waste disposal frequently leads to contamination of the Bhagirathi River, presenting substantial health concerns for the local population (Joshi & Joshi, 2020).

2. REVIEW OF LITERATURE

Solid waste, defined as the unwanted by-products of human activities generated through production, consumption and distribution, has emerged as a critical environmental concern, particularly in developing countries like India (Mor et al., 2021). Effective SWM is essential as it impacts environmental health, social well-being and economic development. While waste can have positive effects, such as recycling and reuse of biodegradable products into compost, and the negative consequences, including the rising volumes of medical waste and e-waste, pose significant challenges to sustainability (Trang et al., 2017). Factors contributing to waste generation, such as urbanization, lifestyle changes and economic growth, have led to a substantial increase in per capita municipal waste generation (Sharholy et al., 2007). Addressing these challenges requires a clear understanding of waste sources, as it forms the foundation for effective guidelines and policy frameworks (Amasuomo & Baird, 2016).

Municipalities, especially in developing countries, face significant obstacles in managing urban waste, including financial constraints, inadequate infrastructure and limited technical expertise to implement sanitary landfills (Burntley, 2007). The lack of reliable data on waste generation, collection, transportation and disposal further hampers decision-making processes (Balasubramanian, 2020). Comprehensive data availability is essential for enabling policymakers to develop sustainable frameworks, introduce appropriate fees or taxes and provide subsidies to enhance SWM efficiency (Nahman, 2011). Studies also highlight socio-economic factors influencing waste production. Higher-income households produce less organic waste but generate more paper and plastic waste, while larger households produce higher amounts of solid waste daily, necessitating tailored management strategies (Trang et al., 2017).

SWM involves activities such as disposal, recovery, recycling, reuse and prevention, which are vital to mitigating the adverse health, environmental and economic consequences of improper waste handling (Chadar & Chadar, 2017). Strategies like composting, incineration, recycling, pyrolysis and Waste-to-Energy offer practical solutions for managing MSW while generating energy (Ouda & Raza, 2014). However, to effectively address the challenges of waste pollution and ensure sustainable urban waste management, proper planning and the development of treatment and disposal facilities are essential (Vij, 2012). Furthermore, inadequate financial, technical and human resources in municipalities remain a significant barrier to implementing sustainable systems (Buenrostro et al., 2003).

The growing challenges of solid waste generation, necessitate integrated approaches that combine effective planning, resource allocation and community participation, especially in the hilly regions of Uttarakhand. By prioritizing preventive strategies, addressing systemic inefficiencies and leveraging innovative solutions,

municipalities can work toward building resilient and sustainable waste management frameworks that align with environmental and socio-economic goals.

3. OBJECTIVES

The primary objective of this study is to evaluate the existing SWM infrastructure in Uttarkashi town with a focus on assessing its adequacy, efficiency and sustainability. The research aims to identify the key challenges faced by household sectors in managing waste effectively within the current infrastructure framework. The study further investigates the underlying causes contributing to these challenges andsuggests preventive measures to enhance the sustainability of the SWM system.

4. RESEARCH METHODOLOGY

The study focuses on evaluating the Municipal Solid Waste Management (MSWM) scenario in Uttarkashi, Uttarakhand, employing a comprehensive approach that combines primary and secondary data sources. Primary data collection involved field surveys, interviews and direct observations, engaging 195 households and NPP management personnel responsible for SWM. Structured questionnaires were administered to gather information on waste generation, disposal practices, and residents' perceptions of the existing MSWM system. Multistage Stratified Proportionate Random Sampling method facilitated the selection of households, enabling an exploration of issues arising from the inadequacies of the SWM system. Semi-structured interviews with municipal officials, waste management personnel and community leaders provided insights into operational challenges, policy perspectives and future prospects. A thorough review of academic literature, government reports and previous studies in waste management in Uttarkashi and similar regions informed the study. The questionnaire, developed based on existing literature and field expertise, facilitated data collection. The analysis involved the use of flow charts and frequency tables, revealing the current state of SWM in Uttarkashi and the challenges it faces in infrastructure development.

Table 1. Sampling Framework

Stage 1	Stage 2	Stage 3		Stage 4
Selection of Town	***Selection of Wards***	***Selection of Mohalla***	***No. of Mohalla in each ward***	***Selection of 5 HH from each Mohalla***
	Ward 01 – Gangori	Gwana, Palya Gangori, Gangori, Khaand, Kotbanglaw Van Vibhag colony, Laksheshwar, Gophiyara	7	35
	Ward 02 – Collector Colony	Masjid Mohalla, Collectorate colony, Upla Badahat	3	15
	Ward 03 – Tiloth	Tiloth	1	5
	Ward 04 – Ganga Nagar	Sunarkholla, Balmiki Basti, Ganga Nagar	3	15
	Ward 05 – Jila Chikitsalya	Jila Chikitsalaya, Bhatwari Park, Gandhi Park	3	15
	Ward 06 – SriRam Leela Maidaan	Ram Leela Maidaan, Jaipur Mandir, Kedarghaat, Kapoor Mohalla, Jarbharat Marg Kaali Kamli, Dharamshaala	6	30

Uttarkashi Town	Ward 07 – Gyansu Paduli Ward	Indira Colony, Gyansu (Paduli), Tambakhani	3	15
	Ward 08 – Joshiyara	Joshiyara, Consairn, Manera Tok (Dilsor)	3	15
	Ward 09 – Ladari	Ladari	1	5
	Ward 10 – Gyansu Hedil	Gyansu, Gyaan Mandir, Jokaani, Hedil Colony	4	20
	Ward 11 – Parla Gyansu	Basunga, Lihara, Parla Gyansu, Pashu Chikitsalaya, Police Line	5	25
Total	**6784**		**39**	**195**

(Source: Nagar Palika Parishad)

5. RESULT AND DISCUSSION

Table 2: Total Solid Waste Generation

Urban Local Body	Current Population	Number of Wards	Present Solid Waste Generation (Metric Tons Per Day - MTPD)				Waste Generation During seasons (MTPD)	
			Dry waste	***Wet waste***	***RDF/C & D and Other***	***Total***	***Non-Tourists***	***Tourists***
*NPP *Badahat (Uttarkashi)*	27102	11	4.5	4.5	1.0	10	8-10	10-16

(Source: Nagar Palika Parishad)

The data from NPP Uttarkashi indicates a population with 27,102 across 11 wards, generates 10 metric tons of solid waste daily, comprising 4.5 metric tons each of dry and wet waste, and 1 metric ton of RDF/C&D and other waste. Seasonal variations significantly impact waste generation, with tourist influx increasing the load to 10–16 metric tons, compared to 8–10 metric tons during non-tourist periods. These dynamics highlight the need for seasonally adaptive urban waste management strategies.

Table 3: Present infrastructure for waste management operations

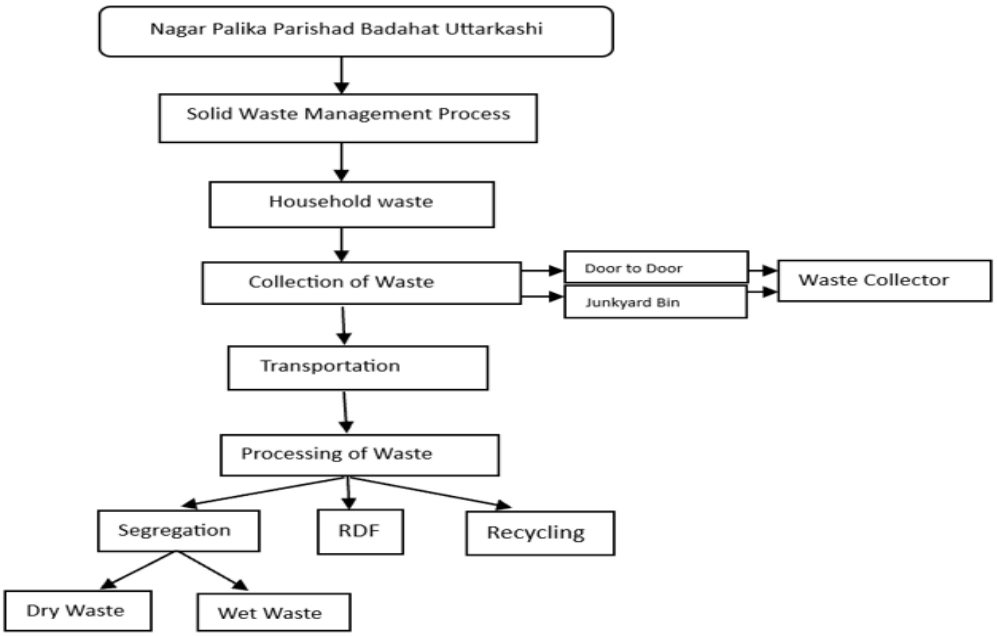
Urban Local Body		Infrastructure involved in Waste Management Operation			
	Waste collection trolleys	*Paryawaran Mitra*	*Mini collection trucks/tractors*	*Composting units' facilities*	*Landfills*
NPP Badahat (Uttarkashi)	60	68	7	8	Open Dumping

(Source: Primary Data)

The Urban Local Body of Uttarkashi employs 60 waste collection trolleys, 68 Paryawaran Mitras, 7 mini collection trucks/tractors, and 8 composting facilities as part of its waste management efforts. However, reliance on open dumping for landfill disposal poses significant environmental concerns. Transitioning to sustainable waste disposal methods is imperative to enhance the overall efficacy of waste management in the region.

5.1 Existing Solid Waste Management infrastructure in Uttarkashi Town

Figure 1. Existing Solid Waste Management infrastructure in Uttarkashi town



Source: Primary Data

The depicted flowchart provides a visual representation of the SWM model adopted in Uttarkashi town. This information was obtained from discussions with the Chairman and Sanitary Inspector of Nagar Palika Parishad Barahat Uttarkashi.

The waste collection process involves 35 collectors and 60 trolleys operating in two shifts, charging a monthly fee of rupees 50-100. Waste is segregated on-site, with Safai Karmachari manually transporting in inaccessible areas. Waste is then transported to the Tambakhani tunnel, leading to contamination of the Bhagirathi River. In some areas, a more suitable disposal site is used. After open disposal, waste is categorized into dry and wet types, with non-segregated waste becoming Refuse Derived Fuel (RDF). Compactor machines handle dry waste in Ward 02, and eight composting pits manage wet waste. However, the produced fertilizer faces underutilization, leading to disposal in forested areas. Non-biodegradable waste is sent to a recycling facility in Rishikesh, while residual waste undergoes bio-remediation at the old dump site. Challenges in procuring RDF for concrete processing plants in Delhi persist.

5.2 Challengesexperienced by the Household Sector concerning SWM infrastructure

Table 4: Administrative Challenges in the Household Sector

Administration issues	No. of Household	Percentage
Delayed cleaning of garbage bins.	176	90
Delayed arrival of pickup vehicles	88	45
Lack of compost pit	146	75
Absence of public awareness initiatives	160	82
Lack of recycling facilities	138	71
Lack of proper disposal sites	195	100

Source: Primary Data

The analysis of household waste management reveals key challenges, including the urgent need for proper disposal sites and timely waste collection, as delayed cleaning of community bins affects 90% of respondents. Unreliable vehicle schedules impact 45% of households, while the absence of compost pits in 75% highlights a gap in sustainable waste practices. Furthermore, 82% of households cite inadequate public awareness initiatives, emphasizing the need for educational campaigns to promote recycling and responsible waste disposal. The lack of recycling facilities, reported by 71% of households, further highlights critical infrastructure deficiencies in waste management.

Table 5: Problems regarding the health due to the poor waste infrastructure

Health problems	No. of Household	Percentage
Respiratory problem	127	65
Eye infection	98	50
Skin Infection of children	117	60
Water borne diseases	166	85

Source: Primary Data

The analysis of health issues linked to inefficient SWM highlights respiratory problems affecting 65% of households, emphasizing the need for improved air quality. Eye infections, reported by 32.5% of households, point to inadequate sanitation and hygiene. Skin infections in 60% of children emphasize their vulnerability, while waterborne diseases, impacting 85% of households, stress the critical need for access to clean water sources.

Table 6: Daily Challenges Faced by Households Due to Poor Solid Waste Infrastructure

Daily Problems	No. of Household	Percentage
Waste scattered across the streets	190	97
Challenges in accessing community trash bins	185	95
Unpleasant odors prevalent in the summer season	195	71
Disposing of garbage in front of one's residence	140	72
Difficulty in accessing the market.	160	82

Source: Primary Data

The 97% of households report waste scattered across streets, while 95% face difficulties navigating around community trash bins, highlighting the need for proper bin placement and management. Unpleasant odor during summer, reported by 71% of households, emphasize the need for effective odor control. Additionally, 72% of households dispose of garbage in front of their residences, and 82% face challenges accessing the market, indicating specific areas for targeted improvement in living conditions.

5.3. Reasons contributing to the issues in SWM infrastructure

Table: 7 Reasons for SWM Issues from a Household Perspective

Reasons	Percentage of the respondents
Lack of Awareness	70
Improper Segregation	55
Illegal disposal of waste	30
Open burning of waste	50
Inadequate waste reduction practices	48
Resistance to change	50
Usage of plastic waste	62

Source: Primary Data

The analysis of household perspectives on SWM highlights key issues requiring intervention. The prevalence of factors such as lack of awareness (70%), improper segregation (55%) and resistance to change (50%), emphasizes the need for educational campaigns. Addressing illegal waste disposal (30%) and open burning (50%) demands stricter regulation enforcement and community engagement. Additionally, the widespread use of plastic waste (62%) calls for the promotion of sustainable alternatives and responsible plastic consumption.

6. PREVENTIVE MEASURES

Preventive Measures	Description
Vehicle Management	Implement GPS tracking and optimize waste collection schedules, increasing vehicle numbers as needed.
Public Education Initiatives	Launch media campaigns on waste management, hygiene, and disposal practices, targeting schools and communities.
Recycling Facilities	Expand recycling infrastructure and introduce incentives to encourage participation.
Designated trash proposal	Enforce designated trash disposal areas and discourage open dumping to reduce environmental hazards.
Community Engagement	Promote community participation in waste management and support for municipal initiatives.
Odor Control	Implement odor control measures, including the use of covered bins, particularly during summer.
Proper Segregation	Encourage waste segregation through educational campaigns and provide guidance on separation methods.
Prevention of Illegal Disposal	Strengthen enforcement and penalties against illegal waste dumping.
Controlled Waste Burning Alternatives	Educate on the dangers of open burning and introduce safer disposal alternatives.
Government Support	Advocate for increased funding and support for Nagar Palika Parishad to enhance SWM systems.

7. CONCLUSION

In light of the present study's comprehensive examination of SWM practices in Uttarkashi town, a stark reality emerges regarding the critical challenges and deficiencies within the existing system. The towns' reliance on open dumping, particularly evident in the Tambakhani Tunnel, not only symbolizes the municipal waste management struggles but also underlines the immediate threats to public health and environmental integrity. The research exposes a multifaceted set of issues, ranging from the lack of waste disposal infrastructure, public awareness, and governmental support to deficiencies in vehicles, technical equipment, human resources, and composting facilities. Respondents expressed dissatisfaction with the municipality performance, highlighting administrative shortcomings and substantial health concerns arising from inadequate waste management practices. The study conclusively advocates for urgent collaborative efforts between municipalities and the government to implement efficient SWM infrastructure, addressing the environmental, societal, health, and economic dimensions of Uttarkashi's challenges. The proposed recommendations from the comprehensive

assessment offer a strategic roadmap towards a cleaner, healthier and more sustainable future for Uttarkashi, emphasizing the necessity for immediate and coordinated action to rectify the identified deficiencies and promote overall sustainable development.

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A CASE STUDY ON MSME UNITS- WITH SPECIAL REFERENCE TO HOWRAH DISTRICT, WEST BENGAL

Ratna Roy[♣]

ABSTRACT

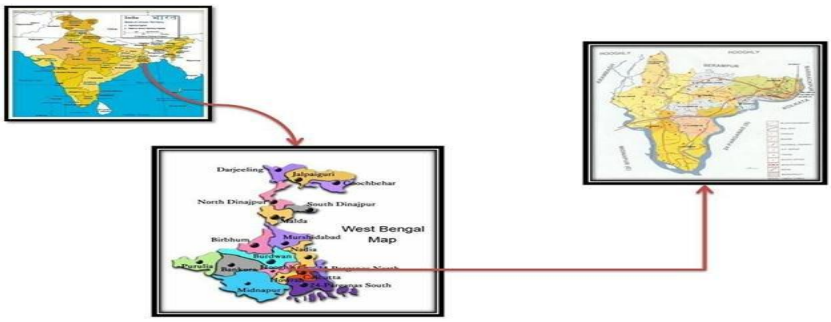
MSME, also called as Micro, Small and Medium Enterprises is considered to be one of the vibrant sectors in terms of its competence for advancements as well as perseverance to face multiple challenges. We know that MSME in India as well as in West Bengal contribute a major percent in of our GDP but their survival is at stake in terms of competition, lack of infrastructure, technology, shortage of labour and non-availability of timely financial support from Banks and other Financial Institutions. In this backdrop, the District Howrah, W.B., India has been selected and accordingly 7 sample units have been selected namely T.S. Udyog, Metal Engineering & Treatment Company Pvt Ltd, Perfect Enterprise, National Foundry Works, Sarpcon Industries, D'vaiz Chemicals and Megeba Bridge Product Pvt Ltd.The objectives of the paper is to analyze the performance of the Units selected under study and the major challenges faced by them on the basis of Finance, Technological, Marketing and Operational issues. Primary data has been collected through a sample questionnaire. Field visit has been conducted along with interview. As a statistical tool Garrett's ranking technique has been applied to deal with Financial Problem, Marketing, Technological and Operational issues. Data have also been collected from Industrial Profile of Howrah District. Statistical as well as Logical derivations are taken into consideration to analyse the data. The paper has ended with the conclusion that mainly financial problems followed by Marketing, Technological and Operational issues are the rank wise major challenges faced by the MSME units under study.

Key Words: Light Engineering units, Growth and Challenges, Financial support

INTRODUCTION

MSME is contributing a major part in the economic development of the country through entrepreneurship and thus helping to generate a large-scale opportunity of employment.

Locational Advantage: With the starting of railways, Howrah District has also got its importance. Situated by the bank of river Hooghly, Howrah district is situated in between of 22°-48' and 22°-12' North latitude and between 88°-50' East longitude. Given below the district of Howrah in the map of India and also separately showing the district.



Source: https://www.researchgate.net/figure/Howrah-District-of-record-West-Bengal-India_fig1_323991089

♣ Assistant Professor, Commerce Department, Bijoy Krishna Girls' College, Howrah, Affiliated under Calcutta University West Bengal, India

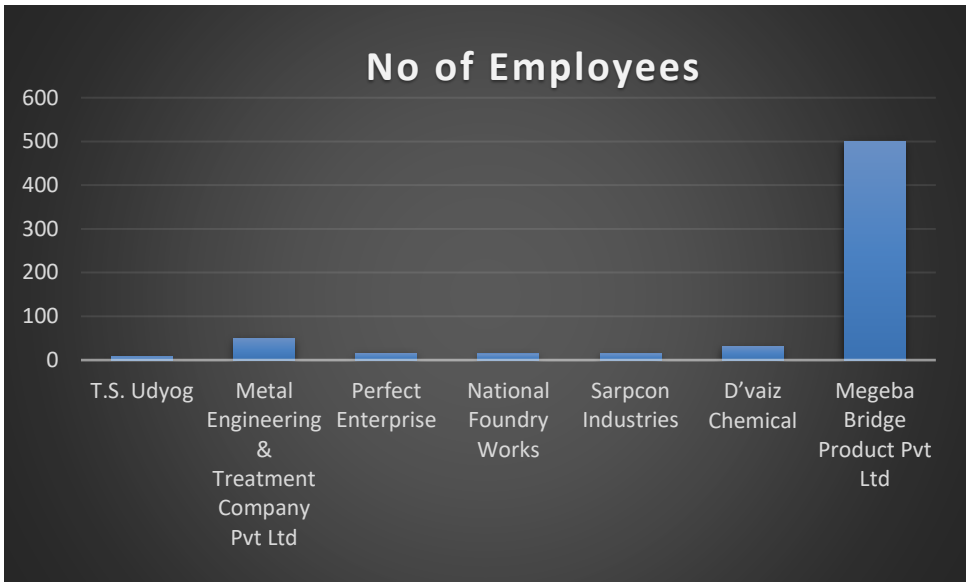
We have selected sample companies namely T.S. Udyog, Metal Engineering & Treatment Company Pvt Ltd, Perfect Enterprise, National Foundry Works, Sarpcon Industries, D'vaiz Chemical, Megeba Bridge Product Pvt Ltd in Baltikuri Industrial Area which comprises of 28 acres of land.

Table: 1 Overview of MSME selected under study

Name of Companies	PARAMETERS						
	Scale of Operation	**Products Manufactured**	**Constitution**	**Age**	**No of Employees**	**Capital Investment (at inception)**	**Power Consumption**
T.S. Udyog	Micro	Iron equipment Used in power sector and steel industries	Partnership	Over 15 years	08-Male 0-Female	Below 5 lakh	800-1200 units
Metal Engineering & Treatment Company Pvt Ltd	Small	Bridge bearing components	Private Ltd	Over 70yrs	50-Male 0-Female	Below 5 lakh	500-800 units
Perfect Enterprise	Small	Fabrication	Private Ltd	Over 15 years	15-Male 01-Female	Below 5 lakh	200-500 units
National Foundry Works	Small	SSD Box, Railway fabrication, Vibration joint of bridge	Sole Proprietary	10-15 yrs	14-Male 0-Female	Above 20 lakh	800-1200 units
Sarpcon Industries	Micro	Iron equipment	Sole Proprietary	5-10 yrs	15-Male 0-Female	Above 20 lakh	200-500 units
D'vaiz Chemical	Medium	Black Pheneyl	Partnership	Over 15 years	32-Male 0-Female	Below 5 lakh	800-1200 units
Megeba Bridge Product Pvt Ltd	Small	Bridge Bearing Parts	Limited Liability Partnership	More Than 65 yrs	500-Male 0-Female	Below 5 lakh	60 KVA-83 Kva

Source: Primary Data

Figure: 1



Source: Self Created

REVIEW OF LITERATURE

Different literature reviews have been conducted for my study, some of which is cited below: -

Sinha (2012) pointed out that due to their small size, the MSMEs often find difficulties to achieve the economies of scale and also fail to capture market opportunities. MSMEs are however flexible enough to capitalise on their innovative ideas.

Yadav (2014) focussed that the leadership and talent managements are required among bank officials for the credit supply. They have further pointed out that bank should also come forward in counseling the entrepreneurs on both finance and non-finance related issues.

Abraham and Schmukler (2017) have pointed out that both supply and demand factors are responsible for the low observed use of banking services by SMEs.They further explained that the macroeconomic environment can also hamper SME finance.

Venkata Sivasree Ch Hema and Vasavi.P (2020) stated that the MSME is for the growth of an Indian Economy. They provide employment and also helps in industrialization in the rural areas. In this paper it has been pointed out about the growth and contribution made by MSME.

Suminah S, et al (2022) stated that the global Covid-19 pandemic had a major influence on various areas of life, and even in Indonesia, inflation was 2.96%. The pandemic also caused a decrease in production, sales and income of MSMEs, for which recovery is required.

OBJECTIVES BEHIND STUDY

I) To investigate the overall scenario of MSME Sector of India
II) To analyse the growth of MSME of Sample units selected.
III) To study the major challenges faced by MSME Units selected under Study.

METHODOLOGY

Data have been collected from Industrial Estate in Howrah District through interview with the Works Manager and Owners of the Units.

Garrett's ranking technique has been applied. The following formula has been applied: -

% Position=100 (Rank given against the variable – 0.5) /Numberof factors ranked by respondents

The next step is to convert the value into scores

Financial Problem, Technological Problem, Marketing Problem and Operational Issues have been selected behind the challenges faced by the sample companies.

RESULTS DISCUSSION

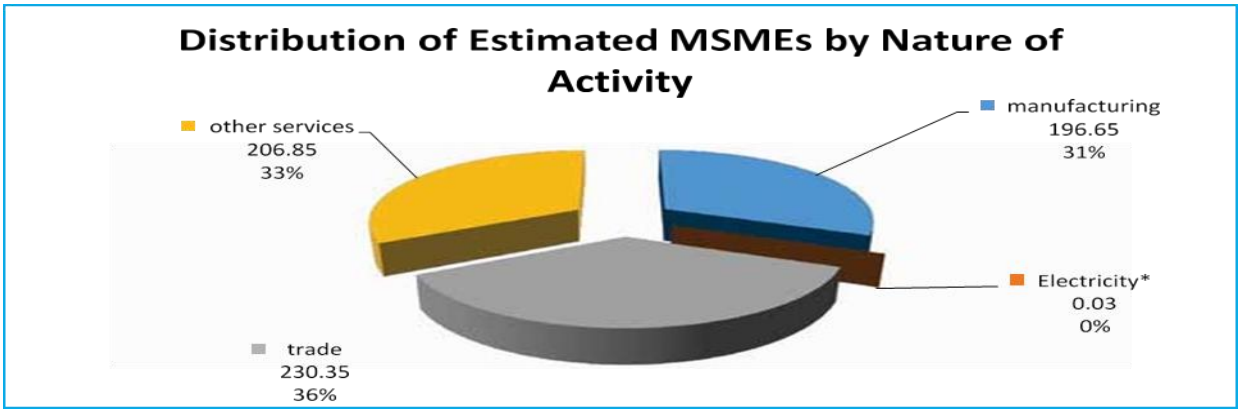
The discussion has been divided into two parts: -

1. Growth of MSME
2. Challenges faced by the sample units

Growth of MSME in India

Let us now, look into the scenario of growth of MSME distribution in India.

Figure: 2: Distribution of Estimated MSME by Nature of Activity

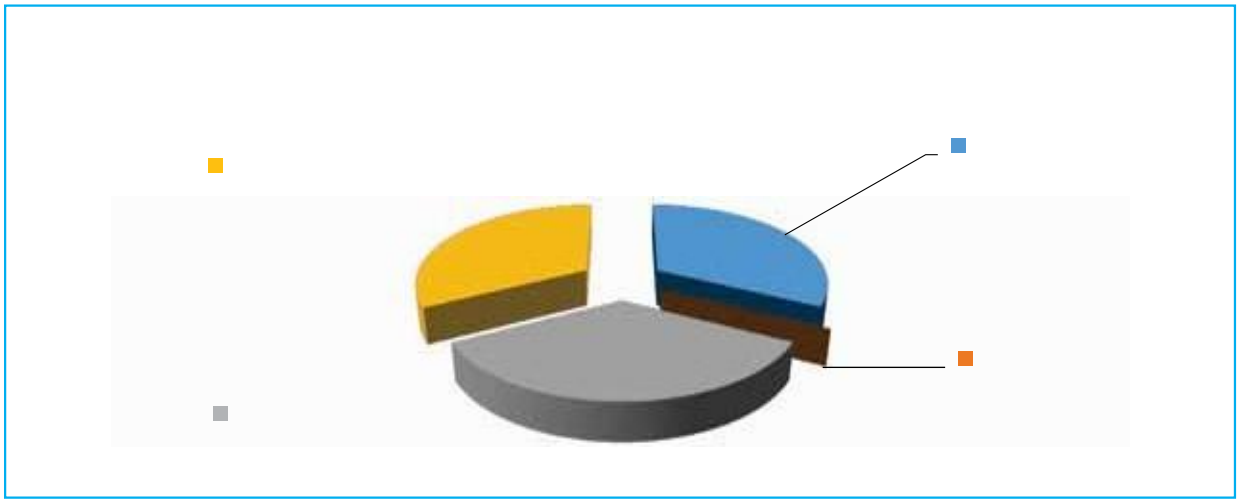


Source: MSMEANNUALREPORT2022-23

From the above it is evident that no of MSME enterprises is maximum in the field of trade.

Employment in MSME Sector: Employment is better in rural areas than urban areas particularly in the field of Manufacturing.

Figure: 3: Employment in MSME Sector

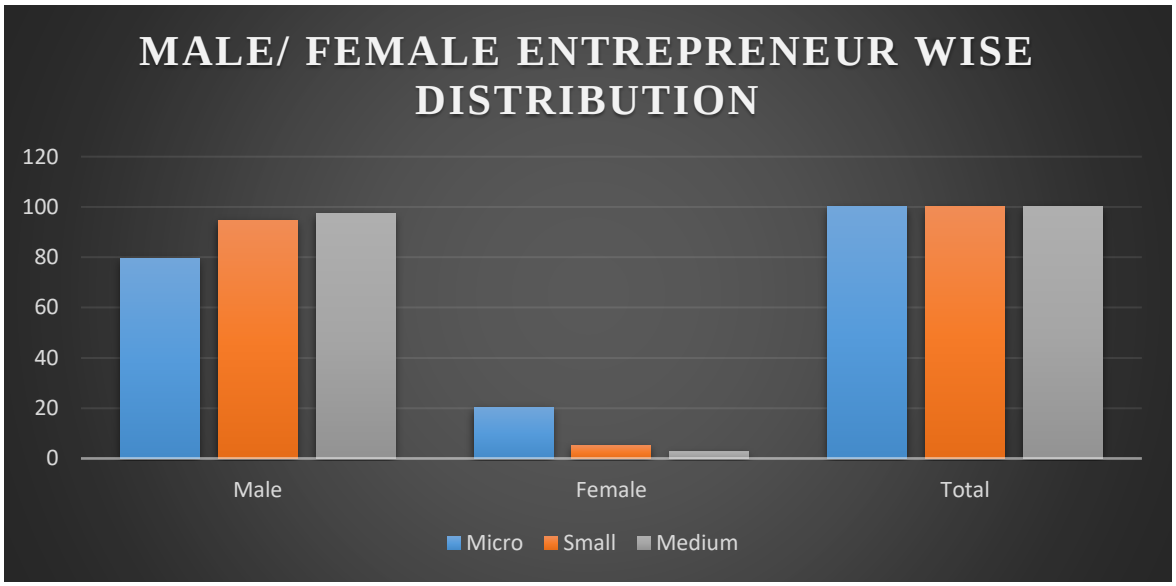


Source: ANNUAL REPORT 2022-23 of MSME

From the above we can say that 35% employment in MSME is related to Trade.

Male/ Female entrepreneurs' wise distribution

Figure 4: Male/Female Entrepreneur Wise Distribution



Source: Self –Created from data of MSME Site

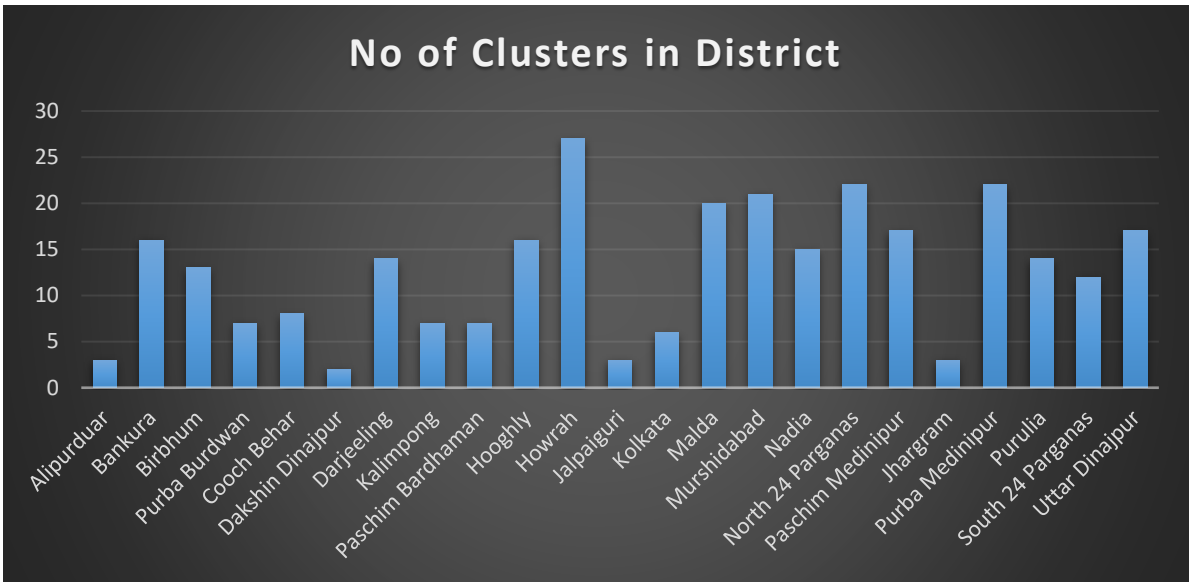
It shows that the percentage of Female entrepreneur is less compared to Male.

Table 2

MSME Clusters of Different Districts of West Bengal:

District	No of Clusters in District
Alipurduar	3
Bankura	16
Birbhum	13
Purba Burdwan	7
Cooch Behar	8
Dakshin Dinajpur	2
Darjeeling	14
Kalimpong	7
Paschim Bardhaman	7
Hooghly	16
Howrah	27
Jalpaiguri	3
Kolkata	6
Malda	20
Murshidabad	21
Nadia	15
North 24 Parganas	22
Paschim Medinipur	17
Jhargram	03
Purba Medinipur	22
Purulia	14
South 24 Parganas	12
Uttar Dinajpur	17

Figure 5



Source: Self-Created

From the above it is evident that the number of Cluster Development Project is maximum in the district of Howrah compared to the other Districts of the state of West Bengal

Let us now analyse the MSME units selected under our study.

Table: 3: Growth of MSME Selected under study

	Growth in comparison to previous year	
Name of Companies	**Sales Turnover**	**Profit Before Tax**
T.S. Udyog	Over 25% (Total turnover 1 crore and above)	Over 25%
Metal Engineering & Treatment Company Pvt Ltd	Over 25% Total Turnover 50 crore approx	Over 25%
Perfect Enterprise	Total turnover 1 crore and above)	Over 25%
National Foundry Works	Over 25% (Total turnover 1 crore and above)	Over 25%
Sarpcon Industries	Over 25% (Total turnover 1 crore and above)	25%
D'vaiz Chemicals	Over 25% (Turnover 1 crore and above)	Over 25%
Megeba Bridge Product Pvt Ltd	Over 25% (Total Turnover100 crore and above)	Over 25%

Source: Field Survey

So, from the above we can say that companies under study have remarkable growth in terms of Sales Turnover and Profit Before Tax and among them MegebaBridge Product Pvt Ltd is the largest company in terms of Sales Turnover.

Major Challenges Of MSME

Ranking of major challenges by sample unit are given below: -

Table:4

T.S. Udyog

Major Challenges	Rank I	Rank II	Rank III	Rank IV
Operational				✓
Marketing		✓		
Technological			✓	
Financial	✓			

Source: Self-Created

Table:5

Metal Engineering & Treatment Company Pvt Ltd

Major Challenges	Rank I	Rank II	Rank III	Rank IV
Operational	✓			
Marketing			✓	
Technological				✓
Financial		✓		

Source: Self-Created

Table:6

Perfect Enterprise

Major Challenges	Rank I	Rank II	Rank III	Rank IV
Operational				✓
Marketing		✓		
Technological			✓	
Financial	✓			

Source: Self-Created

Table: 7

National Foundry Works

Major Challenges	Rank I	Rank II	Rank III	Rank IV
Operational	✓			
Marketing			✓	
Technological		✓		
Financial				✓

Source: Self-Created

Table:8

Sarpcon Industries

Major Challenges	Rank I	Rank II	Rank III	Rank IV
Operational				✓
Marketing			✓	
Technological		✓		
Financial	✓			

Source: Self-Created

Table:9

D'vaiz Chemicals

Major Challenges	Rank I	Rank II	Rank III	Rank IV
Operational				✓
Marketing		✓		
Technological			✓	
Financial	✓			

Source: Self-Created

Table:10

Megeba Bridge Product Pvt Ltd

Major Challenges	Rank I	Rank II	Rank III	Rank IV
Operational				✓
Marketing	✓			
Technological			✓	
Financial		✓		

Source: Self-Created

Garrett's Score has been computed as follows:-

Table 11

Garrett's Value

Rank	Percentile Position	Value
1	12.5**{100X(1-0.5)}/4**	73
2	37.5	57
3	62.5	44
4	87.5	27

Source: Garrett Table

Total score of different problems of MSME under study has been computed as follows:-

Table 12

OPERATIONAL ISSUES

Rank of Respondents (i)	Frequency (ii)	Garrett's Value (iii)	Total Value (ii)*(iii)
1st	2	73	146
2nd	0	57	00
3rd	0	44	00
4th	5	27	135
TOTAL	**7**		**281**

Source: Primary Data

Table 13

MARKETING PROBLEM

Rank of Respondents (i)	Frequency (ii)	Garrett's Value (iii)	Total Value (ii)*(iii)
1st	1	73	73
2nd	3	57	171
3rd	3	44	132
4th	0	27	00
TOTAL	**7**		**376**

Source: Primary Data

Table 14

TECHNOLOGICAL PROBLEM

Rank of Respondents (i)	Frequency (ii)	Garrett's Value (iii)	Total Value (ii)*(iii)
1st	NIL	73	NIL
2nd	2	57	114
3rd	4	44	176
4th	1	27	27
TOTAL	7		317

Source: Primary Data

Table 15

FINANCIAL PROBLEM

Rank of Respondents (i)	Frequency (ii)	Garrett's Value (iii)	Total Value (ii)*(iii)
1st	4	73	292
2nd	2	57	114
3rd	0	44	0
4th	1	27	27
TOTAL	7		433

Source: Primary Data

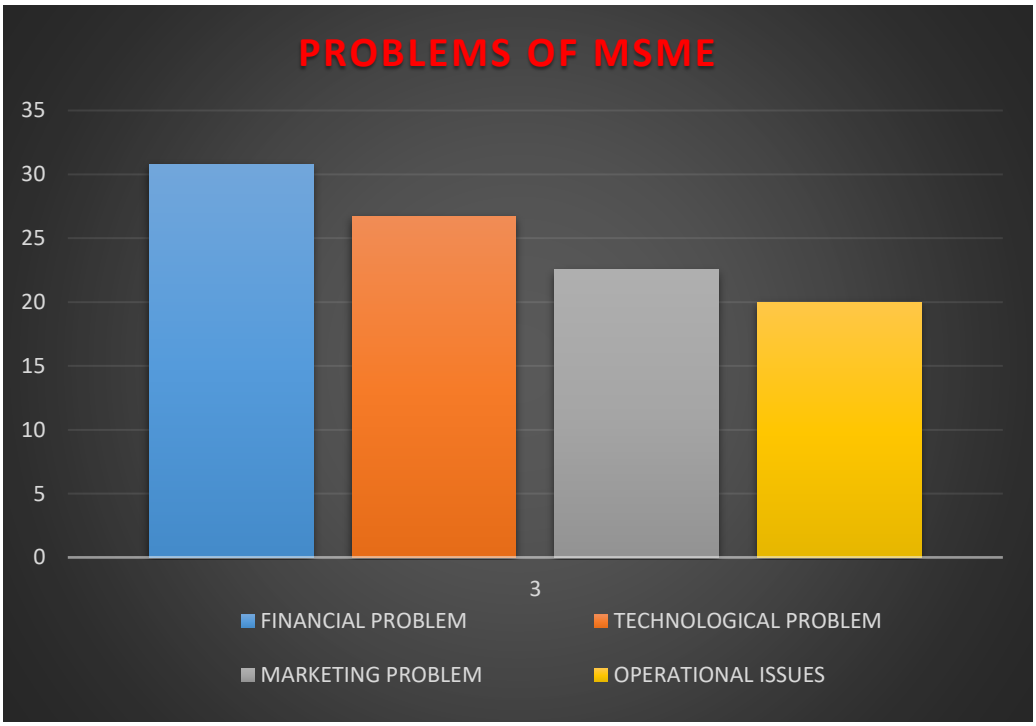
Table 16

Overall Result

Sl. No	Factors	Total Value	Rank	%
1	Financial Problem	433	1	30.77
2	Marketing Problem	376	2	26.72
3	Technological Problem	317	3	22.53
4	Operational Issue	281	4	19.97

Source: Primary Data

Figure: 6



Source: Self-Created

From the above it is evident that Financial Problem is the basic challenge of MSME selected under study. Let us analyse the Financial Problem of the companies in details.

Financial Problem of the Sample Units

Table: 17

FUND FOR OPERATION

NAME OF ENTERPRISE	**FUND FOR OPERATION**
T.S. Udyog	Bank Loan
Metal Engineering	Own Fund, Bank Loan
Perfect Enterprise	Bank Loan
National Foundry Works	Personal Savings
Sarpcon Industries	Non-Bank financial companies (NBFCs)
D'vaiz Chemical	Bank Loan and Own Fund
Megeba Bridge Product Pvt Ltd	Bank Loan

Source: Primary Data

Table: 18

APPLICATION FOR FINANCE/LOAN

NAME OF ENTERPRISE	Name of Banker	FINANCE/LOAN		
		BANK LOAN	BANK TERM LOAN	TRADE CREDIT
T.S. Udyog	BOI, ICICI	Applied	Not Applied	Not Applied
Metal Engineering & Treatment Company Pvt Ltd	PNB	Applied	Not Applied	Not Applied
Perfect Enterprise	SBI	Applied	Not Applied	Not Applied
National Foundry Works	PNB	Did not apply as it is not required	Not Applied	Not Applied
Sarpcon Industries	IDBI	Did not apply owing to rejection	Did not apply owing to rejection	Applied
D'vaiz Chemical	IDBI	Applied	Not Applied	Not Applied
Megeba Bridge Product Pvt Ltd	HDFC	Applied	Not Applied	Not Applied

Source: Primary Data

Table: 19

PREVENTIVE FEATURE TO GET ENHANCED LOAN FROM BANK

NAME OF ENTERPRISE	PREVENTIVE FEATURE
T.S. Udyog	Lengthy Loan Process
Metal Engineering	Bank Loan Access
Perfect Enterprise	Access to Bank Loan
National Foundry Works	Lengthy Loan Process
Sarpcon Industries	Lengthy Loan Process
D'vaiz Chemical	No such problem faced
Megeba Bridge Product Pvt Ltd	No such problem faced

Source: Primary Data

Major Observations: -

I)Non-availability of adequate credit from banks- The MSMEs are confronting problems of credit from the banks. The process of sanction of loan from the banks is too lengthy, so more documentation and paper works are also required with high cost of processing fee.

II)Problems faced by the Banks:

a) Banks generally require collateral security for MSME lending
b) Banks consider MSME projects risky
c) Bureaucracy in lending procedure

III) Less no of Female employees: No of female employees coming in MSME Sector is comparatively less than male.

IV)Growth of the Units: The sample units selected in my study though they are facing the above problems but overall, their turnover has improved than the previous year mainly because of the different schemes provided by the Govt.

CONCLUSION

MSME contribute to the economic development of India in a number of ways. Government of India has also taken various measures to make this sector as the remarkable player in the growth of the Indian economy. The companies selected under my study in Baltikuri Industrial Estate are having turnover of more than 1 crore in almost all cases. But through the interview with the Owners or Works Manager we have understood that Financial Problem is one of the major challenging areas. Result of Garrett's Ranking Technique calculated on the basis of data collected clearly reveals that Financial Problems ranks first followed by Marketing, Technological and Operational issues. But our Govt has taken a number of initiatives through different Schemes to make the MSME as the vibrant sector of Indian Economy.

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Determinants of Dairy Farming Participation and Food Consumption Scores: A Mixed-Process Regression Analysis

Simran Sharma[♣] and Swati Shastri[♣♣]

Abstract

Diversification in agricultural practices is becoming increasingly important for reducing vulnerabilities in the farming sector, particularly in the context of dairy farming. This study focuses on the impact of engaging in dairy farming on food security in the Kaithal district of Haryana. A sample of 400 farm households was analyzed to assess the relationship between dairy farming practices and food security outcomes. The study utilized the Food Consumption Score (FCS) to measure food security, with findings indicating that households involved in dairy farming achieved higher food security scores. Various factors influencing this relationship were examined, including age, family size, land size, caste, and access to loans and subsidies. The analysis revealed that greater engagement in dairy farming significantly improved food security, highlighting the importance of livestock diversification for enhancing nutritional outcomes. The results suggest that promoting dairy farming can be a key strategy in achieving food security in the region, as it not only provides a source of income but also contributes to the self-consumption of nutritious dairy products.

Keywords: livestock diversification, food security, dairy farming, Indian agriculture

Introduction

The evolution of the dairy sector in India and the stellar role played by dairy cooperatives since the launch of Operation Flood form an integral part of the country's remarkable growth story after Independence. Today, India is the largest producer of milk in the world, contributing 23% of global milk production (PIB, GoI, 2022). Dairy farming plays a pivotal role in enhancing food security across various regions, particularly in developing countries. The intensification of dairy production not only contributes to the availability of milk but also supports the economic stability of smallholder farmers, thereby improving household food security. Research indicates that specialized dairy farming, focusing on high-yield breeds and modern farming techniques, can significantly enhance food security by increasing milk production with fewer resources (Kulikov &Minakov, 2023). This is particularly relevant in areas where dairy is a staple in local diets, providing essential nutrients and a reliable source of income for families (Perin &Enahoro, 2023).

In Ethiopia, for instance, participation in dairy production has been shown to increase the likelihood of food security among smallholder households. Studies have demonstrated that dairy farming not only boosts household income but also enhances resilience to food shortages, thereby improving overall food security status (Derbe et al., 2022). Similar findings have been reported in other African nations, where smallholder dairy farming is crucial for providing food and nutrition security, as well as generating income for rural households (Banda et al., 2021). The contribution of dairy farming to food security is further emphasized by its role in supplying a significant portion of the milk consumed in these regions, which is vital for both nutrition and economic stability (Banda et al., 2021). As the global population continues to grow, the demand for dairy products is expected to rise, making the role of dairy farming in food security even more critical (Pandey, 2024). The integration of sustainable practices in dairy farming can enhance productivity while ensuring that food security goals are met, aligning with broader sustainable development objectives (Wattiaux, 2023).

[♣] Department of Economics, Banasthali Vidyapith, Rajasthan, 304022, Tonk, India.
E-mail: simransharma2801@gmail.com

[♣♣] Department of Economics, Banasthali Vidyapith, Rajasthan, 304022, Tonk, India. Email: swatishastri21@gmail.com

However, while global research emphasizes the importance of dairy farming, there remains a gap in understanding the micro-level determinants influencing households' participation in dairy farming and its subsequent impact on dietary outcomes in regions like India. To address this, our study investigates the Determinants of Dairy Farming Participation and Food Consumption Scores: A Mixed-Process Regression Analysis. This analysis is crucial as it unpacks the socio-economic, land, and asset-related factors driving dairy farming participation while assessing its influence on household food consumption.

Fig. 1*:* How dairy farming helps in food security

Literature Review

Dairy farming has emerged as a significant contributor to food security, particularly in developing regions, by enhancing productivity, economic stability, and nutrition. Kulikov &Minakov (2023) demonstrate that technical modernization in dairy farming can improve food security by increasing productivity and resource efficiency. Similarly, Korir et al. (2023) highlight that dairy technology adoption among Ethiopian smallholders boosts productivity and reduces poverty, creating positive impacts from household to national levels.

Studies also underscore the nutritional benefits of dairy. Shamsuddoha et al. (2023) establish that efficient dairy supply chains not only enhance food security by improving nutrient access but also reduce dependency on imports. Derbe et al. (2022) provide quantitative evidence from Ethiopia, showing a direct correlation between dairy production and improved food security among smallholder households.

Research further indicates that factors such as education and occupation are pivotal to food security in dairy farming communities (Chokraborti et al., 2019). In Sub-Saharan Africa, dairy farming's economic and food security impacts are emphasized by Tagba (2024), who also points to resource and market access as key challenges.

Additionally, safety practices and technological advancements are essential in ensuring dairy farming's role in sustainable food security. Feyisa (2024) highlights safety measures' importance in Ethiopian dairy production, while Melnikova &Gilsanz (2023) show that frugal innovations can improve economic viability, thereby contributing to food security. In the Indian context, Kumar et al. (2020) find that food safety measures directly impact productivity and profitability, strengthening food security among smallholders.

2 Data and Methods

2.1 Study location and Sampling

The study was conducted at Kaithal district of Haryana, India. Under the study, data was collected from 5 blocks namely Pundri, Siwan, Dhand, Kaithal and Kalayat, comprising total sample of 400 farmers. A structured questionnaire was used enquiring about dairy farming and 7-day food consumption recall of various categories of food like vegetables, milk, wheat etc.

2.2 Construction of Food security Index

To assess household food security**, Food consumption Score**, by World food Programme, was used. According to World food Programme, "The frequency weighted diet diversity score or Food consumption score is a score calculated using the frequency of consumption of different food groups consumed by a household during the 7 days recall period." A higher score means that the household consumed a higher variety of food with a higher frequency. It is computed as

$$FCS=\sum(\text{food group frequency} \times \text{food group weight})$$

Fig 2: Food consumption Score weights

Source: (World Food Programme (WFP) Vulnerability Assessment and Mapping Unit, 2008)

2.3 Joint estimation of dairy farming and food security

Variables: The dependent variables include:

- Dairy Participation: A binary variable indicating whether the household engages in dairy farming (1) or not (0).
- Food Consumption Score (FCS): A continuous variable representing the household's food security level.

Independent variables include:

- Demographics: Age, family size, number of earning family members.
- Economic Factors: Land ownership, subsidies, loans.
- Assets and Resources: Presence of pumpsets, tractors, advanced machinery, etc.
- Education: Household education levels.
- Other Factors: agricultural advice.

The Conditional mixed process model is used due to the mixed nature of the dependent variables: binary (dairy participation) and continuous (FCS). The CMP framework allows for simultaneous estimation of multiple equations, taking into account possible correlations between error terms in each equation. (Roodman,2011)

Equation 1: Dairy Participation (Probit Model)

$$\begin{aligned}\text{dairy\_binary}i = {} & \alpha 0 + \alpha 1\text{Age}i + \alpha 2\text{familymembers}i + \alpha 3\text{familymembersearning}i \\ & + \alpha 4\text{Caste}i + \alpha 5\text{Land}i + \alpha 6\text{Study}i + \alpha 7\text{Subsidy}i + \alpha 8\text{loan}i \\ & + \alpha 9\text{agricultureadvice}i + \alpha 10\text{MSPawarenessi} + \alpha 11\text{Pumpset}i \\ & + \alpha 12\text{Tractor}i + \alpha 13\text{Advmachi} + \alpha 14\text{Storage}i + \alpha 15\text{Labour}i + \epsilon i1\end{aligned}$$

Equation 2: Food Consumption Score (FCS - Linear Model)

$$\begin{aligned}FCSi = {} & \beta 0 + \beta 1 dairy\_binary i + \beta 2 Agei + \beta 3 familymembersi \\ & + \beta 4 familymembersearningi + \beta 5 Castei + \beta 6 Landi + \beta 7 Studyi \\ & + \beta 8 Subsidyi + \beta 9 loani + \beta 10 agricultureadvicei \\ & + \beta 11 MSPawarenessi + \beta 12 Pumpseti + \beta 13 Tractori + \beta 14 Advmachi \\ & + \beta 15 Storagei + \beta 16 Labouri + \epsilon i2\end{aligned}$$

3 Results

Figure 3 Farmers involved in Dairy farming

The analysis of factors influencing dairy farming engagement, measured as the likelihood of households selling milk, reveals important socio-economic and structural determinants. Casteplays a pivotal role, with Scheduled Caste (SC) households exhibiting a significant positive association. This finding aligns with Khan et al. (2021), suggesting that SC households, constrained by historical disadvantages and limited access to mainstream economic opportunities, leverage dairy farming as a critical livelihood strategy. Similarly, Scheduled Tribe (ST) households demonstrate a positive, albeit marginal, association. This reflects their reliance on dairy farming for income diversification, particularly in the absence of other sustainable income sources. These observations highlight dairy farming as a key economic inclusion tool for marginalized communities.

Land ownership emerges as a major determinant of dairy farming engagement. Households with holdings above 10 acres show significant positive effects. This result suggests that larger landowners perceive dairy farming as a supplementary income source, integrating it into their broader agricultural portfolio. Notably, this contradicts findings by Staal et al. (2002), who argued that land size is not a constraint for dairy farming. In the

present context, access to larger landholdings likely facilitates resource allocation for dairy production, including fodder cultivation and infrastructure investment.

Households with members who completed 10th or 12th grade are significantly more likely to engage in dairy farming, implying that formal education fosters awareness of its economic benefits and operational efficiencies. Moreover, the strong positive association observed among master's degree holders suggests that higher education not only enhances knowledge but also strengthens the capacity for informed decision-making and strategic investment in dairy farming. This corresponds with Hansen and Greve (2015) and highlights education as a catalyst for entrepreneurial behavior in agriculture.

Asset ownership yields mixed results. While pump sets show a marginally significant positive effect, reflecting the importance of water availability in dairy production, assets such as tractors and advanced machinery do not significantly influence dairy engagement. This aligns with Gargiulo et al. (2018) and suggests that conventional farm equipment primarily supports crop farming rather than livestock-related activities. The insignificant role of labor availability further indicates that dairy farming in the region operates within a framework of family labor, reinforcing its viability as a small-scale, low-labor-intensive enterprise. The negative and significant constant term underscores that, in the absence of enabling socio-economic factors, households are unlikely to engage in dairy farming.

The findings on Food Consumption Scores (FCS)offer crucial insights into the nutritional benefits associated with dairy farming. A strong positive relationship (coefficient: 16.35, p = 0.000) demonstrates that households engaged in dairy farming exhibit significantly higher FCS, consistent with Kumar et al. (2019). This underscores the nutritional importance of dairy products in enhancing dietary diversity and improving overall food security.

Land ownership also exerts a substantial influence on FCS. Households with holdings above 10 acres exhibit the highest improvements (coefficient: 12.71, p = 0.000), reflecting their greater ability to access diverse food sources, including dairy and other nutrient-rich items. Similarly, landowners with 2 to 4 acres experience a notable positive impact (coefficient: 5.42, p = 0.002), reinforcing the role of land as a critical determinant of household food security.
Access to loans emerges as another important factor, with a positive coefficient (2.53, p = 0.04). This suggests that financial support improves households' capacity to purchase diverse and nutritious food, thereby enhancing dietary outcomes. Loans likely act as a liquidity buffer, enabling families to invest in both agricultural inputs and food consumption, particularly during periods of financial stress.

The findings suggest that dairy farming plays a critical role in improving both economic stability and nutritional outcomes, especially for marginalized households. To further support this sector, government policies could focus on expanding access to credit, particularly for small and landless farmers, to encourage investment in dairy activities. Additionally, promoting education and skill development tailored to modern dairy practices can empower households to diversify their income sources effectively. Ensuring access to water resources and infrastructure, such as pump sets, can further support dairy productivity. Modest and targeted interventions, such as enhancing financial inclusion and improving resource availability, may create an enabling environment for households to engage more actively in dairy farming, thereby contributing to income diversification and improved food security.

Table I Regression analysis

Conclusion

The analysis of the Food Consumption Score (FCS) highlights several significant factors influencing dietary patterns among individuals in Kaithal, Haryana. Engaging in dairy farming demonstrates a profound positive effect on FCS, indicating that individuals involved in dairy farming have access to a rich source of nutrition, contributing to a more diverse diet. Furthermore, land ownership significantly impacts dietary patterns, with those owning larger plots of land showing substantial increases in their FCS. Access to loans also emerged as a significant variable, suggesting that financial resources enable families to diversify their food sources.

These findings suggest several potential policy recommendations for Kaithal, Haryana, aimed at enhancing the impact of dairy farming on local livelihoods and food security. Firstly, initiatives to promote dairy farming through training, resource provision, and financial support can significantly improve production methods and management skills for both new and existing dairy farmers. In addition, policies that facilitate land access and reforms may empower smallholders, potentially increasing agricultural productivity and contributing to improved food consumption. Expanding access to microloans and agricultural credit can further support farmers in making sustainable investments in their practices. Complementing this with financial literacy programs would be beneficial, enabling informed and strategic decisions around these investments. Furthermore, community-based nutritional education programs can play an important role in fostering awareness about the health benefits of diverse foods, including dairy products, to encourage balanced diets. Given the cross-sectional nature of this study, future research could benefit from a longitudinal approach to provide deeper insights into the ongoing impact of these factors over time.

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Figures and Tables

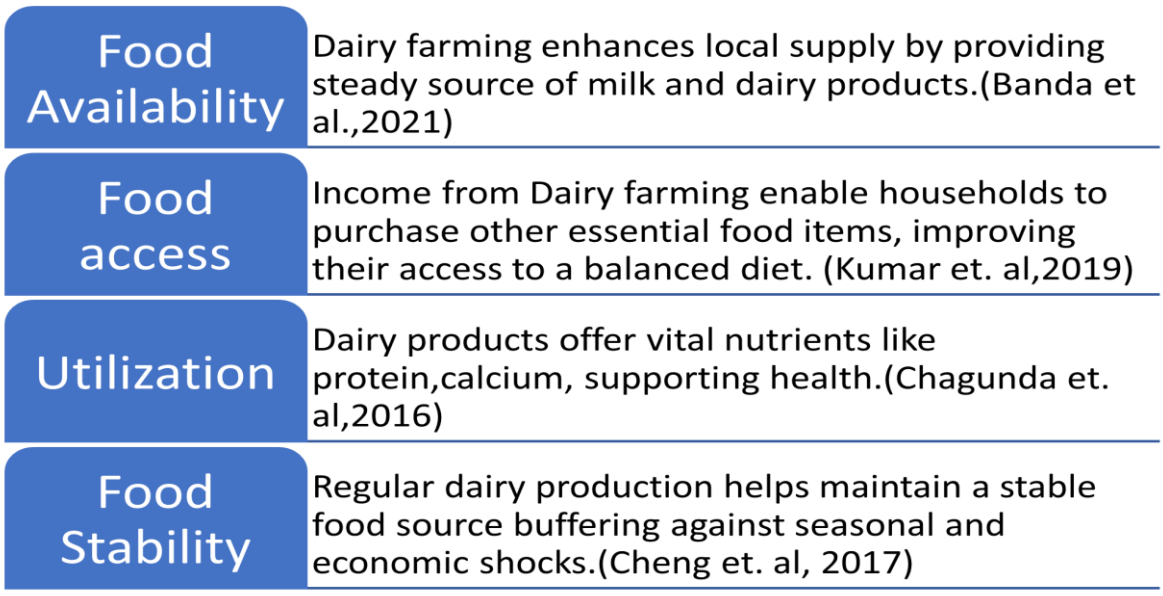

***Fig. 1**:* How dairy farming helps in food security

	Food consumption group	Food group	Weight (definitive)
1	Maize, maize porridge, rice, sorghum, millet, pasta, bread and other cereals	Main staples	2
	Cassava, potatoes and sweet potatoes, other tubers, plantains		
2	Beans, peas, groundnuts and cashew nuts	Pulses	3
3	Vegetables, leaves	Vegetables	1
4	Fruits	Fruit	1
5	Beef, goat, poultry, pork, eggs and fish	Meat and fish	4
5	Milk, yogurt and other dairy	Milk	4
6	Sugar and sugar products, honey	Sugar	0.5
7	Oils, fats and butter	Oil	0.5
8	Spices, tea, coffee, salt, fish power and small amounts of milk for tea.	Condiments	0

Fig 2*:* Food consumption Score weights

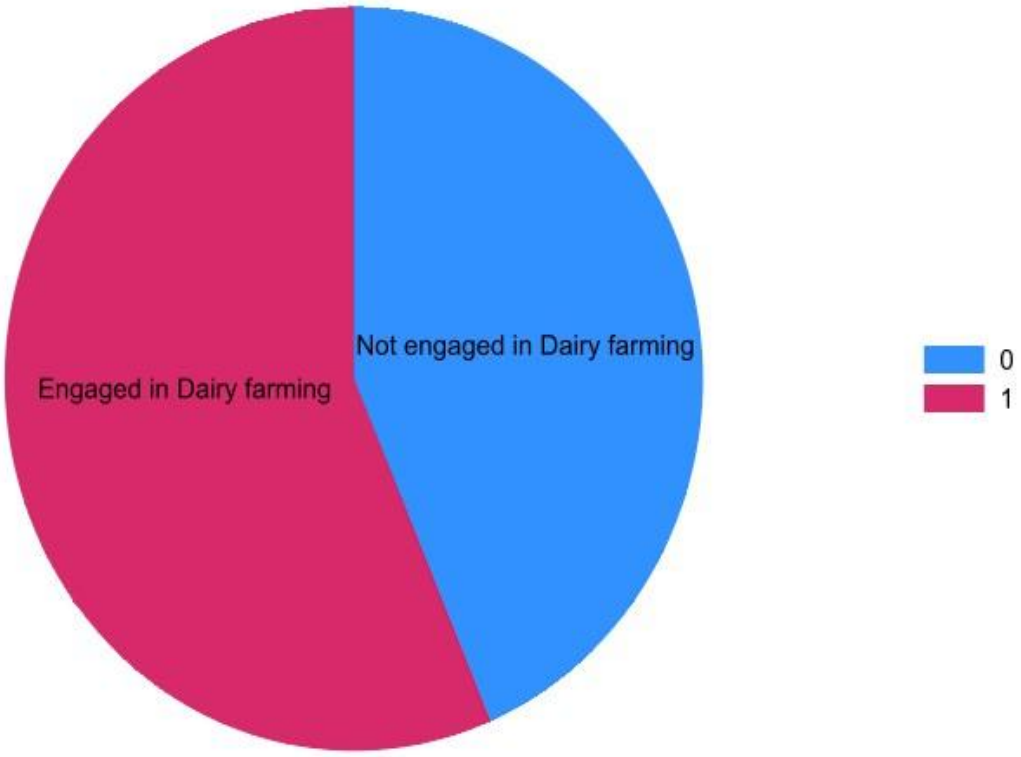

Figure 3 Farmers involved in Dairy farming

Table II Regression analysis

Variable	Coefficient	Standard Error	P-Value
Engaging in Dairy			
Age	0.005141	0.005588	0.358
Family Members	-0.02909	0.021664	0.179
Loan (YES)	-0.05628	0.145904	0.7
Caste: OBC	0.157651	0.175913	0.37
Caste: SC	0.647553	0.254346	0.011
Caste: ST	0.382671	0.231465	0.098
Land: > 10 acres	0.571028	0.246102	0.02
Land: 4 to 10 acres	0.521569	0.219301	0.017
Land: 2 to 4 acres	0.182263	0.204437	0.373
Subsidy (YES)	0.019778	0.129626	0.879
Agricultural Advice (YES)	0.04999	0.113973	0.661
10^{th}	0.650571	0.193752	0.001
12^{th}	0.435889	0.195438	0.026
Graduate	0.377548	0.213889	0.078
Masters	1.135104	0.33539	0.001
Pump Set (YES)	0.43849	0.242751	0.071
Tractor (YES)	0.157914	0.13234	0.233
Advanced Machinery (YES)	0.01463	0.179761	0.935
Labor (YES)	0.053173	0.127667	0.677
Constant	-1.36964	0.423372	0.001
Food Consumption Score (FCS)			
Engaging in Dairy	16.3539	4.394292	0
Age	-0.01949	0.047022	0.679
Family Members	0.355111	0.224761	0.114
Family Members Earning	0.362123	0.408016	0.375
Loan (YES)	2.533664	1.236075	0.04
Caste: OBC	-0.97598	1.471169	0.507
Caste: SC	0.802637	2.273628	0.724
Caste: ST	-1.83551	1.923407	0.34
Land: > 10 acres	12.70862	2.403171	0
Land: 2 to 4 acres	5.422026	1.745454	0.002
Land: 4 to 10 acres	8.770127	2.19418	0
10^{th}	-1.33984	1.814249	0.46
12^{th}	0.90253	1.666812	0.588
Graduate	2.501431	1.843639	0.175
Masters	-3.52823	3.026379	0.244
Constant	54.28384	2.968015	0

Multidimensional Poverty Index (MPI) and Achievement of Sustainable Development Goal-1 in India: An Inter-State Comparison

Chinmoy Sarkar[††††] and K. K. Bagchi[‡‡‡‡]

Abstract: Poverty does not arise only due to lack of income, wages and monetary resources essential to meet the basic needs rather it is highly correlated with other non-monetary factors. In the opinion of Amartya Sen (1976) "the measurement of poverty is composed with two fundamental steps- determining who is poor (identification) and building an index to reflect the extent of poverty (aggregation)". So far, a unidimensional measure has been used worldwide extensively by the policy maker to make a cut-off among poor and non-poor in the society. However government of India has taken number of development programs especially SDG goals, a good percentage of people are suffering from severe poverty. But India now is very concern about the overall development of the nation and numbers of SDG goals are implemented accordingly. As a result, massive changes come in all respect say, headcount ratio, intensity, MPI. Rural areas advanced more compared to urban areas as government has introduced many multifaceted welfare initiatives in the vulnerable zones. At the same time the important social indicators such as cooking fuel, sanitation, drinking water, electricity etc. comes in advance and modern alteration as needed. The main aim of this paper is to portray the extent of extreme poverty among states as well as between regions and social groups.

Key word: Poverty, Multidimensional Poverty Index (MPI), SDG goals, Deprivation
JEL classifications: 015,018,038

Introduction

Poverty does not arise only due to lack of income, money and monetary resources required to meet the basic needs rather it is highly correlated with other non-monetary factors. According to Amartya Sen (1976) "the measurement of poverty is composed with two fundamental steps- determining who is poor (identification) and building an index to reflect the extent of poverty (aggregation)". So far, a unidimensional measure has been used worldwide extensively by the policy maker to make a cut-off among poor and non-poor in the society. Perhaps Human Poverty Indicator (HPI) conducted by UNDP to complement the Human Development Index (HDI) in 1977 was the first influential multidimensional approach but HPI neither captured incidence of poverty nor nature of multidimensional poverty at an individual level. For a comprehensive understanding of poverty irrespective of monetary factors Multidimensional Poverty Index (MPI) contributed a world excepted concept of poverty measure where both monetary and non-monetary deprivation has included. The world Multi-dimensional Poverty Index was designed by Oxford Poverty and Human Development Initiative (OPHI) in collaboration with United National Development Program (UNDP) to feature it in UNDP's prestigious Human Development Report of 2010.

There are number of Sustainable Development Goal (SDG) has framed for different purpose. SDG 1 has made for achievements of ends of poverty in all forms established by United Nations in 2015. Poverty is the foremost issue that determines the overall development of a certain country. It is a challenging matter for policy maker which can reduce the inequality. In SDG1 seven major targets has been set to eradicate poverty say, (i) eliminate extreme poverty (target-1), end half of the total poverty (target-2), implement nationally

[††††] Dr. Chinmoy Sarkar, Assistant Professor in Economics, Siliguri College of Commerce, Siliguri, Darjeeling, West Bengal, 734001, Email. sarkar_chinu@rediffmail.com
[‡‡‡‡] Dr. Kanak Kanti Bagchi, Professor (Retd.), Department of Economics, University of North Bengal, Darjeeling, West Bengal, India. Email ID: kkbagchi@hotmail.com

appropriate societal protection system (target-3), national application of equal rights in the ownership, basic service, technology, and economic service (target-4), building resilience to environmental economic and social disaster (target-5), mobilization of resources for ending poverty (target-6) for the establishment of policies and frameworks aimed at eliminating poverty at all levels (targets-7). In these program total 14 indicators has assigned to measure the poverty systemically. As we know multidimensional poverty index (MPI) is employed to present the status of the people living below the poverty lines, it helps us to make comparison across the countries, states and regions. We also can use this method to locate poverty across the society, groups, caste, rural-urban segments. It is the most useful tools to classify the weakest people who are poorest of the poor in different angles. Sustainable development goal tries to eradicate poverty by implementing number of developmental strategies periodically. In this study we will discuss performance of SDG1 across the major states in India considering MPI measure with Alkira-Foster counting methodology.

Objective of the study

The primary purpose of the study is to depict the presence of severe poverty across the states, region and social groups. In this paper we have highlighted performance of SDG1 over headcount ratio, poverty intensity and MPI for the period of 2015-16 to 2019-21. Mainly we focused on the changes of incidence of poverty and intensity of poverty through MPI in urban and rural areas precisely. We have selected 10 large states based on the population density and area to assess the impact of SDG1 programs for overall development. Finally, the individual performance of social indicators is exercised to get relative contribution along with provided schemes.

Data and Methodology

To discourse the Multidimensional poverty with assigned indicators we have inculcated the data from a progress report 2023, organized by NITI Aayog, government of India. Besides we have used some other secondary information collected from other sources to make a valid trend of our thought. Total 10 major States (Maharashtra, Uttar Pradesh, Behar, West Bengal, Andhra Pradesh, Tamil Nadu, Gujarat, Rajasthan, Karnataka, and Madhya Pradesh) have been considered to judge the performance of SDG1 over poverty level. The States are selected according to their population density and overall areas of the state. We have exercised uncensored data to evaluate the changes of important social indicators. As sources available we have used the data of 2015-16 to 2019-21 to compare the changes of social indicators performances across the various strata of the states.

Government Expenditure on SDGs Targets

To meet the Sustainable Development Goal (SDG) in all respect government of India has allotted fund on number of social services. It comprises an extended set of many other aspects like education, sports, art and culture, medical and public health, family welfare, water supply and sanitation, etc. Special attention has been given for SCs, STs and OBCs categories of peoples. As days passes, the cost on these social schemes also increases. In the following table we can see overall total budgetary expenditure increased from INR 32.85 in trillion in 2014-15 to INR 60.72 trillion in 2019-2020 BE almost 54 percent has increased. For individual changes of social sector are quite remarkable observed in the span of the mentioned period. In table-2 the expenditure on social services as percentage to GDP has discussed periodically. Here we also observed the overall expenditure as percentage to GDP has been increasing with time.

Deprivation Status across the Major States

The findings of the evaluations of headcount ratio, intensity and MPI have been discussed in this section. The proportion of multidimensional poor individuals in the total population or the incidence of poverty is denoted by H. A is a measure of the extent of poverty, which is determined by approximate average. Conversely, MPI demonstrates the prevalence and intensity of multidimensional poverty and is calculated by considering the headcount and level of poverty. In the following table we can see that percentage of people for both H and A has decreased for all the states considered in this table in between two period 2015-16 to 2019-21. Maximum change of H observed in Uttar Pradesh, Bihar, Madhya Pradesh and Rajasthan. Similarly for A maximum development found in Bihar, West Bengal, Madhya Pradesh and Rajasthan. Overall progress of MPI also found in all the state discussed in this table.

We have shown the changes of H, A and MPI in rural and urban areas separately in this table. It is quite noticeable that overall development achieved for all indicators found in rural areas compared to urban portions. As rural areas were far from any development strategies, SDG1 decisions did impact much more on those areas. Similarly, we can see a good percentage of development of MPI happened in rural areas compered to urban side. These changes will be more perceptible if we see the diagrams related to this table. In these diagrams the blue shaded bar showed the changes of H, A and MPI in rural areas which is far better than changes in urban areas of same indices.

Multidimensional Poverty by Social Indicators

In this section we have discussed different social indicators have been used in MPI measure plays a very crucial role to indicate the overall growth of a nation with SDG goals implemented in development strategies. Mainly three dimensions of MPI has considered namely- education, health, and level of standard living and number of social indicators is considered under each dimension as follows.

In this table we have shown the changes of indicators for health and education dimension under uncensored headcount ratio. Under health dimension nutrition, child & adolescent mortality and maternal health are considered and is has found that maximum changes come in nutrition after maternal health compared to child & adolescent indicators for all the states. A good improvement has been observed in the years of schooling compared to school attendance indicator under education dimension. The result will be more observable by the diagrams drawn below based on that table.

In this table we have discussed the other important dimension standard of living under which number of indicators has considered. The changes of number of deprived populations in cooking gas, electricity, sanitation, lodging, assets and bank account for the period 2015-16 to 2019-21 has discussed below. The extreme variation has been found in cooking fuel and sanitation as compared to other indicators. Maximum fluctuations observed in Maharashtra, Bihar, Uttar Pradesh, Tamil Nadu, Andhra Pradesh and in Karnataka in case of cooking fuel and for sanitation we found in Maharashtra, Bihar, Madhya Pradesh, Rajasthan, Karnataka, Uttar Pradesh, Andhra Pradesh and in West Bengal. These all development has shown in the following diagram to picture out more visibly.

Conclusion and Policy Implications

As days goes on peoples became more efficient with modern technologies and they are more informed now about the actual picture of the world. So, incidence of poverty should negligible with progressive atmosphere of the society. But unfortunately, due some hindrance, limitation and other unavoidable circumstances aproximately16.4 percent people reportedly multidimensionally poor. However government of India has

taken number of development programs especially SDG goals, a good percentage of people are suffering from severe poverty. But our nation is now very concern about the overall development of the nation and number of SDG goals are implemented accordingly. As a result of that massive changes comes in all respect say, headcount ratio, intensity, MPI. Rural areas advanced more compared to urban areas as government has introduced many multifaceted welfare initiatives. At the same time the important social indicators such as cooking fuel, sanitation, drinking water, electricity etc. comes in advance and modern alteration as needed. A significant improvement has been observed in case of cooking fuel and sanitation as compared to other indicators. So, we can made inverse relation among SDG goals and poverty reduction over time. For better benefit of MPI government should take many other necessary initiatives in those places where maximum numbers of poor families are living. Proper funding in proper place should provide to get targeted benefits. Across the region, social groups fund should allot for better result of SDGs.

As the mission of Sustainable Development Goal-1 is “end poverty in all its form everywhere”, the government of India should focus on the emerging issues for better implementation of this goal to fulfilment of the aim “No Poverty” in India. On the basis of the above study the following policies may implement for the needful return of the SDG-1:

1. Different flagship programs say, swatch Bharat Mission, Beti Bachao Beti Padhao, Pradhan Mantri Awas Yojan, Pradhan Mantri Janadhan Yojana etc. should implement accurately in appropriate place.
2. Resources should mobilise across the countries to make available for better use.
3. As most of the people are deprived from drinking water, electricity and housing benefits, government should focus on those issues.
4. Policies need to be applied in health issues to develop maternal health, nutrition and child and adolescent mortality.
5. Need of effective education should be included in the polices so that school attendance and year of schooling can be improve.
6. On the basis of MPI index government should take necessary initiatives in those places where maximum number of poor families is living.

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Table-1: Trend in social service sector expenditure by government (combined Centre and States) in INR Trillion

Item	2014-15	2015-16	2016-17	2017-18	2018-19 RE	2019-2020 BE
Total Budgetary Expenditure	32.85	37.61	42.66	45.16	55.17	60.72
Expenditure on social services of which:	7.68	9.16	10.41	11.4	14.47	15.79
i. Education	3.54	3.92	4.35	4.85	5.81	6.43
ii. Health	1.49	1.75	2.13	2.43	2.92	3.24
iii. Others	2.65	3.48	3.93	4.13	5.74	6.12

Source: India's much forward- Progress on the SDGs

Table-2: Trend in social service sector expenditure by government (combined Centre and States) as percentage to GDP

Item	2014-15	2015-16	2016-17	2017-18	2018-19 RE	2019-2020 BE
Expenditure on social services of which:	6.2	6.6	6.8	6.7	7.6	7.7
i. Education	2.8	2.8	2.8	2.8	3.1	3.1
ii. Health	1.2	1.3	1.4	1.4	1.5	1.6
iii. Others	2.1	2.5	2.6	2.4	3	3

Source: India's much forward- Progress on the SDGs

Table-3: Headcount ratio, intensity and MPI across the major states in percentage

Major States	Headcount Ratio			Intensity			MPI		
	2015-16	2019-21	Changes	2015-16	2019-21	Changes	2015-16	2019-21	Changes
Uttar Pradesh	37.68	22.93	**-14.75**	47.60	44.83	-2.77	0.179	0.103	-0.077
Maharashtra	14.80	7.81	-6.99	43.75	41.77	-1.98	0.065	0.033	-0.032
Bihar	51.89	33.76	**-18.13**	51.01	47.40	**-3.61**	0.265	0.160	-0.105
West Bengal	21.29	11.89	-9.41	45.50	42.33	**-3.14**	0.097	0.050	-0.047
Madhya Pradesh	36.57	20.63	**-15.94**	47.25	43.70	**-3.55**	0.173	0.090	-0.083
Tamil Nadu	4.76	2.20	-2.56	39.97	38.70	-1.27	0.019	0.009	-0.0111
Rajasthan	28.86	15.31	**-13.56**	47.34	42.70	**4.63**	0.137	0.065	-0.005
Karnataka	12.77	7.58	-5.20	42.76	41.21	-1.55	0.055	0.031	-0.023
Gujarat	18.47	11.66	-6.81	44.97	43.25	-1.72	0.083	0.050	-0.012
Andhra Pradesh	11.77	6.06	-5.71	43.28	41.12	-2.16	0.051	0.025	-0.026

Sources: MPI- Progress Review, NITI Aayog, 2023

Table-4: Rural-urban comparisons on changes of Headcount ratio, intensity and MPI across the major states in percentage

	Headcount Ratio		Intensity		MPI	
	Rural	Urban	Rural	Urban	Rural	Urban
Uttar Pradesh	-17.94	-6.15	-2.76	-2.78	-0.093	-0.032
Maharashtra	-11.25	-2.47	-2.04	-1.72	-0.052	-0.011
Bihar	-19.05	-7.18	-3.62	-3.07	-0.111	-0.040
West Bengal	-10.50	-6.52	-3.13	-3.10	-0.052	-0.032
Madhya Pradesh	-20.58	-6.61	-3.75	-2.11	-0.107	-0.031
Tamil Nadu	-4.29	-0.96	-1.37	-0.88	-0.018	-0.004
Rajasthan	-15.91	-6.67	-4.80	-3.40	-0.085	-0.031
Karnataka	-9.12	-1.70	-1.51	-1.74	-0.036	-0.008
Gujarat	-2.54	-2.69	-1.63	-2.40	-0.048	-0.013
Andhra Pradesh	-7.01	-2.43	-1.91	-4.20	-0.032	-0.011

Sources: MPI- Progress Review, NITI Aayog, 2023

Table-5: Percentage of total population deprived in each indicator of Health and Education (uncensored headcount ratio)

	Health			Education	
	Nutrition	Child & Adolescent Mortality	Maternal Health	Years of Schooling	School Attendance
Uttar Pradesh	-8.04	-1.43	-5.41	-4.31	-0.99
Maharashtra	-3.81	-0.31	-0.63	-0.63	-1.86
Bihar	-9.68	-0.45	-8.40	-3.97	-1.91
West Bengal	-6.33	-0.43	-2.95	-2.96	-1.70
Madhya Pradesh	-10.86	-1.28	-7.98	-3.92	-1.63
Tamil Nadu	-5.60	-0.31	-3.38	-1.92	-0.27
Rajasthan	-8.53	-0.81	-5.16	-7.03	-4.23
Karnataka	-3.60	-0.05	-0.22	-1.54	-1.03
Gujarat	-3.27	-0.40	-2.05	-1.88	-1.62
Andhra Pradesh	-3.44	-0.55	-1.11	-1.09	-1.00

Sources: MPI- Progress Review, NITI Aayog, 2023

Table-6: Percentage of total population deprived in each indicator of Standard of living (uncensored headcount ratio)

	Standard of living						
	Cooking Fuel	Sanitation	Drinking water	Electricity	Housing	Assets	Bank account
Uttar Pradesh	-15.93	-32.04	-1.60	-9.09	-1.79	-6.81	-4.79
Maharashtra	-19.42	-19.61	-3.08	-6.25	-0.25	-1.00	-0.62
Bihar	-19.62	-22.70	-0.48	-9.75	-0.46	-8.80	-4.01
West Bengal	-11.76	-15.90	-4.50	-6.72	-0.61	-3.42	-2.76
Madhya Pradesh	-10.36	-29.63	-7.52	-12.09	-1.50	-9.60	-4.71
Tamil Nadu	-8.96	-19.60	-0.34	-6.79	-0.36	-3.99	-3.78
Rajasthan	-9.38	-24.88	-8.94	-6.87	-10.18	-9.73	-1.85
Karnataka	-24.07	-17.02	-2.38	-0.82	-1.10	-2.74	-3.85
Gujarat	-14.05	-11.04	-2.40	-1.31	-0.94	-2.23	-5.02
Andhra Pradesh	-21.81	-23.54	-3.19	-0.21	-2.88	-2.85	-1.17

Sources: MPI- Progress Review, NITI Aayog, 2023

Figure-1: Rural-urban comparisons on MPI across the major states in percentage

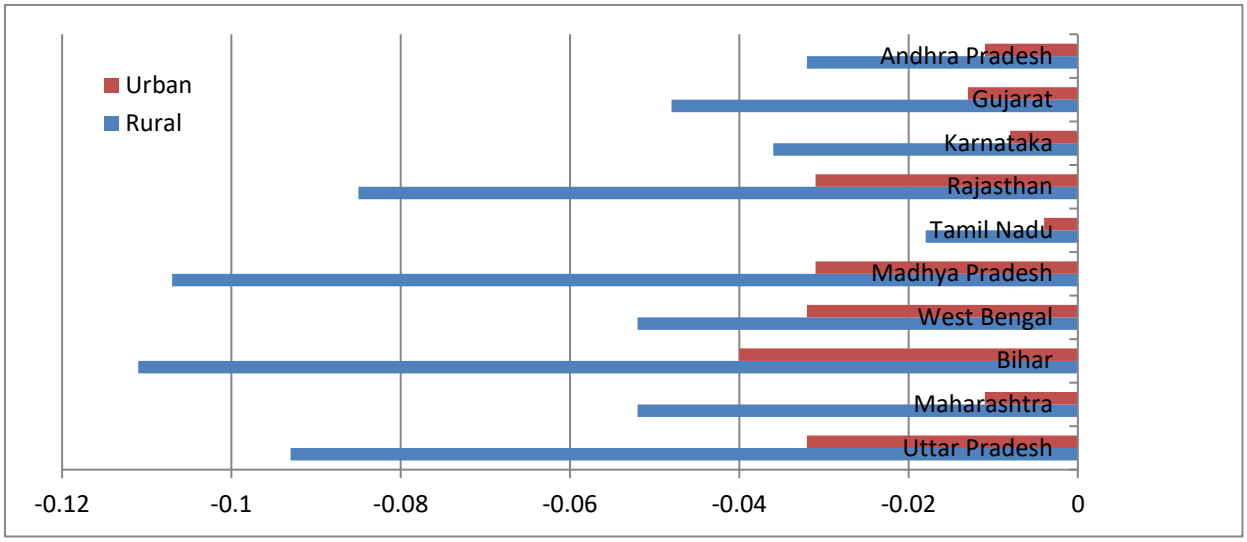

Figure-2: Rural-urban comparisons on intensity across the major states in percentage

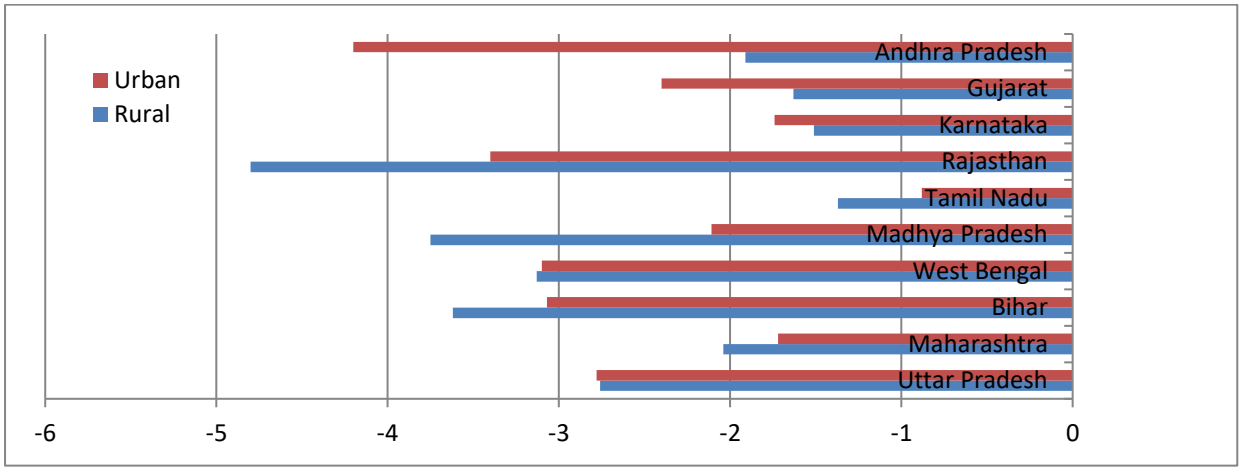

Figure-3: Rural-urban comparisons on Headcount ratio across the major states in percentage

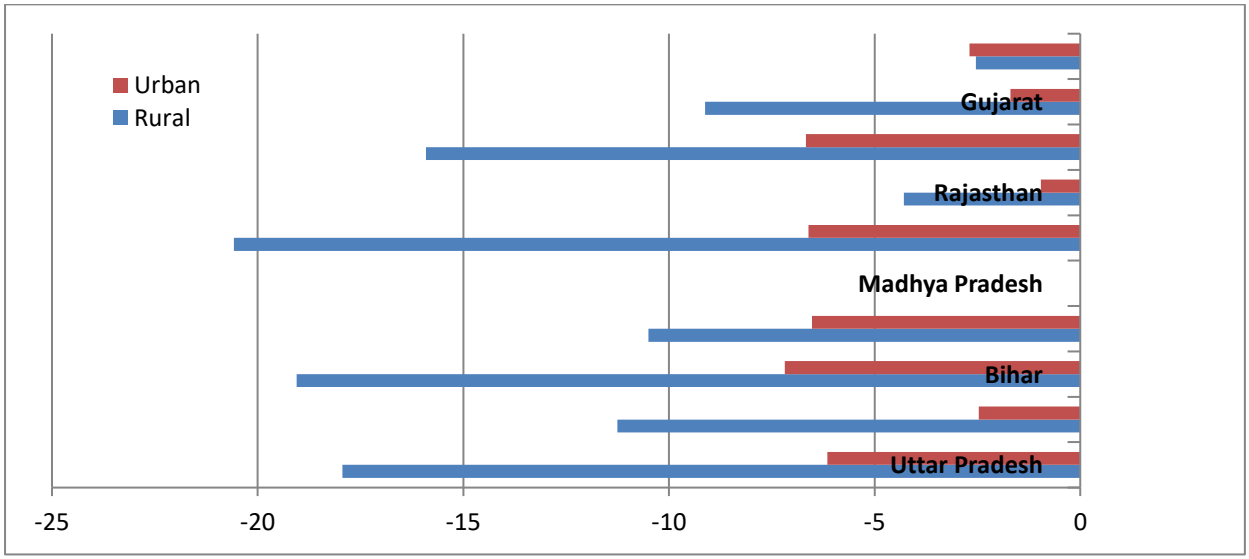

Figure-4: Percentage of total population deprived in each indicator of Health

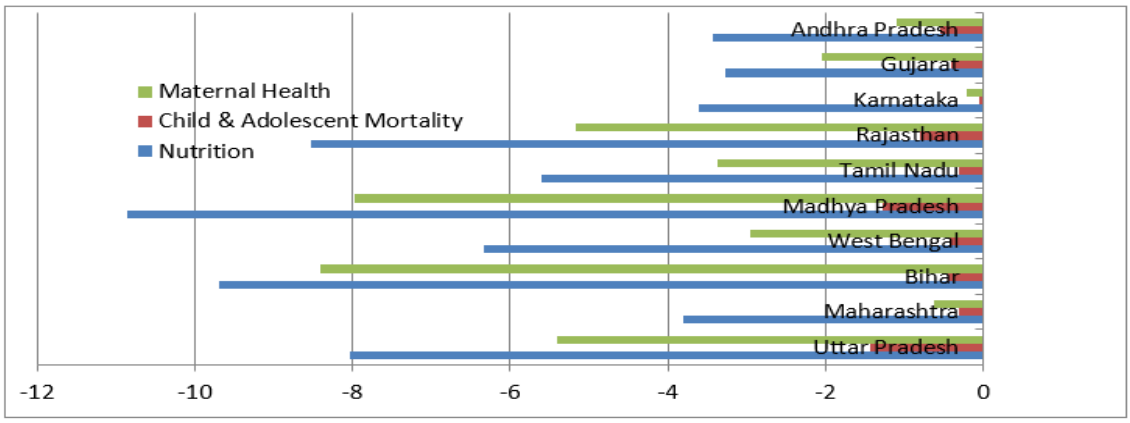

Figure-5 : Percentage of total population deprived in each indicator of Education

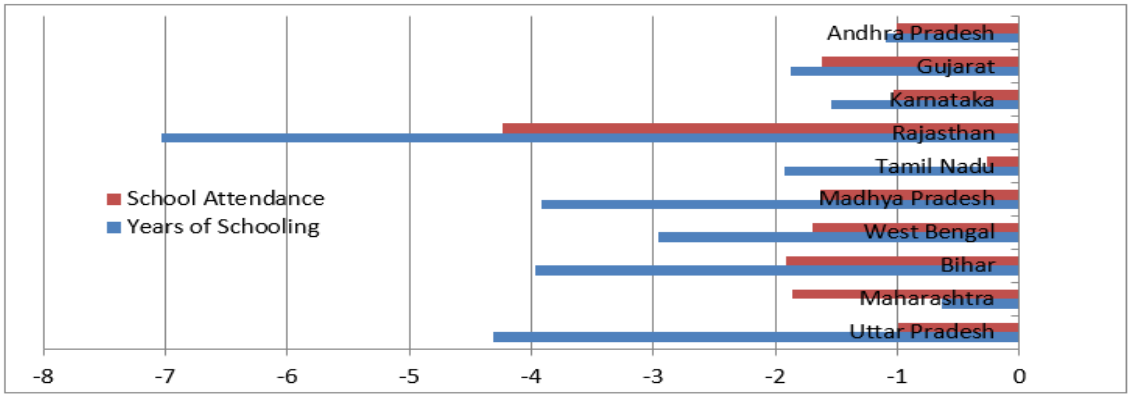

Figure-7: Percentage of total population deprived in each indicator of Standard of living