# Efficiency of Higher Education System in India : A State-wise Analysis

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## ABSTRACT

Higher education (HE) sector in India has experienced unprecedented growth in terms of quantity. The striking growth of higher education institutions and enrolments has put India on the track of massification of this sector. But with this massification Higher education Institutes are facing quality issue. Due to the quality concerns, questions are raised about public funding to this sector which is becoming increasingly scarce, particularly as competition increases from other recipients such as healthcare system.The efficient use of resources and quality have become the central concerns for the higher education sector in India and are attracting considerable attention nowadays.

In this light this paper proposes to analyse the efficiency of higher education system in India and its regional disparity. For this efficiency scores are computed for the higher education systems of the state with Data Envelopment Analysis (DEA)

Technique takingtwo input variables -number of Higher Education Institutions (HEIs) and number of teaching faculties, and two output variables – total students enrolled and number of outturn/ pass outs. It is found that regional disparity related to efficiency of higher education system in India exists. On the basis of efficiency score states are classified as highly efficient,less efficient and highly inefficient states.

**Key words**: Higher Education, Technical Efficiency, Data Envelopment Analysis, Efficiency Score.

## I. Introduction

The Indian economy is striving to get benefited from its large demographic dividend.This dividend could be encashed only if we provide quality education to our youth. As far as quantity is concerned, the expansion of higher education has already taken place. The number of Universities grew from 490 in 2005-06 to 993 in 2018-19 and the number of colleges increased from 20,769 in 2005-06 to 39,931 in 2018-19. Alongside the expansion in the number of institutions, the gross enrolment ratio (GER) also increased from 11.6 percent in 2005-06 to 26.3 percent in 2018-19 (Department of Higher Education, 2008; 2019). The striking growth of higher education institutions and enrolments has put India on the track of massification of this sector.But with this massification Higher education Institutes are facing crunch of faculty, infrastructure and funds. Public funding to this sector is becoming increasingly scarce, particularly as competition increases from other recipients of public funds such as healthcare. Another added concern with respect to higher education system in India is quality as the Indian universities do not appear anywhere in the global rankings. So many policymakers have found themselves asking



whether higher education institutions are using their resources productively or not.Thus productivity, efficiency and quality are central concerns for the higher education sector and attracting considerable attention among policy makers now a days.

Though there is resource crunch in higher education it is the urgent need that these resources should be utilised at maximum level, this is what we mean by efficiency of higher education system in India. The efficiency of higher education has its own regional dimension in India. Some states are producing the higher outputs while some are not. But for analysing the output performance inputs should also be taken in consideration then only the efficiency analysis will have its meaning.

In this light the present research analysis the efficiency of higher education system in India and its regional disparity. The efciency can be understood to imply the maximum possible output from a given set of inputs. The present paper is divided into sevensections. The section1 deals with the introduction. The section 2 deals with the review of literature, section 3 with objectives and section 4 with methodology.The section 5 deals with the state-wise current statusof Higher Education in India. The section 6 deals with the analysis of the efficiency of Higher education systems of the states in India. The section7 gives the conclusion and suggestions.

## II. Review of Literature

Empirical studies have done earlier to measure the efficiency of institute or units, may be higher education institutes or other with the help of Data Envelopment Analysis or other methods. Few of them which used DEA method are explained below.

Cooper, Charnes and Rhodes (1978) introduced the

technique DEA. It is a non-parametric technique to find the relative efficiencies of decision-making units (DMUs) incorporating multiple inputs and multiple outputs. In very short span of time, DEA has grown rapidly as a powerful analytical tool for measuring the performance. This tool has provided new insights to the entities worldwide for example use of DEA tool has provided better benchmarks in various applied studies. After, the work of Cooper, Charnes and Rhodes (1978), this field has been greatly explored by the various researchers e.g. Banker, Charnes, Cooper (1984). In recent years, DEA has flourished in many areas such as banking, hospitals, energy and environment etc. Avkiran (2001) used Data Envelopment Analysis (DEA) approach to examine the technical efficiency of Australian universities. Three performance models have been developed, namely, over all performance, performance on delivery of educational service sand performance on fee, payment enrolments. The study states that DEA is appropriate when the efficiency of an institution inconverting multiple inputs into multiple outputs is to be measured. The findings show that Australian universities are technically efficient. The performance modelsused in the study adequately discriminate between technically efficient and inefficient universities.

Salerno (2002) used DEA to assess the relative efficiency of 183 research and doctoral granting institutions in 1993. Three different models were estimated. Institutions were first grouped into two quality tiersand separate technical efficiency analyses were conducted. Both used the same input and output measures and were estimated using a VRS DEA model. Scale efficiency was estimated and he also examined whether efficiency scores differed by type of institutional control and the presence of medical facilities. The third model was a constant returns to scale (CRS) DEA analysis of 35 public universities from the



183 from which estimates were made of overall, technical, and allocative efficiency. Three labor inputs were specified (all FTEs): 1) faculty members, 2) graduate teaching assistants, and 3) graduate research assistants. On the output side, he included three education outputs (lower-level undergraduates, upper-level undergraduates, and graduate students) measured by FTE enrolments and publication counts as a proxy for research. In the cost analysis, input prices were also included

Abbott and Doucouliagos (2003) did a third study on the efficiency of Australian universities, again using 1995 data collected from DEETYA. In total they developed and present findings for four DEA models. Two were conducted using all 36 institutions and two truncated samples were also analyzed. For the latter, analysis groups were constructed based on the ratio of each institution's research to teaching output (i.e. output mix). By and large the authors suggest that, overall, efficiency appears high and that Australian universities were performing very well. No implications for higher education policy are offered, though they do admit improvements in efficiency cannot be ruled out. At the same time they conclude that there is a high degree of homogeneity in the system yet, because DEA only provides relative efficiency scores, it may be the case that the entire system is under-performing.

Benneyanet al. (2007) applied DEA to identify the countries with most efficient healthcare systems. Almost 65 countries were identified on following six key dimensions - clinical outcomes, health adjusted life years, access, equity, safety and resources. The results reported only few countries to be efficient and suggested improvement measures.

Cunha and Rocha (2012) applied DEA technique to evaluate the comparative efficiency of public higher education institutions in Portugal. The analysis is performed for three

separate groups: public universities, public polytechnics and the several faculties of University of Porto. By using several inputs and outputs at the institutional-level, they identified the most technically efficient institutions that may work asbench marking thesector. There resultssuggestthatagreatportionof institutions may be working inefficiently, contributing to a significant waste of resources.

Overall, the literature has been confirming that DEA is commonly used to measure the efficiency of institutions. Most of the studies indicate that technical inefficiency is a common phenomenon in higher education around the world. But many studies explained in efficient use of resources over the most recent years, especially among public funded institutions, with the suggestions to pay attention in this regard.As explained above the optimum use of resources is must for the development of a system and with the measurement of efficiency the performance of a system is assessed. The gap which is identified by the review of literature that not a single study focused to measuring the efficiency of Higher Education System of states in India sothe present research which offers state-wise analysis of efficiency of higher education systemhas a significance of developing insight into the quality and disparity in higher education system in India.

## III. Objectives

The majorobjectives of thepresent research are as follows:

1. To measure the efficiency of the higher education system of the states in India.
2. To find out the disparity among states regarding the efficiency of higher education system and classify the states according to their efficiency levels.



## IV. Research Methodology

This research is basically a descriptive type of research explaining about the efficiency and disparity of Higher education system in India. Efficiency, in particular, technical efficiency, is the comparison between inputs used in a certain activity and the produced outputs and their optimal values (Worthington,2001). Previous studies which aimed at analysing the efficiency of higher education institutions used this non-parametric approach of Data Envelopment Analysis (DEA). When multiple inputs and outputs are used to measure the efficiency of decision making units (DMUs), DEA is applied that involves the use of linear programming methods to construct a non-parametric frontier to evaluate the relative input-output efficiency of a Decision Making Unit (DMU). That is why the present research also used DEA to measure the efficiency of of higher education systems of 29 states in India.

DEA evaluates the relative efficiency of each DMU in a group of DMUs in which all members are use an identical set of inputs to produce a variety of identical outputs.DMUs are the targets of evaluation under DEA technique which perform the same type of functions and having identical goals and objectives. They could be firms, government bodies, non-profit institutions or even states and countries. When a DMU attains the optimal level of output witha given amoun tofin puts, taking technology as given ,the DMU is said to be technically efficient which means that it is operating at the production possibility frontier. Efficiency measures are thus calculated relatively to this frontier.

Inthisstudy, DEA is performed usingan output-orientationperspective with assuming variable returns to scale (VRS). Under VRS, an increase in inputs is expected to result in a disproportionate increase in the outputs i.e.,

decreasingreturns, increasing or constant.

It is to be noted that despite the optimal level of efficiency of DMUs is computed, thisisamaximizationproblem becauseanoutput-orientation analysis is performed,where the output is triedtomaximise with thegiven level of inputs.

The DEA output oriented VRS Linear Programming Model used for the analysis is as follows:

Max $_{\phi,?}\phi$

Subject to $-Y\lambda + \phi y_i \leq 0$

$X\lambda - x_i \leq 0$

$N1'\lambda = 1$

$\lambda \geq 0$

Here $\phi$ is a scalar which varies between 1 and $\alpha$ and $\phi$ -1 is a proportional increase in output that $DMU_i$ could be achieved, having input quantities held constant. Whereas $1/\phi$ measures technical efficiency and varies between 0 to 1. It measures the distance between $DMU_i$ and the efficiency frontier or best practice frontier. With $1/\phi$ <1, the $DMU_i$ is inside the frontier and is called inefficient, while with $1/\phi = 1$ the $DMU_i$ is efficient and lies on the frontier. The vector ? is a (n × 1) vector of constants that measures the weights used to compute the location of an inefficient DMU, if it were to become efficient, and N1 is an n-dimensional vector of ones. The restriction N1' ?=1 imposes convexity of the frontier implying for variable returns toscale.

### ❖ Input- Output Variables and Data Collection

Prior to the implementation of DEA, inputs and outputs are to be defined. After reviewing the literature, number of Higher Education Institutions (who responded for AISHE. 2019)and total faculty available in higher educationin 2018-19 in the state are considered as inputs for DEA application. These



inputs work as the main resources required for the normal performance of Higher Education Institutions in the state. As outputs, we have considered the total students enrolled and total pass outs at all levels in 2018-19 in the state . Thetotalnumberof scholars enrolled and pass out Ph.D. and M.Phil. degrees can be understood as a proxy for the research capacity of the institutions (Kantabutra and Tang, 2010). These two outputs also reflect the teaching activity of HEIs. All these data refer to the year 2018-19 was collected from All India Survey of Higher Education (AISHE) 2018-19. To avoid the problem of overlapping only the set of these two input and outputs were used. Though the number of inputs and outputs are very limited but actually they represent the other indicators also. The researcher also wanted to incorporate some other variables such as, the number of research papers published in reputed journals, number of students employed but state-wise data were not available so those variables could not be included in the study.

### ❖ Classification of States

After computing the efficiency scores the states are classified as highly efficient, less efficient and highly inefficient states on the basis of the global efficiency scores. The formula for clustering is used as: (Maximum Score-Minimum Score)/3.

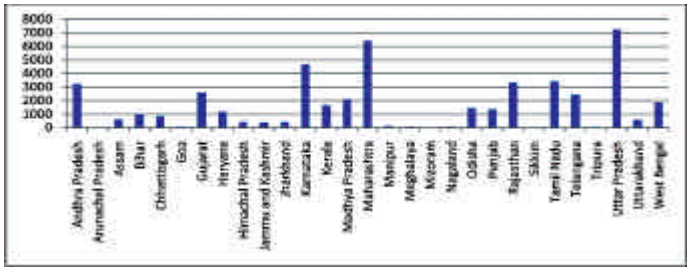
## V. State-wise Analysis of Higher Education System in India

The higher education system in India could be analysed with the help of number of institutions of Higher Education, number of faculty available, students' enrolment, and pass-out students. In India total 51,649 institutions are registered across states to provide higher education to 37.399 million studentswith1.416 million faculty members generating 9.092

million pass-outs (Department of Higher Education, 2018-19). Figures 1,2,3and 4 present the state-wise status of higher education in India.The state-wise analysis shows that there is wide regional disparity among states regarding Higher education system in India. Figure 1,2 &3 show that some states are havinglarger number ofhigher education institutions and faculty members such as Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu, Rajasthan, Gujrat, Telanganaetc. whereas some states like all north-eastern states,Jharkhand, Goa, Jammu Kashmir, Himanchal, Uttarakhan, Chhattisgarh, Bihar etc. are having less numbers.

**Figure 1:**

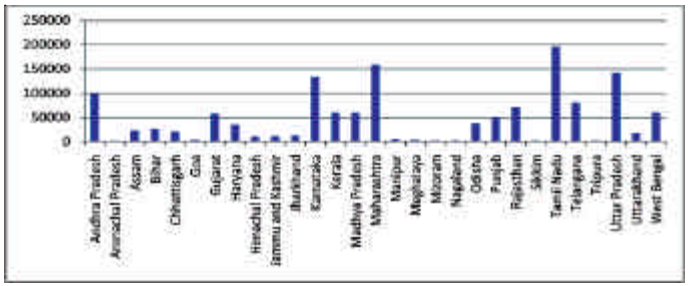
**Number of Higher Education Institutions in States (2018-19)**




*Source: Constructed from the data collected from AISHE-2018-19*

**Figure 2:**

**Total Teachers Available in Higher Education Institutions in States (2018-19)**




*Source: Constructed from the data collected from AISHE-2018-19*

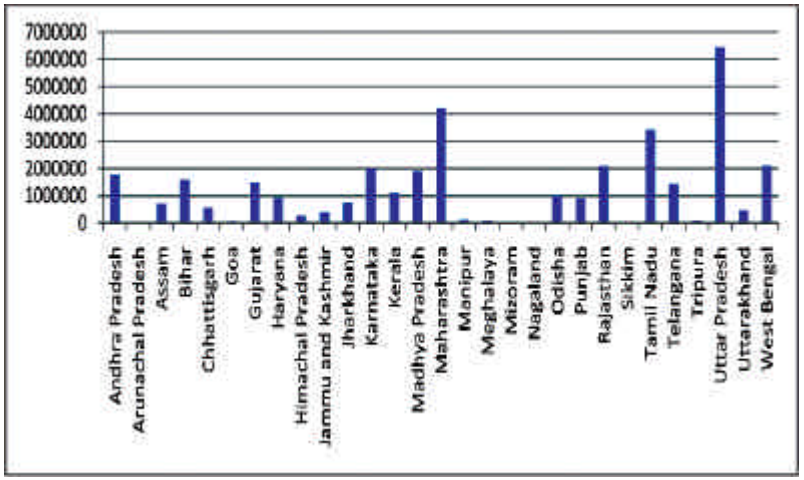


As far as the output is concerned the total number ofstudents and of pass-outs also vary according to states (figure 3 and 4). Some states have large enrolment and are producing larger number of pass-outs such asUttar Pradesh, Karnataka, Tamil Nadu, Maharashtra, etc. whereas others are having less number. Some states like Telangana and Gujrat have large number of students and faculty members but enrolment and number of pass-out students are less according to that.

On the basis of mere absolute figures it is very difficult to say which states are performing efficiently in higher education. Because absolute figures show that most of thestates which are producing higher outputs are also taking more inputs. So with the help of Data Envelopment analysis efficiency is tried to measure.

**Figure 3:**

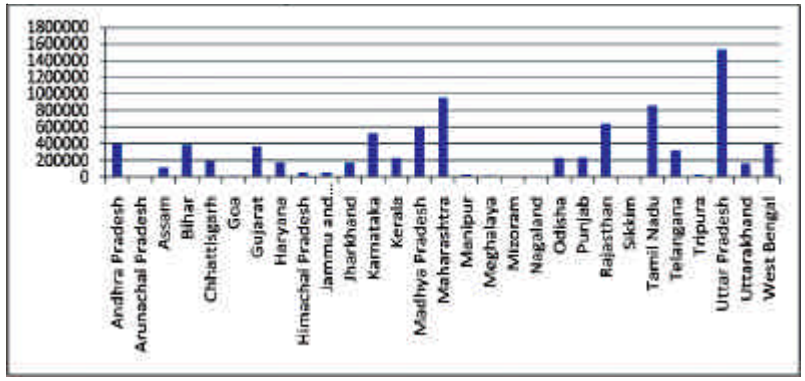
**Total Students Enrolled in Higher Education Institutions in States**




*Source: Constructed from the data collected from AISHE-2018-19*

**Figure 4:**

**Total Pass outs in Higher Education Institutions in States**




*Source: Constructed from the data collected from AISHE-2018-19*

## VI. State-wise Analysis of Efficiency in Higher Education with the Help of Data Envelopment Analysis (DEA)

To analyse the efficiency of Higher Education Systems of various states Data Envelopment Analysis technique is applied. The results are given in Table 1.

**Table 1:**

**Efficiency Scores of Higher Education Systems of States in India (2018-19)**

| State | GES | PTE | SES | Operating Scale | State | GES | PTE | SES | Operating Scale |
|---|---|---|---|---|---|---|---|---|---|
| Andhra Pradesh | 0.298 | 0.53 | 0.563 | DRS | Manipur | 0.511 | 0.533 | 0.959 | IRS |
| Arunachal Pradesh | 0.526 | 1 | 0.526 | IRS | Meghalaya | 0.609 | 0.655 | 0.93 | IRS |
| Assam | 0.63 | 0.683 | 0.922 | DRS | Mizoram | 0.359 | 0.5 | 0.718 | IRS |
| Bihar | 1 | 1 | 1 | - | Nagaland | 0.316 | 0.442 | 0.716 | IRS |
| Chhattisgarh | 0.641 | 0.646 | 0.991 | IRS | Odisha | 0.441 | 0.525 | 0.839 | DRS |
| Goa | 0.427 | 0.465 | 0.918 | IRS | Punjab | 0.418 | 0.525 | 0.796 | DRS |
| Gujarat | 0.445 | 0.546 | 0.815 | DRS | Rajasthan | 0.627 | 0.794 | 0.79 | DRS |
| Haryana | 0.434 | 0.533 | 0.815 | DRS | Sikkim | 0.783 | 1 | 0.783 | IRS |
| Himachal Pradesh | 0.449 | 0.462 | 0.972 | IRS | Tamil Nadu | 0.606 | 1 | 0.606 | DRS |
| Jammu and Kashmir | 0.585 | 0.592 | 0.987 | IRS | Telangana | 0.319 | 0.525 | 0.607 | DRS |
| Jharkhand | 1 | 1 | 1 | - | Tripura | 0.727 | 0.883 | 0.823 | IRS |
| Karnataka | 0.285 | 0.495 | 0.576 | DRS | Uttar Pradesh | 0.751 | 1 | 0.751 | DRS |
| Kerala | 0.362 | 0.522 | 0.693 | DRS | Uttarakhand | 0.679 | 0.709 | 0.957 | DRS |
| Madhya Pradesh | 0.722 | 1 | 0.722 | DRS | West Bengal | 0.612 | 0.925 | 0.662 | DRS |
| Maharashtra | 0.438 | 0.727 | 0.602 | DRS | India | 0.466 | 1 | 0.466 | DRS |

*Source: Computed*

*Note: GES = Global or Overall Efficiency Score, PTE = Pure Technical Efficiency Score and SES= Scale Efficiency Score; IRS = Increasing Returns to Scale, DRS=Diminishing Returns to Scale*

The efficiency scores are ranging from 0 to 1. Some states having 1 efficiency score are highest efficient and lying on the production frontier whereas states having less than 1 are not efficient. The higher the value of efficiency score the higher will be the efficiency of the higher education system of the state which means that the state is efficiently using its resources and trying to give higher outputs with given resources. The global efficiencyscoreis equal to the multiplication of pure technical efficiency and scale efficiency scores. Though India is technically efficient means trying to utilise the resources utmost but the global efficiency score and scale efficiency score of India show that its higher education system has a large scale than required and is not much efficient. It is working under deceasing returns to scale (DRS) so to be efficient it needs to reduce the scale of higher education system looking at current output to gain the efficiency.

Bihar and Jharkhand are the states which are making the efficiency frontier and are having fully efficient higher education system. The pure technical efficiency as well as scale efficiency of these states are also equal to one which means they are fully utilising the inputs and operating at appropriate scale looking

at given inputs level.The scale efficiency scores show Andhra Pradesh, Karnataka, Tamil Nadu, Telangana, Maharashtra, West Bengal, Kerala are working at DRS and need high reduction in scale means downsize the system to operate efficiently whereas other states operating under DRS (table 1) need slight reduction.

Similarly Arunachal Pradesh is operating at very low scale and it needs to increase the scale a lot to gain efficiency. Other states operating under IRS (table 1) need to expand their higher education system.

Along with Bihar and Jharkhand the states of Arunachal Pradesh, Madhya Pradesh, Sikkim, Tamil Nadu and Uttar Pradesh have technical efficiency score equal to one and there is no possibility of increasing the output without changing the scale.

The states are classified according to the efficiency of their higher education systems in Highly efficient, moderately efficient and less efficient states. Table 2 gives the classification.

**Table 2:**
**Classification of States according to the Efficiency Score of Higher Education System**

| Class | Name of States(Rank) | Number of States |
|---|---|---|
| Highly Efficient (0.667-1) | Bihar (1), Jharkhand (1), Sikkim (3), Uttar Pradesh (4), Tripura (5), Madhya Pradesh (6), Uttarakhand (7), Chhattisgarh (8), Assam (9) | 9 |
| Less Efficient (0.333-0.667) | Rajasthan (10), West Bengal (11), Meghalaya (12), Tamil Nadu (13), Jammu & Kashmir (14), Arunachal Pradesh (15), Manipur (16), Himachal Pradesh (17), Gujarat (18), Odisha (19), Maharashtra (20), Haryana (21), Goa (22), Punjab (23), Kerala (24), Mizoram (25) | 16 |
| Highly Inefficient (0-0.333) | Telangana (26), Nagaland (27), Andhra Pradesh (28), Karnataka (29) | 4 |

*Source: Computed*

*Note: Clustering is done with the help of the Formula= (Maximum-Minimum)/3,*

Table 2 shows that the number of highly efficient states is 9 (31 per cent) out of 29 states of India which were analysed. Sixteen states are moderately efficient states which is more than 50 percent of States (approx 55 per cent) and only four states (14 per cent ) are highly inefficient states.

The analysis of table 1 and 2 clearly indicate the fact that higher education systems of most of the states in India are less efficient and they are not utilising the resources optimally for the development of Higher Education in India. The states which are producing large number of graduates, post graduates, research scholars etc. such as Maharashtra, West Bengal, Karnataka, Tamil Nadu are also not performing efficiently.Whereas the higher education system in Bihar, Jharkhand, Assam, Sikkim, Tripura is small in size but working efficiently. The results again supports the argument that higher quantity does not mean higher quality or efficiency. The states which are producing the higher number of students pass-outs also using larger resources than the states which are making the efficiency frontier. Bihar and Jharkhand which are found to be efficient are having less number of HE institutions and teachers (figure 1 and 2) but relatively providing college education to the higher number of students and producing higher number of pass-outs at all level as compared to the states with larger system of higher education such as Maharashtra, Telangana, Andhra Pradesh and Karnataka. Here it is to be understand that DEA

compute the efficiency score on the basis of maximum output with given level of resources and on that basis the findings are explained. The lower efficiency here does not mean the lower quality of higher education in the state. The study only tries to give an indication to the states which are found less efficient or inefficient that the system of Higher Education is not working there at its full capacity. There is a need to increase the accessibility of students to higher education and provide them the opportunities and facilities to complete their education.

## VII. Conclusion

The higher education system decides the knowledge power of a country. To take benefit from its demographic dividend India needs to focus on providing quality Higher education to its Youth. Since there is resource crunch in higher education it is the urgent need that these resources should be utilised at maximum level, this is what we mean by efficiency of higher education system in India. But the analysis shows that higher education systems in most of the states are very inefficient as compared to Bihar and Jharkhand which form the frontier and having efficiency score of one. The states of Sikkim, Uttar Pradesh, Tripura, Madhya Pradesh, Uttarakhand, Chhattisgarh and Assam are having comparatively more efficient higher education system in India as compared to other states. There is an alarming situation for the states of Andhra Pradesh and Karnataka which are not able to score even 0.3 and performing under DRS. Along with them Tamil Nadu, Telangana, Maharashtra, West Bengal, and Kerala also need to downsize the system of higher education to operate efficiently. Arunachal Pradesh, Mizoram and Nagaland are the states operating at IRS and should expand their higher education system to operate efficiently. If optimal use of resources is ensured than only India will be able to achieve its policy goals of Higher education. So states have to seriously take the issue of efficiency while making policy for higher education and its implementation at the priority.



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# The Status of Financial Inclusionin Assam: Evidence From Secondary Data

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## ABSTRACT

Economic growth is harmonious and sustainable when it is inclusive in nature. By the beginning of the new millennium, concerns have been raised about the inclusiveness of the growth process. In this context, it is imperative to usher in an acceptable degree of financial inclusion, especially in rural areas so that the large mass of the population that are deprived of the basic banking facilities, can be brought within the ambit of the financial system. This would enhance rural investment, enterprise, and income, which ultimately will lead to higher growth for the state.Keeping in mind the urgent need of the term "financial inclusion", it has become a major agenda in government policy which aim to provide basic banking facilities to the rural people at an affordable cost. The objective of financial inclusion is to extend the scope of activities of the organised financial system to include the poor and excluded sections of people within its circle. In this context, the paper mainly focuses on the services provided by the banking sector, while explaining the status of financial inclusion in the state.

Along with this, the paper makes a comparative studyof the state with the all India level in various financial inclusion aspects such as availability and outreach services of financial inclusion.
**Key Words :** Sustainable, inclusive, financial, banking, investment, policy

## 1. Introduction

Economic growth is harmonious and sustainable when it is inclusive in nature. By the beginning of the new millennium, concerns have been raised about the inclusiveness of the growth process. In this context, it is imperative to usher in an acceptable degree of financial inclusion, especially in rural areas so that the large mass of population that are deprived from the basic banking facilities, can be brought within the ambit of the financial system. This would enhance rural investment, enterprise, and income, which ultimately will lead to higher growth for the state. Besides, it is globally accepted that financial inclusion will promote social inclusion and will result in a much more cohesive social and economic order (Levine, 1997). Keeping in mind the urgent need of the term "financial inclusion", it has become a major agenda in government policy which aim to provide basic banking facilities to the rural people at an affordable cost. The objective of financial inclusion is to extend the scope of activities of the organised financial system to include the poor and excluded sections of people within its circle. Moreover, for promotion and development, a fund to improve the credit absorption capacity of the rural people is necessary.

In India, there has been a growing importance of



implementing various policies under financial inclusion scheme. But, it has been noticed from time to time that the banks were unable to reach the vast section of rural people and bring them under the banking network. The excluded groups are basically small and marginal farmers, rural artisans, women, informal workers. These sections of population which can be located in rural areas are therefore bound to depend upon the informal financial sources. But due to the high interest rates and other social costs associated with the informal sector, the dependence on informal sector becomes more costly as it seems to be. Chakrabarty (2009) also highlights the fact. Thus, the urgency of attaining financial inclusion position can be felt.The urgency of providing credit and other banking facilities to the excluded class first came in to action from the nationalisation of banks in 1969. The main thrust of this act was to transform banking from 'class banking' to 'mass banking'. Setting up of regional rural banks was another milestone in this regard. The period of 1969 to 1991 can be characterized as a period of huge branch expansion, leading to less number of populations per branch. In this regard, Goyal (2008) observed that the significance of informal sector also declined during this period.Although there was expansion of formal banking services, it was soon felt by the banking system that small and marginal borrowers are not bankable and lending to such a target group were not profitable in a competitive market. There existed sub optimal use of credit in the system which lowered investment and growth. Hence, the banking infrastructure demanded the Government to initiate reforms measures in the economy in 1991. Kumar et al (2005) has also explained the incidence in their study.The post reform period was signified as major turning point of the Indian banking system, but very soon it turned in to a different direction. Mohan

(2006) observed that banks started to prefer their customer to gain profit on the first place rather than to expand credit among the excluded people. The overall picture of the so called "mass banking" structure of the banking system changed due to the mixture of preferred zone of creditors and a rising number of bad debts. This, in turn, reduced the amount of credit supply in the economy from 43 percent in 1991 to 31 percent in 2001. However, in 2006, the percentage increased to 35 percent. According to the data provided by All India Debt and Investment Survey, the share of money lenders showed an upward trend in 2002 than that of in 1991. In 2002, the share of moneylenders rises to 29.6 percent whereas the percentage was 15.7 in 1991.The picture of Assam regarding the position of financial inclusion was not at all satisfactory. According to census 2001, the percentage of people accessing formal banking services in Assam stood at a mere rate of 20.5 percent against the national average of 35.5 percent. According to the Situation Assessment Survey of Farmers, 2003 (NSSO), in a majority of states, the outstanding debt of farmers was financed more by the institutional agencies than the non-institutional agencies. However, in a few states such as Andhra Pradesh, Rajasthan, Assam, Bihar and Punjab; the financing of debt was more by non-institutional sources. The survey revealed that in Assam, 62.6 percent farmers depended upon the informal sources of credit while 37.5 percent of the farmers' population depended upon the formal institutional sources. However, at all-India level, the percentage of people depended upon informal sources was 42.4 percent and 57.7 percent people were availing credit facilities from formal sources.

With this background, the paper focuses on the services provided by the banking sector, while explaining the status of



financial inclusion in the state.Along with this, the paper makes a comparative studyof the state with the all India level in various financial inclusion aspects such as availability and outreach services of financial inclusion.

## 2. Data Source

The paper is basically based on secondary data. Data representing various aspects of financial inclusion in the state have been assembled from various publications of the Reserve Bank of India, reports of State Level Bankers' Committee (SLBC), Census of India, various publications of NABARD and planning commission, All India Debt and Investment Survey (AIDS), publications under Government of Assam viz. Directorate of Economics and Statistics, Planning and Development Department and various independent research and reports.

## 3. Line of Analysis and Outcomes

The banking sector plays a significant role in implementing the financial inclusion policies in an economy. Hence, while discussing the status of financial inclusion, the paper seeks to study the situation of accessibility of financial services specially the banking services in Assam.

### 3.1 Availability of banking services- In Assam with reference to India:

The most important thing in the financial inclusion position of an economy lies in the availability of banking services to the people. For analyzing the availability of banking services, average population per bank branches is the most prominent indicator.

**Number of bank branches and average population per branch**:

Due to the poor branch network, the penetration of banking services has been usually low in Assam. In 1949, only 8 branches of commercial banks were operating in the state. In June 1969, the number of bank branches increased to 74 and the average population per branch office at that time was 1.88 lakh. Although the nationalization of banks in 1969 brought an expansion of bank branches all over the country, the position of Assam was far behind in comparison with other states as well as with the national level. The public sector banks spread all over the state, but private sector banks concentrated in Guwahati only (Pati, 2005).

After the nationalization of banks in 1969, the number of bank branches increased drastically in Assam from a mere 74 number of branches to 354 in 1977. The average population per branch office (APPBO) also decreased as a result. The APPBO was 1.88 lakh in 1969 and came down to 41 thousand in 1977. Although there was a momentary increase in the number of bank branches in the state during the period of 1969-1991, the growth was still lacking in other important aspects like credit- deposit (CD) ratio. The CD ratio, in general was very low in the state compared to the national average. The expansion of bank branches has been shown in table 1.

**Table 1:**

**Expansion of Scheduled Commercial Banks in Assam as well as in India**

| Year | Number of offices | | Deposits (Rs. Cr) | | Credit (Rs. Cr) | | CD Ratio | |
|---|---|---|---|---|---|---|---|---|
| | Assam | India | Assam | India | Assam | India | Assam | India |
| 1969 | 74 | 8387 | | 4665 | | 3609 | | 77.4 |
| 1972 | 152 | 14650 | 67 | 8360 | 30 | 5553 | 44.8 | 66.4 |



| Year | Number of offices | | Deposits (Rs. Cr) | | Credit (Rs. Cr) | | CD Ratio | |
|---|---|---|---|---|---|---|---|---|
| | Assam | India | Assam | India | Assam | India | Assam | India |
| 1975 | 208 | 18575 | 105 | 12637 | 50 | 9119 | 47.6 | 72.2 |
| 1981 | 518 | 36037 | 394 | 40413 | 178 | 26857 | 45.2 | 66.5 |
| 1991 | 1236 | 61724 | 2200 | 200568 | 1093 | 124203 | 49.7 | 61.9 |
| 1995 | 1260 | 63817 | 3956 | 379174 | 1530 | 210939 | 38.7 | 55.6 |
| 2000 | 1232 | 65521 | 8478 | 822133 | 2669 | 469032 | 31.5 | 57.1 |
| 2001 | 1239 | 65908 | 9864 | 950705 | 3193 | 556436 | 32.4 | 58.5 |
| 2002 | 1232 | 66276 | 11552 | 1097049 | 3627 | 683591 | 31.4 | 62.3 |
| 2003 | 1216 | 66436 | 12922 | 1278667 | 3695 | 759210 | 28.6 | 59.4 |
| 2004 | 1221 | 66970 | 14770 | 1517200 | 4607 | 890866 | 31.2 | 58.7 |
| 2005 | 1235 | 68116 | 18080 | 1753174 | 6220 | 1157807 | 34.4 | 66.0 |
| 2006 | 1234 | 68681 | 20871 | 2093042 | 8763 | 1517497 | 42.0 | 72.5 |
| 2007 | 1262 | 70711 | 25758 | 2598823 | 11154 | 1949567 | 43.3 | 75.0 |
| 2008 | 1317 | 74326 | 31666 | 3228817 | 13057 | 2394566 | 41.2 | 74.2 |
| 2009 | 1369 | 79056 | 39427 | 3937336 | 15115 | 2857525 | 38.3 | 72.6 |
| 2010 | 1434 | 83997 | 49545 | 4601926 | 18311 | 3345619 | 37.0 | 72.7 |
| 2011 | 1504 | 89110 | 59100 | 5426510 | 21053 | 4076868 | 35.6 | 75.1 |
| 2012 | 1574 | 96059 | 674546 | 61741471 | 251713 | 47827752 | 37.3 | 77.4 |
| 2013 | 1749 | 109279 | 766802.7 | 70126203.6 | 285249.5 | 55253170.3 | 37.19 | 78.8 |
| 2014 | 1861 | 115822 | 850690 | 80282202 | 317126 | 62642898 | 37.2 | 78.02 |
| 2015 | 2047 | 125863 | 973785 | 88909822 | 359113 | 68808493 | 36.9 | 77.4 |

*Source: RBI Basic Statistics 1975-1995, Basic Statistical Returns of SCBs in India, RBI & Quarterly statistics on Deposits and Credit of SCBs, RBI (Various Issues), Adopted from Goyal (2013). Note: * 1969 and 1972 figures are of December quarter, 1975 to 1981 figures are of June quarter and 1991 onwards are of March quarters.*

Table 1 represents the number of bank branches and the number of average population per bank branch from the period in the state as well as in the country from the period 1967 to 2014. From the data, it can be seen that the strategy of "reaching the unreached" and the initiatives taken by the Government and RBI towards this approach resulted in an expansion of branch banking statistics in the state. Policies like nationalization of banks in 1969 and 1980, setting up of RRBs, lead bank scheme etc. were the main reasons for this expansion.

From the table 1, it is analyzed that the expansion of scheduled commercial banks in the state during 1972 to 1991 period was higher in Assam than the all-India level. Assam

registered an increase of 38 percent of branch expansion while the all-India figure was 17 percent. During this period, the bank branches increased from 152 to 1236 that is more than 8 times in Assam than 4 times increase at the national level (from 14650 to 61724).

Likewise, the situation of average population per bank branch also improved in due course. From the table 2, it can be noted that in 1967, the population density of a bank branch was 1.99 lakh but it declined drastically to 18135 in 1991. The trend of APPBO was higher in the state than at all-India level. At national level, the APPBO came down to 13771 in 1991 from 73000 in 1967.

**Table 2:**

**Average Population per Bank Branch in Assam and India (APPBO)**

| Year | Assam | India |
|---|---|---|
| 1967 | 199000 | 73000 |
| 1969 | 188000 | 65000 |
| 1971 | 120000 | 46000 |
| 1975 | 68000 | 29000 |
| 1981 | 36308 | 18062 |
| 1991 | 18135 | 13711 |
| 2001 | 21008 | 15209 |
| 2005 | 20960 | 14949 |
| 2011 | 20724 | 13581 |
| 2012 | 19826 | 12603 |
| 2013 | 18553 | 11569 |
| 2014 | 16769 | 10452 |
| 2015 | 15245 | 9619 |

*Source: RBI (2006), p.20; Basic Statistical Returns of SCBs in India, 2014; Assam State Gazetteer, Chapter VI, Banking Trade and Commerce, p.534.*
*Note: Figures for 2013, 2014 and 2015 are author's calculation on the basis of Census data, 2011.*



From the table 2, it is evident that the population density per bank branch in Assam decreased to 15245 in 2015 and the same was 9619 at all-India level. It shows that the state as well as the country achieves the outreach indicator of financial inclusion to a favorable level.

However, it can be figured out that the expansion of bank branches in Assam remained stagnant during the post reform period. Prior to the reforms, the growth of bank branches was momentum. The main thrust of the banking sector at that time was "to reach the unreached". But after the reforms, due to the increasing number of bad loans and special preference to the "class banking" on the part of the banking sector; the strategy of banking expansion in the state was thrown to the back. As a result, the number of bank branches during the period from 1991 to 2005 stuck around 1235 whereas the national figure for the same was 68116 in 2005 from 61724 in 1991.

Moreover, Bhavani and Bhanumurthy (2013) analyzed that the expansion of bank branches in rural Assam in the post reform period was disappointing as the expansion only concentrated in the urban areas. Although, the average population per bank branch remained high both in Assam and in all-India level, it was more noticeable in the case of Assam. This is because during that period, the increase in bank branches in the state was almost stagnant. Hence, it can be concluded that the performance of Assam in terms of availability of bank branches till the period of 2005 was very poor as compared with the national level.

In spite of undertaking various policies by the Government of India and RBI towards financial inclusion in Assam, the status was not at all satisfactory. The number of bank branches increased to 2047 from 1234 during the period of 2006-2015. During this period, Assam recorded about 66 percent increase

in the number of bank branches since 2006. At the same time, the percentage of increase in bank branches at the national level was about 84 percent. Although the trend of outreach dimension was almost satisfactory, the opening up of new branches in the state concentrated in and around Guwahati. In 2011, 186 numbers of bank branches situated only in Guwahati and 313 branches were operating in the next 15 big centers next to Guwahati. This constitutes that one third of the bank branches were located in these 16 centers only (Goyal, 2013). Although, the average population per branch was decreasing in both Assam and at all-India level, it was not a sharp decrease.

### 3.2 Banking Penetration in Assam vis-a-vis India:

Another important parameter of an inclusive financial system is penetration/ accessibility among the users of financial services. The facility of deposit accounts is one of the important indicators of financial inclusion. Deposit habits among the poor with irregular income enable them to plan their budget as well as nurture the savings habit among them (RBI, 2008). This, in turn, makes the amount of deposit accounts per 100 persons/ adults as an important parameter in analyzing financial inclusion. At the same time, the credit accounts per 100 persons/ adults indicate the credit expansion among the people. Therefore, savings and credit accounts both are key indicators of financial inclusion process. In the present study, deposit accounts per 100 persons and credit accounts per 100 persons are used to analyze the penetration of banking services. Table 3 represents the deposit and credit accounts per 100 persons in Assam along with all-India figure.



**Table 3:**

**Deposit and Credit Accounts per 100 Adult Populations**

| Year | Deposit Accounts | | Credit Accounts | |
|---|---|---|---|---|
| | Assam | All-India | Assam | All-India |
| 1981 | 11.6 | 28.9 | 1.4 | 6.2 |
| 1991 | 34.9 | 60.3 | 7.0 | 13.9 |
| 2001 | 39.4 | 55.0 | 4.5 | 9.7 |
| 2005 | 39.1 | 59.3 | 5.9 | 13.3 |
| 2011* | 47.3 | 66.9 | 5.3 | 10.0 |
| 2012* | 53.29 | 74.61 | 5.64 | 10.8 |
| 2013* | 59.35 | 86.33 | 6.12 | 10.6 |
| 2014* | 69.40 | 101.33 | 7.17 | 11.46 |

*Source: RBI (2006), Basic Statistical Returns of SCBs in India, RBI, (2011, 2012, 2013& 2014)*

*Note: * figures indicate number of accounts per population.*

*From the table it can be analyzed that the deposit accounts per 100 populations is very less in Assam compared with the all-India average. The number of deposit accounts per 100 persons is 69.40 in 2014 as against 101.33 at all-India level. Similarly, the credit accounts per 100 persons are at only 7.17 while the national level data were 11.46.*

### 3.3 Usage of Banking Services in the State and at All-India Level:

Inclusive financial system cannot be attained only with expanding bank branches in a particular area, unless the banking services are not used properly by the people. Generally, the banking system is available for two services- deposits and credit of the banks. Therefore, the present study tries to figure out the usage of banking services with the help of the available data regarding deposits and credit of the commercial banks.

### Deposits, Credit and Credit- Deposit Ratio:

In the words of Bhavani and Bhanumurthy (2013), the number of bank branches is not the only indicator of financial inclusion, rather the usage of banking services in the form of

deposit and credit of the customers is also equally important. Table 4 indicates that the trend of deposits and credit were same as that of the bank branches during 1972-1991 period. During the period, the deposit and credit of Assam increased 33 and 36 times as compared with the national figures of 24 and 22 respectively. The deposits increased to 8.2 and 8.7 in Assam and at all-India level, respectively, during the post reform period till the year 2005. Likewise, the increase in credit accounts was 5.7 times and 9.3 times respectively. The table shows that the growth of credit accounts in the state was less than the all-India average. But, the credit accounts increased during the period 2001-2006 compared with the growth of deposit accounts.

Although the increase of credit of Assam was not significant during the reforms, it showed an increasing trend in the twentieth century. Similarly, the growth of deposits also increased only in the twentieth century. Till the twentieth century, the growth of credit in the state was not even satisfactory, but a momentary change took place from the beginning of the year 2000.

Over time, both the deposit and credit of Assam overtook the national average. The deposit increases at a very high rate during the period of 2011-2015 with a compound annual growth of 75.14 in Assam and the rate of all-India is 74.94 which is slightly lower than the state level data. The trend of credit is also similar to that of a deposit. The compound annual growth of credit in the state is also very high at 76.35 and the national level data is 75.98.

This proves that in recent time the usage of banking services in the form of deposit and credit is favorable in the state and retains a better position than the country's average.



**Table 4:**
**Annual Growth rate of Deposit, Credit and Credit-deposit ratio**

| | Deposit | | | | Credit | | | | CD Ratio | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1981-1991 | 1991-2001 | 2001-2011 | 2011-2015 | 1981-1991 | 1991-2001 | 2001-2011 | 2011-2015 | 1981 | 1991 | 2001 | 2011 | 2015 |
| Assam | 18.1 | 16.2 | 19.6 | 75.14 | 14.4 | 11.2 | 20.8 | 76.35 | 42 | 50 | 32 | 36 | 36.9 |
| India | 16.4 | 16.8 | 19.0 | 74.94 | 15.9 | 15.8 | 22.0 | 75.98 | 67 | 62 | 57 | 75 | 77.4 |

*Source: RBI (2006) and Table 1*

*Note: The growth rates for 2001-2011 and 2011-2015 are author's calculation based on the data from the table 1.*

**Credit per capita and Deposit per capita:**

Per capita credit and per capita deposit are other important indicators for analyzing the usage parameter of banking services. Although the per capita deposit in Assam was generous, it was seen to be less than the national average. On the other hand, the gap between the state and national average was higher in the case of per capita credit. Till the year 2011, the per capita deposit and per capita credit were much lower in the state than the national average. Table 5 reveals the data of per capita credit and per capita deposit in the state of Assam vis. a. vis India. As the population data is for the year 2011, the per capita credit and per capita deposit data are taken till 2011 for comparison with earlier data.

From the table 5, it is noticed that even in 2011, the per capita deposit and per capita credit of the state is lower than the national average. The per capita deposit of Assam in 2011 is 18961 against the amount of 43034 at all-India level. The amount of per capita deposit is only 45 percent of the national average.

**Table:5 :**

**Credit per capita and deposit of Assam and India**

| | Deposits | | | | | Credit | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year → | 1981 | 1991 | 2001 | 2011 | CAGR | 1981 | 1991 | 2001 | 2011 | CAGR |
| Assam | 210 | 981 | 3701 | 18961 | 16.2 | 65 | 405 | 1155 | 6752 | 16.7 |
| India | 642 | 2370 | 9245 | 43034 | 15.0 | 281 | 1167 | 4976 | 32574 | 17.2 |

*Source: RBI (2006), Basic Statistical Returns of SCBs in India, RBI, 2011. Adopted from Goyal (2013).*

On the other hand, the per capita credit in the state is 6752 while the amount is 32574 at national level. The table indicates that the growth trends of per capita credit and per capita deposit are significant in the state. But the growth of per capita credit is increasing at a higher rate than that of per capita deposit. The table reveals that the annual growth of per capita credit from 1981 to 2011 is 16.7 as against 16.2 rate of annual growth in per capita deposit. The figures for the same at the national level are 17.2 and 15 respectively.

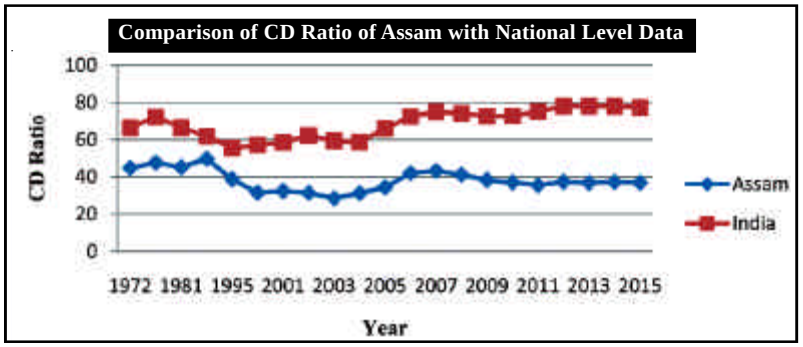
**Credit Deposit Ratio (CDR):**

The credit deposit ratio of Assam has been far below than the national average over the years. It is represented by the figure 1 that the gap between Assam and the national average was narrowing down from 1975 to 1991. The gap was lowest in 1991. But after the reforms, again the gap between the state and the country started increasing. In 2011, the credit deposit ratio of Assam was 35.6 percent and at the same time, the national figure was 75.1 indicating a gap of almost 40 percent between the two. The gap between Assam and national level still continues to remain at 40.5 percent in 2015.



**Figure 1:**

**Credit Deposit Ratio of SCBs in Assam and India**




*Source: Table 1*

**4. Conclusion:**

From the analysis of the present study, it is observed that the performance of Assam is poor in comparison to the performance at national level. The share of rural banking has been performing better than the overall performance of banking sector in the state. However, 86 percent of the population is living in rural areas, whereas the percentage of rural population at the national level is 65 percent and hence it cancels out the good performance of rural banking in Assam. From the study, it is evident that to some extent, the financial inclusion position is achieved in rural Assam. But, there is lots of scope for improving the position of financial inclusion in the state.

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# Problems and Challenges in Indian Agriculture Sector

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## ABSTRACT

The objective of this research is to study the problems and challenges of sustainable agricultural development in India. Sustainability implies achieving a balance between supply and demand for agricultural products. The green revolution can bring efficiency in agricultural products and hence productivity increases. The final yield of agriculture depends on the yield of various resources, the strategies and the methods adopted. To cope with drought due to decreased rainfall, the farmer must use innovative strategies. Study findings reveal innovative strategies and achievement of growth. As the largest private sector "agriculture" it enjoys a very important position in the Indian economy. Since it has links from various sectors such as production, processing and marketing; agriculture continually dominates change in India. The work aims to study the importance of sustainable development in the field of agriculture

through the use of secondary data. Agriculture is the main occupation in India, as a large population lives in rural areas and has agriculture for their livelihood. Sustainable development in the agricultural sector aims to increase productivity, efficiency and the level of employment and also aims to protect and preserve natural resources through overuse. It also provides a mechanism to reduce soil degradation through multiple cropping systems and through deforestation and many other reasons.
**Keywords:** Challenges, Economic Development, Problems, Sustainable Growth

## Introduction

The development of sustainable agriculture integrates three main objectives; Environment, health, economic prosperity and sustainability of livelihoods. In other words, sustainability is based on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. Therefore, the management of natural and human resources is of utmost importance. Human resource management includes consideration of social responsibilities such as the living and working conditions of farm families, the needs of rural communities, and the health and safety of consumers both now and in the future. Stewardship of land and natural resources involves maintaining and enhancing this vital resource base over the long term.

The role of the agricultural sector in the Indian economy can be seen through its contribution to GDP (Gross Domestic Product) and employment. This sector also contributes significantly to the sustainable economic development of the country. The sustainable agricultural development of any country



depends on the judicious combination of its available natural resources. Indeed, agriculture determines the fate of a country like India, where roughly two-thirds of the population still live-in rural India with agriculture for their livelihood, despite increasing urbanization that has taken place over many decades. So if agriculture goes wrong, it will be really bad for the economy, as falling agricultural growth affects not only employment, but also GDP (thus increasing poverty). The broader objective for the improvement of the agricultural sector can be achieved through the rapid growth of agriculture, which depends on the increase in acreage, cropping intensity and productivity. But for a country like India, increasing productivity is more important than the rest of the two. This is simply due to increasing urbanization, industrialization, and the limited land size of the country.

Productivity can be increased in two ways. First, increasing production through the efficient use of available resources. Second, increase production by varying the input. The first method is better with regard to productivity and sustainability. But due to the increase in population, this method cannot provide a permanent solution. Therefore, we can opt for the second method, which can potentially cause environmental degradation in the economy and affect its sustainability. Therefore, issues related to sustainable agricultural development need to be addressed.

## Need for the study

Agriculture plays an important role in economic growth and development and therefore remains the largest platform. Agricultural performance in the 1990s has fluctuated widely erratically with a downward trend over the period. The close

relationship between the performance of agriculture and that of the economy obviously implies that agriculture must grow at a high rate to stimulate economic growth. However, for agriculture to grow at the expected rate, it is imperative that quality investments are made in key areas that have growth potential. Over the past three decades, the government has realized that non-targeted investments in agriculture could be disappointing. Therefore, any future investment in agriculture must focus on avoiding such disappointments and achieving the objectives pursued. For example, even with the overall poor performance of agriculture, few subsectors such as horticulture and dairy have performed well. Therefore, investments in agriculture should be directed to areas that are likely to achieve high productivity.

**Objectives**

1. To know the present status of Indian agriculture sector.
2. To study the challenges and opportunities in agricultural sector.
3. To identify problems and challenges in Indian agriculture sector.
4. To find the future prospects and solution for growth in Indian agriculture sector.

**Review of Literature**

According to Nath, (2008) after first world war, various types of essential improvementsare done in agricultural sector which also reflects in Indian agricultural statistics. To observe and to assess the agricultural situations in rural area, GoI appointed a committee named 'The Royal Commission' in the year 1926 and this committee reported to GoI in the year 1928.



This Royal Commission suggested to establish a research center for the development of agriculture sector named 'Imperial Council of Agricultural Research' which is now known as 'Indian Council of Agricultural Research'.

Rao and Hanumantha (2000) defined that agriculture development is essential for national development and for this purpose, infrastructural innovations are essential. From the 6the decade of 20$^{th}$ century, Indian agriculture sector has incredible development that various irrigation projectsare completed and GoI supports for cooperative credit organizations for financial assistance to the agriculture sector. As a result of this policy, India became self-sufficient in food grains in this period.

Bajaj (2001) has focused on the improvement of agriculture sector which was an urgent demand during the period of independence. For the purpose of improvement in Indian agriculture sector, irrigation facility was essential and to improve in the irrigation facilities in draught area, some steps were taken. This irrigation facility resulted into decreasing the ratio of migration of farmers and also in decreasing rural indebtedness through obtaining land reform policies. It is realized that average area of irrigated agriculture is increased from 18.9 million hectares to 20.2 million hectares during three years of 1947 to 1950.

Rena studied on the agriculture during independent period and defined that various challenges are faced by India particularly in agriculture sector. Agriculture productivity was good hence import of agriculture food was become essential, because this productivity was not sufficient and large group of people was below poverty line. To control this problem, India has introduced the policy of Green Revolution. The policy of

green revolution had transformed the nation from Hungry nation to Food-exporter nation.

Shetty (2014) examined the demand and supply situation for agriculture products in seventh decade of 20th century and defined that India had stopped to import food grains from other nations and become self-sustain in the production of cereal grains by 1980. Green Revolution had made tremendous changes in agriculture sector; hence, India has become independent in food productivity. As an impact of green revolution, India has started exports of food grains, by increasing agricultural productivity from 108.46 million tons in 1970-71, to 129.6 million tons in 1982-81.

Kannan (2011) has analyzed Indian Agriculture Reform Policy and reported that the cropping pattern in India has transformed from food crops to cash crops. During 1960 to 1980, it was essential for the nation to focus on food crops. This tendency of Indian farmers has now changed due to increasing irrigation facility, changing market structure and implementation of innovative practices in agriculture sector.

**Present Status of Indian Agriculture Sector**

Agriculture is one of the most prominent sectors of the Indian economy. It is the source of livelihood for almost two-thirds of the country's rural workforce living in rural areas. Indian agriculture provides employment for 65% of the labor force, accounts for approximately 27% of GDP, contributes 21% of total exports and the raw material for various industries. It is estimated that the livestock sector contributes 8.4% of the country's GDP and 35.85% of agricultural production. In India, about 75% of people live in rural areas and still depend on agriculture, about 43% of the geographical area of India is used



for agricultural activities. The estimated production of food grains is approximately 211.17 metric tons in the country. The total geographical area that belongs to agriculture is 329 MH of which 265 MH represent a variable degree of potential production. The net planted area is 143 MH of which 56 MH are net irrigated area in the country.

**Agricultural Production in India**

Indian agricultural production in most of the country is closely related to the optimal use of the country's available natural and human resources. Therefore, thanks to agro-climatic conditions and rich natural resource base, India has today become the world's largest producer of numerous commodities. The country is a leading producer of coconuts, mangoes, milk, bananas, dairy products, ginger, turmeric, cashews, legumes, and black pepper. It is also the second largest producer of rice, wheat, sugar, cotton, fruits and vegetables. Indian agricultural production is closely related to sound and prudent water management practices. Most agricultural practices in India are limited to a few monsoon months. During the monsoon season, India is usually endowed with abundant rains; Although not infrequently, this generous monsoon turns into terror, causing uncontrollable floods in different parts of the country and, ultimately, affecting agricultural production.

**Sustainable Agriculture Development**

Sustainable development issues can be discussed under three broad types of agricultural systems, viz. traditional production system, modern agricultural system and sustainable agricultural system. In addition, we can compare them in three dimensions: ecological, economic and social sustainability.

Ecological sustainability: Most traditional and conventional agricultural practices are not ecologically sustainable. They misuse natural resources, reduce soil fertility, cause soil erosion, and contribute to global climate change. But sustainable agriculture has some important advantages over traditional practices.

**Soil fertility**:

The continuous drop in soil fertility is one of the major problems in many parts of India. Sustainable agriculture improves soil fertility and structure.

**Water**:

Irrigation is the largest consumer of fresh water, and fertilizers and pesticides pollute both surface and groundwater. Sustainable agriculture increases the organic matter content of the top layer of the soil, thus increasing its ability to retain and store water that falls as rain.

**Biodiversity**:

Sustainable agriculture practices involve mixed farming, increasing the diversity of crops produced and increasing the diversity of insects and other animals and plants in and around fields.

**Health and pollution**:

Chemicals, pesticides and fertilizers seriously affect the local ecology and the population. The indiscriminate use of pesticides, improper storage, etc. they can cause health problems. Sustainable agriculture reduces the use of dangerous chemicals and controls pests.



**Land use pattern**:

Overexploitation of land causes erosion, landslides, and floods that clog irrigation canals and reduce land accessibility. Sustainable agriculture avoids these problems by improving productivity, conserving the soil, etc.

**Climate**:

Conventional agriculture contributes to the production of greenhouse gases in various ways, such as reducing the amount of carbon stored in the soil and vegetation, through the production of methane in irrigated fields and the production of artificial fertilizers, etc. you can easily overcome this problem.

**Economic sustainability**:

For agriculture to be sustainable, it should be economically viable in the long term. Conventional agriculture involves more economic risk than sustainable agriculture in the long term. Governments are sometimes inclined to view export-oriented production systems as more important than supply to domestic demand. This is not OK. Focusing solely on exports implies hidden costs: in transport, in ensuring local food security, etc. Policies must consider domestic demand and, in particular, food security as equally important to the visible trade balance.

**Social sustainability**:

Social sustainability in agricultural techniques is related to the ideas of social acceptability and justice. Development cannot be sustainable unless it reduces poverty. The government must find ways to enable the rural poor to benefit from agricultural development. Social injustice is where some sector of society neglects development opportunities. But having a

robust social sustainability system can bridge the gap between the haves and the have-nots. Many new technologies do not become applicable in the agricultural sector due to lack of acceptance by local society. Sustainable agriculture practices are useful because they are based on social customs, traditions, etc. local innovation. The local people have the knowledge about the crops and livestock in their environment.

**Emerging Opportunities in Indian Agriculture Sector**

In the session of Dr. M.S. Swaminathan, Member of Parliament and Chairman of the MSSRF on "Emerging Challenges and Opportunities"he appreciated TAAS 'timely initiative and his recommendations provided new policy direction to the new government. Such efforts were necessary to address current challenges such as managing the global food crisis, adapting to climate change, and cooperatives for increasing farm incomes. His speech focused on the following main themes:

The first and foremost issue was the conservation and, wherever possible, the improvement of the ecological foundations for sustainable agriculture, which included land, water, biodiversity and marine resources. Urbanization put enormous pressure on available land and water resources. Major agricultural lands were being converted to non-agricultural uses, which needed to be reversed through an appropriate land use policy. Common property resources had to be well protected. There was a significant revolutionary development in the management of small farms with respect to all subsectors, i.e., crops, livestock and fisheries. This process needed to be encouraged to provide "the power of mass production to mass



production of small farmers." The institutional mechanisms that allow this process should include

I. Decentralized production to increase the availability of quality seed with the required insurance coverage,
II. Delivery of improved technology and associated services to farmers, and
III. Product aggregation to improve market access, which should essentially aim for an 'end-to-end' or 'farm-to-plate' approach covering production, processing, marketing, etc.

Furthermore, farming must become a professionally rewarding and intellectually satisfying occupation to attract young people to farming. The orientation of agricultural development should shift from increased production to increased farm income. This was important to control the growing disparity between rural and urban areas and to diversify rural livelihood options, which include agricultural, livestock, fishing and horticultural activities. Therefore, linking farmers to the market should be given a high priority.

**Problems and Challenges in Indian Agriculture Sector**

The central theme of agricultural development is the need to improve productivity, generate employment and provide a source of income for the poor segments of the population. FAO studies have shown that small farms in developing countries contribute between 30% and 35% of total agricultural production. The pace of adoption of modern technology in India is slow and agricultural practices are too haphazard and unscientific. Some of the basic issues for the development of the Indian agricultural sector are the revitalization of cooperative institutions, the improvement of rural credit, research, the

development of human resources, the promotion of trade and exports, agrarian reforms and education.

**Future Prospects and Solution for Indian Agriculture Sector**

The agricultural sector is a major contributor to the Indian economy around which socio-economic privilege and deprivation revolve, and any change in its structure is likely to have a corresponding impact on the existing pattern of social equity. Sustainable agricultural production depends on the efficient use of soil, water, livestock, plant genetics, forests, climate, rainfall, and topology. Indian agriculture faces resource constraints, infrastructure constraints, institutional constraints, technological constraints, and policy-induced constraints. Sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a way as to ensure the achievement and continuous satisfaction of the human needs of present and future generations. Such sustainable development (in the agricultural, forestry and fisheries sector) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable, and socially acceptable. Therefore, achieving sustainable agricultural development requires the optimal use of natural, human, capital and technical resources. In India, crop yield is highly dependent on rainfall, which is the main reason for the declining growth rate of the agricultural sector. These uncertainties hit small farmers and workers the hardest, who often lead everyday lives. Therefore, something must be done to help farmers and they must be supplied with enough water and electricity as they feel unsafe and continue to die from drought, floods and fires.



India is the second largest country in the world in terms of population; You must realize that you are a great resource for the country. India has a large number of inactive people. You need to find ways to explore your talents and make the numbers contribute to growth. Especially in agriculture, passive unemployment can be noticed. Sustainable development in India can also be achieved through the full utilization of human resources. A large part of the poor population of the country is dedicated to agriculture, unless we increase their standard of living, the general growth of this country is not possible. If we continue to ignore the poor, this disparity will continue to widen between classes. Debt traps in the country are forcing farmers to commit suicide. People are migrating to the city in the hope of a better livelihood, but the population of the slums in the cities is also increasing. Therefore, the rural population must have employment in their areas and the opportunity to prosper. India has been labeled a “developing” country for quite some time; To move towards the “developed” countries, we must get rid of this enormous dependence on the agricultural sector.

**Conclusion**

It has been observed that for a growing country like India, the practice of sustainable agriculture is of great importance as it accelerates productivity, efficiency, employment and provides guidance to reduce practices that affect soil quality, resources water and degradation. of other natural resources. Basically, it aims to adopt specialization and use environmentally friendly tools to protect and preserve the environment, as well as improve the level of production without harming the environment. Looking at the performance of the Indian agricultural sector, we will easily recognize that performance has increased

significantly over the years. Despite many challenges such as urbanization, growth of the secondary sector, etc., it has achieved significant growth.

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# Employment Generation and Asset Creation under MGNREGA

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## ABSTRACT

MGNREGA is one of the largest safety net programmes. This programme aims to recede the problem of both poverty and unemployment in India. Most of the people in rural areas depend on unskilled manual work for survival. Under this situation MGNREGA comes in as a saviour by providing 100 days of unskilled manual work to rural households. This paper based on secondary data analyses employment generation and asset creation under MGNREGA over the years. Literature shows that MGNREGA provides significant employment opportunities to the targeted population. However, the number of families that completed 100 days of employment has declined over the years. The assets created under MGNREGA are helpful to the backward and vulnerable sections of the society, who has a relatively lower asset base. But the work completion rate shows a declining trend and most of the work which was started could not be completed. COVID-19 and lockdown has an adverse impact on the performance of MGNREGA during 2019-20 and 2020-21.

**Keywords :** employment generation, asset creation and rural



## 1. Introduction

Poverty and unemployment are the two widely discussed topics in development economics. There is no denying the fact that even the most developed nations suffer from this twin problem. The governments of various countries have been trying to address the problems of poverty and unemployment over the years. In India, to eliminate this twin problem, the Government has implemented various policies and programmes such as Community Development Programme, Integrated Rural Development Programme, National Rural Employment Programme, Rural Landless Employment Generation Programme, Training of Rural Youth for Self-Employment, National Food for Work Programme, Million Wells Scheme etc. One such programme is National Rural Employment Guarantee Act (NREGA), 2005. It aims to ensure economic growth in the rural areas. It is a right based programme and have the transparency and accountability provision (Khera, 2011). The annual budget allocation of this program is more than 60,000 crores (72,000 crores for financial year 2021-22) making it the largest net safety programme in India. MGNREGA not only confines itself in the objective of employment generation, but also catalyzes overall development of the country in general. The act provides safety nets to the poorest and vulnerable people like ST/SC/OBC, and small and marginal farmers. The scheme thus follows the principle of inclusive growth, self-targeting, pro-targeting that mostly attracts the weaker sections of the society. With the help of the scheme, weaker sections living standard increases because they fulfill both practical need and strategic needs of the rural people (Pankaj and Tankha, 2010). Therefore, taking into the above consideration the paper tries to analyze the performance of MGNREGA and also to oversee

whether the objectives of the scheme are achieved or beyond the reach of the programme. The specific objectives of the paper are

1) To analyses employment generation over the years under MGNREGA.

2) To analyses asset creation over the years under MGNREGA.

This article consists of six sections. The second section includes review of existing literature, third section discuss the data source and methodology, the fourth section deals with employment generation under MGNREGA. The fifth section deals with asset creation under MGNREGA and policy implications emerging from the study are presented in the concluding section.

## 2. Review of Existing Literature

MGNREGA plays a vital role in providing employment to a large number of Indian populations. For the financial year 2020-21 (As on 2 February 2021) around 28.13crore person days have been generated and around 6.63crore households has been benefitted. MGNREGA provided increasing employment opportunities and household participation (Gill et al., 2013). Some literature states that the most backward and vulnerable section such as SC, ST, agriculture labour, female headed and households with lower asset base were participating more in MGNREGA work compared to others (Ghosh, 2009). MGNREGA offered basic employment for marginalized group but did not provide substantial help to the most vulnerable sections (Rhonda et al. 2017). Bhowmik (2013), report that there is an increase in the number of participating household. Breitruz et al. (2017) stated that participation in the programme was determined by difference between MGNREGA wage and market



wage rate. Deninger et al. (2012) argue that in the short term MGNREGA contributed to employment diversification; especially for females and those with limited land endowment. Jha and Gaiha (2012) shows that the number of households that completed 100 days of employment was deteriorating over the years and performed the worst among other indicators. Some study found that the weaker section of the society benefitted the most from NREGA (Gill, 2013). MGNREGA also increased the work engagement period for both subsidiary and principal workers (Reimeingam, 2016) Though MGNREGA was able to provide employment to rural household particularly women and SC/ST it could not provide 100 days of employment to households participating in MGNREGA scheme (Srinivas and Pandyaraj, 2017). Modi (2019) found that there is a lack of systematic planning which result in execution gap in the programme thus reducing both person days and number of families that could complete 100 days employment. There was a sharp decline of families engaged under MGNREGA from 1.6 crore (in March 2020) to 1.9 lakh families (in April 2020) in a short span of only one month (Jebararj, 2020).With so many immigrants returning to their village, they solely rely on MGNREGA. Thus the scheme has become very crucial during the pandemic times (Verma, 2020).

Literature shows that lack of proper implementation at the ground level by the implementing agencies as the main drawback of poor performance in asset creation (Sugapriyan and Prakasam, 2015). The drastic fall in the work completion rate during the financial year 2019-20 and 2020-21 is mainly because of the strict lockdown of the nation in response to COVID-19 pandemic (Jebararj, 2020;Verma, 2020 ). Studies (Mishra, 2011, Bhargava, 2013; Modi, 2019), found that work on individual

land is more durable and productive since the land owner feels the sense of belongings of the asset and tend to take care. MGNREGA created useful assets including roads and various forms of storing rain water but some asset created did not even last beyond one rainy season (Sudarshan et al. 2010). A substantial amount of assets were created but its completion rate was very poor (Srinivas and Pandyaraj, 2017). Abraham et al. (2013) show that gap between work demand and supply and unfinished work on durable assets were the main reason for bad performance of MGNREGA. Aggarwal et al. (2012) show that owner of the land where wells were constructed by MGNREGA, all of them were small and marginal farmers. Also the asset created under this programme result in income-generation. Some studies reveal that most of the projects fall under productive asset; i.e. it becomes the productive base of the villages (Gill et.al 2013).

## 3. Data Source and Methodology

This paper is purely based on secondary data. Secondary data's are used to analyze the achievement of this program in terms of employment generation and asset creation. Secondary data are collected from official website of the programme www.nrega.nic.in .This article is also based on the review of selected literature, collected from different journals and books.

## 4. MGNREGA and Employment Generation

The primary objective of MGNREGA is to provide employment to the unskilled rural workers. Apart from providing 100 days employment the acts also provides various rights and entitlements to the workers like safe drinking water, first aid box, child care facilities, travelling allowances (if worksites is



more than 5 km from the residents), providing shades in the worksites, ex gratia payments and free medical treatments. These benefits are given to the registered households who hold a job card. Hence, the programme plays a vital role in providing employment to huge number of Indian population. Performance of MGNREGA on employment generation is discussed on terms of total number of active workers, employment provided, number of person days and number of household that completed 100 days work using secondary data.

Table 1 shows the national level beneficiary status of MGNREGA from financial year 2014-15 till 20 January 2021.The number of job card issued increased very marginally during the last 4 years. The total number of job card issued is 1402.62lakh as on 20 January 2021. In case of registered total workers there has been a declining trend I.e. 2,580lakh during 2014-15 to 2,573.38lakh in 2015-16 and during 2015-16 till 23 September 2018 there is a very marginal increase with a rate of 0.0027. The numbers of active job card show increasing trend except for the year 2016-17. As on 20 January 2021 the number of active job card is 814.48lakh. The total number of active worker was 1,134.2lakh in the financial year 2015-16 which came up to 1432.64lakh in financial year 2019-20. The total active worker constitutes of more SC workers than ST workers (21% of SC workers and 17 % of ST workers) and the remaining 60 percent constitutes other workers (OBC, general, other weaker sections). Total number of active women workers increased from 557.89 lakh in financial year 2015-16 to 707.78 lakh till 20 January 2021 (financial year 2020-21 is not completed yet so the total may vary).

**Table 1.**

**National Level Beneficiary Status of MGNREGA from 2015-16 till 20 January 2021**

(in lakh)

| Different Indicators | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 |
|---|---|---|---|---|---|---|
| Job card issued | 1,292.9 | 1,269.23 | 1,271.67 | 1,279.05 | 1478.96 | 1402.62 |
| Registered total workers | 2,573.38 | 2,579.9 | 2,579.9 | 2,580.01 | 2974.32 | 2981.16 |
| No. of active job card | 742.42 | 692.86 | 732.58 | 735.89 | 921.45 | 814.48 |
| Total active workers | 1,134.28 | 1,137.94 | 1,137.94 | 1,138.09 | 1432.64 | 1429.14 |
| SC workers against total active workers | 242.43 | 243.04 | 243.04 | 243.06 | 289.57 | 288.82 |
| ST workers against total active workers | 195.4 | 195.95 | 195.95 | 196 | 237.99 | 237.1 |
| Others against total active workers | 696.89 | 698.95 | 698.95 | 699.04 | 905.04 | 903.18 |
| Total no. of active women workers | 557.89 | 559.74 | 559.74 | 559.82 | 707.06 | 705.78 |

*Source: www.nrega.nic.in*

Employment generation is the principal objective of NREGA.Table 2 shows the performance of MGNREGA in generating employment over the last five years. Employment demanded both in terms of household and person is higher than the employment provided. The employment provided in terms of household and person constitutes 88 percent and 84.99 percent of the employment demanded during financial year 2014-15 and this percent was maintained even in financial year 2017-18. Employment provided in terms of household and person constitutes around 90 percent (each) of the employment demanded during financial year 2019-20. This shows that initially the employment demanded could not be provided at both household and person case. But 2019-20 shows that about 99 percent of work demanded both at household and person case were actually provided with work.



The total number of family that completed 100 days wage employment was 39, 91,171 during thefinancial year 2016-17 which constitutes only 7.8 percent of total household which received employment. During 2018-19 the total number of household that completed 100 days of employment was 52, 59,483 (highest among the last 5 years) which constitute around 10 percent of the total household that receive employment. Thus it can be concluded that even though thenumber of household that completed 100 days of work increase every year but the objective of achieving 100 days employment to all households seems gloomy. The average day of employment per household was highest during 2018-19 which was 50.88 days. The average days of employment as on 20 January 2021 was 44.75.

**Table 2:**

**Employment Indicator of MGNREGA from 2016-17 till 20 January 2021 (All India)**

| Year | Employment demanded | | Employment provided | | Average days of employment per household | No of families completed 100 days |
|---|---|---|---|---|---|---|
| | No. of Household | No. of Person | No. of Household | No. of Person | | |
| 2016-17 | 5,69,30,497 | 8,98,00,136 | 5,12,22,314 | 7,66,91,127 | 46 | 39,91,171 |
| 2017-18 | 5,73,16,613 | 8,96,19,873 | 5,11,82,438 | 7,59,50,658 | 45.69 | 29,60,174 |
| 2018-19 | 5,87,65,841 | 9,11,91,963 | 5,26,65,090 | 7,77,32,341 | 50.88 | 52,59,483 |
| 2019-20 | 6,16,58,298 | 9,34,08,574 | 6,15,26,229 | 9,30,63,079 | 48.4 | 40,60,744 |
| 2020-21 | 79,905,710 | 12,25,92,628 | 6,95,31,290 | 10,14,94,222 | 44.75 | 30,75,479 |

*Source: Ministry of Rural Development, GOI.*

Table 3 show the employment generated in terms of person days (all India level) from the period 2016-17 till 20 January 2021. Total person days generated shows an increasing trend from 235.64crore in financial year 2016-17 to 310 .74crore till 20 January 2020. SC person day as percentage of total person day generated is higher than ST person days as a percentage of

total person days generated in all the five financial years. The number of women person day generated was 56.16 percent against total percent days generated which shows that most of the workers were women. But in the year 2017-18 the women person days as against total person days generated declined to 53.53 percent which further lowered to 17.42 percent. During 2020-21 as on 20 January 2021 the women person days came up to 52.42 percent. The increase in total person days to 310.74crore is attributed to the corona virus pandemic. With the nation's lockdown, crores of migrant workers lost their daily wage work and started returning home.

**Table 3 :**

**Employment Generation In Terms of Person Days From 2016-17 till 20 January 2021**

| Year | Total Person day generated (in Cr) | SC person day % as of total person day | ST person day % as of total person day | Women person days % as of total person day |
|---|---|---|---|---|
| 2016-17 | 235.64 | 21.32 | 17.62 | 56.16 |
| 2017-18 | 233.74 | 21.56 | 17.49 | 53.53 |
| 2018-19 | 267.96 | 20.77 | 17.42 | 54.59 |
| 2019-20 | 265.4 | 19.97 | 18.41 | 17.42 |
| 2020-21 | 310.74 | 19.91 | 17.83 | 52.42 |

*Source: compiled and calculated by author using MIS report from www.nrega.nic.in*

## 5. Asset Creation under MGNREGA

MGNREGA works as a stimulant for local economic development through the creation of productive assets.Strengthening of natural resources management is the secondary objective of the MGNREGA. The natural resource management involves works that address the causes of chronic poverty like drought, deforestation and soil erosion and so



encourage sustainable development (Ministry of Rural Development).

**Table 4:**

**Work Completion Rate under MGNREGA (all India) Over the Years**

| Financial year | No. of work started | No. of work completed | No of work not yet completed | Work completion rate (in %) |
|---|---|---|---|---|
| 2017-18 and earlier | 4,11,52,836 | 4,03,51,783 | 8,01,053 | 98.05 |
| 2018-19 | 77,76,230 | 64,99,526 | 12,76,704 | 83.58 |
| 2019-20 | 80,04,009 | 45,63,139 | 34,40,870 | 57.01 |
| 2020-21 | 76,69,465 | 11,09,547 | 6559918 | 14.47 |

*Source: compiled by author using MIS report from www.nrega.nic.in*

Table 4 shows the yearly work completion rate of MGNREGA at all India level. During 2017-18 and earlier number of work started was 4, 11, 52,836 but only4, 03, 51,783 works were completed. The work completion rate was 96.4 percent during 2017-18 and earlier. The work completion rate shows a declining trend from 98.05 percent in 2017-18 and earlier, 83.58 percent in 2018-19 and 57 percent in 2019-20. In 2020-21 (till 2 February 2021) the work completion rate very low at around 14 percent only implying that total work started could not be completed. Since inception of MGNREGA a total of about 1, 20, 78,545 work, which constitute around 18 percent of total work are not completed yet. The drastic fall in the work completion rate during the financial year 2019-20 and 2020-21 is mainly because of the strict lockdown of the nation in response to COVID-19 pandemic (Jebararj, 2020;Verma, 2020 ).

**Table 5 :**
**Asset Creation Under MGNREGA Over the Years**

| Assets | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 |
|---|---|---|---|---|---|---|
| Anganwadi/ other rural infrastructures | 2,161 | 9,285 | 95,082 | 1,50,789 | 50,283 | 66,777 |
| Coastal areas | 231 | 557 | 229 | 148 | 116 | 83 |
| Drought proofing | 1,89,287 | 2,63,698 | 2,66,266 | 3,63,350 | 3,55,629 | 2,89,997 |
| Rural drinking water | 11,846 | 29,960 | 28,457 | 28,074 | 8,509 | 2,547 |
| Food grain | 297 | 831 | 1,072 | 1,037 | 640 | 460 |
| Flood control and protection | 1,01,096 | 1,22,108 | 95,249 | 89,968 | 88,830 | 81,292 |
| Fisheries | 4,948 | 6,218 | 5,652 | 6,128 | 5,257 | 5,855 |
| Micro irrigation work | 1,12,529 | 1,76,877 | 1,48,952 | 1,44,630 | 1,47,289 | 1,43,721 |
| Work on individual land | 10,48,872 | 29,38,299 | 33,01,067 | 66,46,440 | 53,86,126 | 48,62,826 |
| Land development | 2,97,514 | 5,02,992 | 2,80,703 | 2,93,654 | 2,69,296 | 2,35,439 |
| Others | 93,531 | 1,01,593 | 81,465 | 41,502 | 12,626 | 3,817 |
| Playground | 1,721 | 2,898 | 6,237 | 7,451 | 3,599 | 1,257 |
| Rural connectivity | 4,45,870 | 5,30,159 | 4,04,706 | 3,88,726 | 3,02,749 | 2,90,741 |
| Rural sanitation | 7,94,382 | 11,32,609 | 1,107,225 | 5,79,721 | 3,80,378 | 3,37,464 |
| Bharat Nirman Rajeev Gandhi Sewa Kendra | 5,525 | 7,534 | 10,115 | 4,178 | 1,624 | 961 |
| Water harvesting and conservation | 2,76,939 | 5,92,178 | 3,81,704 | 3,16,919 | 3,60,176 | 3,38,533 |
| Renovation of traditional water bodies | 1,53,521 | 2,00,055 | 1,41,953 | 94,843 | 71,178 | 66,444 |
| Total | 35,40,270 | 66,17,851 | 63,56,134 | 91,57,558 | 74,44,305 | 67,28,214 |

*Source: compiled by author using MIS report from www.nrega.nic.in (as on 1 February 2021)*

Table 5, shows the asset creation under MGNREGA over the years. During the financial year 2015-16, around 35,40,270 assets were created under MGNREGA out of which asset created under individual work constitute around 30 percent (highest), followed by followed by rural sanitation (22%) and rural connectivity (13%). Asset created under coastal area category



and food grain category constitutes only 0.006% and 0.008% respectively which is very low. The number of asset created over the years follow a non monotonic trend. The total asset generation increased to 66, 17,851 in 2016-17 which had a marginal fall to around 63, 56,134 during 2017-18. During 2018-19 there was a sharp increase in total asset created to 91.57lakhs from 63.56lakhs in 2017.18. After financial year 2018-19 there is a constant fall in the number of asset created. It falls to 74.44 lakhs in 2019-20 and 67.28 lakhs in 2020-21. Table 3 shows the same trend as table 5, which shows that the lockdown effect of COVID-19 has a great effect on participation of people in MGNREGA thereby adversely affecting their livelihoods.

Under the various category of work undertaken in NREGA scheme, work on individual land constitutes the highest as against the total asset created. Table 5 shows that starting from 2015-16 to 2020-21, majority of work are done under this category. Whereas the community based assets like food grains, anganwadi/other rural infrastructures, work on coastal areas etc. Constitutes only around 1 percent of total asset created. The assets created under community based work tend to detoriate within a year or two because of the problem of tragedy of commons. During the earlier yearsassets created under rural sanitation and rural connectivity were high but during the financial year 2020-21, it constitute around 5 percent of total asset created.

## 1. Conclusion:

MGNREGA has proved to be one of the best wage employment programmes in India. It supports the basic needs of the rural poor but the performance of the scheme is getting worse over the time. Only a few households were able to

complete 100 days of employment over the years. MGNREGA provides 50 average days of employment to the participating households. But total person days generated show a rising trendand this may be because of thousands of reverse migration of labors during COVID-19 pandemic.

In terms of asset creation the work completion rate is continuously decreasing over the years. But the total number of asset created shows a non-monotonic trend.The papershows that asset created under individual land (i.e. individual asset creation) is more durable and productive compare to community based asset creation. Literature suggests that the asset must be created based on the needs and requirement of the locality.

COVID-19 has an adverse effect on participation in MGNREGA thereby adversely affecting their livelihoods. But MGNREGA has been a savior to millions of unemployed people during the pandemic. By quantity wise every parameters tend to shows a decreasing trend but the numbers of person days generated has been overwhelming. This shows that MGNREGA has been able to sustain the livelihoods of rural people by giving employment opportunities despite strict lockdown of the nation. Thus it is important to strengthen the features of MGNREGA further so that it can retaliate any future uncertainties.

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# Skill Development Initiatives in Arunachal Pradesh

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## ABSTRACT

The paper briefly highlights the skill development initiatives taken in Arunachal Pradesh. In the State, primarily the government is taking various skilling initiatives. NGOs are also involved in such activities. The State is providing vocational training to its people through various industrial training institutes and polytechnic colleges in various subjects such as plumber, carpenter, welder, electrical, secretarial practice, computer etc. In addition, government has also started skill development initiative schemes, both long and short term particularly for the unemployed youth and the early school leavers. It was found that many individual were selected through the 'Job Mela', a government flagship program, in different districts for their skill development. Majority of the students joined skill development trainings have completed their courses. It is found that about 60 per cent of trainees under SDI scheme were employed, revealing a good employment outcome of the scheme.

**Keyword:** Skill Development Initiatives, Training, Employment, Arunachal Pradesh

### 1. Introduction

Skill development has a vital role in economic growth and social development. Skill development improves the labour productivity and makes them more adjustable with the challenges and opportunities in the real world of work. Furthermore, skill development enhances women empowerment, improves standard of living, expands trade and wage and makes the labour more employable as well as adaptable to new technologies (Riaz et al., 2014; Saner and Yiu, 2014; Epifani and Grancia, 2008; Punjani, 2014).

In view of these, skill development has been included in national policies of many countries in the world (Fernandez, C.M. and Choi, K., 2012). In fact, over the years, skill development has gaining importance increasingly due to its significant role in increasing income, saving, investment, productivity and transforming the economy (Rodrick et al., 1995).

India is expected to surpass China, highest populated country in the world, in terms of population by next few years and to become the world's youngest country. More importantly,

about 64 per cent of India's population is expected to fall under the working age group by the next few years while the other developed countries are on ageing stage. Exploration of the potential benefits posed by the young population highly depends on adoption and implementation of the appropriate policies and strategies. In this context, Kanchan and Varshney (2015) stated that if the increasing population is left untrained and unemployed it may turn into demographic liability. The country can take advantage of the demographic dividend by converting its huge population to skilled manpower. Accordingly, the National Skill Development Policy 2009 has been adopted to guide skill development strategies and to link these strategies to policies in economic growth, employment and social development arenas. With this policy plan, the country aims to impart skill training to 500 million people by 2022. In addition, The Ministry of Skill Development and Entrepreneurship, a separate ministry of the government of India, has been created in the year 2014 with the aim to accomplish all the skill development efforts of the Government of India throughout the length and breadth of the country.

In accordance with the centre's ambitious aim of skill development, the State Arunachal Pradesh has also been engaged in the adoption and implementation of skill initiatives in order to produce manpower with higher quality. Arunachal Pradesh is located at the eastern most part of the country and is characterized by low level of development owing to geographical disadvantage and other factors such as poor infrastructure in terms of transport, connectivity, lack of skilled manpower etc. Skill development trainings have a great role to play in the development of the State. The State has various formal institutions for skill training like Industrial Training



Institutes (ITI's), Polytechnics etc. In addition, State has initiated other short term skill development training initiatives for the unemployed and drop out students in the State. Besides, Department of Rural development, Textile, Industry, Agriculture, Horticulture, Tourism, Women and Child Development etc are the other departments that are also involved in such initiatives[3]. From the various local dailies also, it is visible that the skill development initiatives are not confined to only one agency or stakeholders. NGO's and other agencies are also involved in such initiatives.

Given the role of skill development in overall development and the great scope of such initiatives to contribute in the development of Arunachal Pradesh, one among the states adopting various skill development initiatives, an attempt is made to look in to the status of skill development initiatives in the State along with the outcome of those initiatives.

## 2. Skill Development and India- A Review of Literature

Skill development training has a crucial role in the economy of any country. It has been observed that the investment in human capital add directly to the economic growth of the country (Romer, 1994). Such instances have also been recorded in the economies of South Korea and Taiwan. Rodrick et al. (1995) showed that the presence of highly skilled labour and the timely intervention of Government in skill development process transformed the economies of these two countries in 1960's. Globalization has raised the importance of skill development even more. Epifani and Gancia, (2008), globalised world will facilitate trade and with its expansion, market size will enlarge which in turn will increase the demand for highly skilled labour. Further, there may be slow down in the economic development

in the absence of requisite skilled manpower and also endangers the country's competitiveness (Saner and Yiu, 2014). A good economic environment along with skilled manpower transforms the economy from labour intensive to capital intensive and ultimately to knowledge intensive economy (Saner and Yiu, 2014).

To ensure the future needs for skilled manpower in the development process, the Government of India has initiated many skill training initiatives mainly in the form of institutional technical and vocational trainings. To strengthen the skill training initiatives in the country, the Government of India has launched the National Skill Development Policy 2009 framework and many other training initiatives. The creation of Ministry of Skill Development and Entrepreneurship is another effort to encourage the skill related initiatives in the country. Despite of these initiatives for skill development, there is still deficiency in skilled manpower in the country. It has been identified that even after the advantage of having largest young population, India is facing acute shortage of skilled manpower (Okada, 2012) which has affected its economy (Kemal, 2007). Further, due to the launch of ambitious project 'Make in India', there arises urgent necessity for skilled manpower within the country (Sharma and Nagendra, 2016). The 'Make in India' project aims to make India a global manufacturing hub and for that the country has to be ready with latest modern know how to grab the future opportunities. It is expected that such project will encourage foreign as well as domestic investment and create employment and other beneficial opportunities (Deka and Batra, 2016). Thus, it is clear that skill development initiatives have great significance in India. Failure to comply with the demand for skilled manpower may endanger India's competitiveness as



the country has the advantage to play a key role in labour supply in the near future. All these necessitate more pro-active measures to fill the skill gap.

The issues such as employability, adaptability, quality, qualification mismatch etc also needs to be addressed properly because it affects the employment opportunities. According to Chenoy (2012), these issues arise particularly due to the non focused nature of skill development initiatives of both government and private space on the employability as most of the courses were not based on the needs of industries. However, challenges like attitudinal challenges, delivery, leadership and external challenges, rigid labour laws and tedious approval and submission process in certification and training, being faced by various stakeholders in the way of skill development training in India (Chanda, 2015). In certain circumstances, many hesitant to start business venture after the completion of skill training particularly due to the lack of guidance, support and financial resource (Grover and Dak, 1986).

It is evident that the skill development initiative undertaken in India has great potential to contribute to its development but yet to get full attention of the researchers. Owing to this research gap, an attempt has been made here to see the state of skill development initiatives in Arunachal Pradesh.

## 3. Objective

The specific objective of the study is to examine the status of skill development initiatives in Arunachal Pradesh along with the outcome of those initiatives.

## 4. Methodology

The study is based on secondary data collected from sources

such as NSDC Skill Gap Study of North East– Arunachal Pradesh, Ministry of Skill Development & Entrepreneurship, (2012); An Overview of Skill Development & Entrepreneurship in Arunachal Pradesh-2016 (GoAP); Skill Development in Arunachal Pradesh-A Comprehensive Study 2017, North Eastern Development Finance Corporation Limited (Nedfi) and various research articles and online data sources.

Skill Development Initiatives undertaken in the State are examined based on the available secondary data. However, the outcome related data were not available for the existing scheme/ skill initiatives, except for skill development initiative scheme undertaken by the Department of Skill Development and Entrepreneurship. Thus, considering the data limitation, especially the outcome related data, the outcome of the skill development initiative in the State are evaluated for the trainees selected through the government flagship programme called **Job Mela** under the skill development initiative scheme in the year 2013.Using simple statistical tools like percentages, tables and figures, the analysis has been made in the present study.

## 5. Skill Development Initiative in Arunachal Pradesh

Socio-economic development is one of the main objectives of any government and skill development, being essential for foundation of the socio-economic development, is highly recommended. The requirement of skill for the development of any country or economy is identified all over the world. Due to its importance in the socio-economic development, countries are increasingly giving more and more emphasis on the skill development. It is also identified that mere education without any practical skill make more difficult for the job aspirants to get job in today's competitive world. As per the Federation of



India chambers of commerce and Industry (FICCI, 2015), the shortage of skilled manpower in the world will stand at approximately 56.5 million by 2020.

Similarly in India, the importance of skill and its requirement is identified from the very beginning of planning period. The skilling process was running alongside the general education system in the country. Formal vocational and skill training system in the country was started with the setting up of first Industrial training institute (ITI) in 1969 by the ministry of Labour & Employment, Government of India (GOI). In order to formalize and regulate vocational education for higher level skills, the All India Council of Technical Education (AICTE) act 1987, has been made an official regulator of polytechnics and technical colleges in the country.

As per the Census 2011, GOI, the population of India is the second highest population in the world having literacy rate of 73 per cent and projected to be the youngest country by 2020. New opportunities in new sectors after 1990's led the government to expand the skilling capacity of the country. Finally in an effort to train the huge population of the country Government of India formed the National Skill Development policy in 2009. The initiative started with the aim to impart skill training to 500 million people by 2022[4]. After that, many such initiatives have been carried out by government through partnership with private stakeholders, state government and through its various departments. Finally in 9th November 2014 a separate ministry has been formed to coordinate all the skill development efforts throughout the country.

In Arunachal Pradesh, other than general education system, formal technical and skill development training are provided through properly established institutions under various

departments. The Directorate of Higher Secondary Education providing skill development training through government higher secondary schools of the State. For the higher and technical education, the Directorate of Higher and Technical Education is implementing diploma level courses through its polytechnics. There are seven polytechnics which are currently functioning in the State namely: Rajiv Gandhi Government Polytechnic, Itanagar; Tomi Polytechnic College, Basar; Government Polytechnic, Dirang; Government Polytechnic, Laying; Government Polytechnic, Namsai; Government Polytechnic, Pasighat and Government Polytechnic, Roing.

Other than the polytechnics, the State has one higher and technical institute, North Eastern Regional Institute of Science and Technology (NERIST). It is a public deemed university. Selection process of students are based on three type of entrance examination and out of the total seat, 80 per cent seat are reserved for North Eastern (NE) students, 10 per cent each for eight NE states and remaining 7 per cent seat is for meritorious students, 10 per cent for rest of the country and 3 per cent for disabled students[5].

Apart from the above, Directorate of Skill Development & Entrepreneurship is providing training programme through its various schemes namely Craftsmanship Training Scheme (CTS), Skill Development Initiative Scheme (SDIs), and Capacity Building Programme under Border Area Development Programme (BADP). In addition to these, government is also planning to start Micro Units Development and Refinance Agency (MUDRA) and Chief Minister's Soft Loan Scheme for skilled persons. These two schemes are the loan and subsidy provisions which the department is planning to provide to the skilled person those who possess NCVT certificate[6].



**Craftsmanship Training Scheme**

Under the CTS, department is imparting vocational training through various Industrial training institutes (ITIs). First ITI was established at Roing, Lower Dibang Valley District of the State in 1971. In subsequent years, more ITIs were established and till date there are six ITIs in the State. Out of them, ITI East Siang is privately owned and managed by private company and remaining five ITI's are owned and controlled by government. Courses offered in these ITIs are presented in Table 1.

**Table 1:**

**Industrial Training Institutes (ITIs) in Arunachal Pradesh**

| Sl. No. | ITIs | Courses Offered |
|---|---|---|
| 1. | ITI, Roing | Plumber, Carpenter, Welder, Wiremen, Mechanic, Fitter, Electrician, D/Man, Surveyor, IT&ESM |
| 2. | ITI, Dirang | COPA, Preservation of Fruits & Vegetables, Welder, Secretarial Practice, Electronic and Mechanic. |
| 3. | ITI, Yupia | Secretarial Practice, Hair & Skin care, Baker & Confectioner, Fashion Technology. |
| 4. | ITI, Tabarijo | D/Man, IT &ESM, Electrician and Secretarial Practice |
| 5. | ITI, Balinong | D/ Man COPA, Mechanic Diesel, Mechanic RAC |
| 6. | ITI, East Siang | Electrician, Mechanic Diesel and Welder Source: NSDC Skill Gap Study North-East, Arunachal Pradesh, GOI, 2012 |

*Source: NSDC Skill Gap Study North- East, Arunachal Pradesh, GOI, 2012*

**Skill Development Initiative Scheme**

Under the skill development initiative scheme, trainees were selected through the State flagship programme called Job Mela and sponsored to various registered Vocational Training Providers (VTPs) for further training. Job Mela is an awareness and sensitization programme on the importance of skill development and training. The counseling and selection of trainees to undergo training and job placement was done by various registered VTPs under the guidance of District Administration and District Industries Centre (DIC). Through the counseling programme, various categories like educated unemployed, dropouts etc were encouraged to take up one or two trade of their own choice and pursue the subjects in the vocational institutes of India. Under SDI scheme, 100 per cent placement assistance was provided to all the trainees and 70 per cent job guarantee to all the trainees in a batch. The trainees were awarded with National Council of Vocational Training (NCVT) certificate by the Director General of Training, Ministry of Skill Development & Entrepreneurship after the successful completion of training. The Job Mela was held in all districts of the State and through this program the sensitization on the importance of skill development was done. The first maiden Job Mela was held in 30th August to 1st September, 2013 at Itanagar. The second was held in all districts from 2nd February to 8th March and third was in 16th November to 20th December 2015.

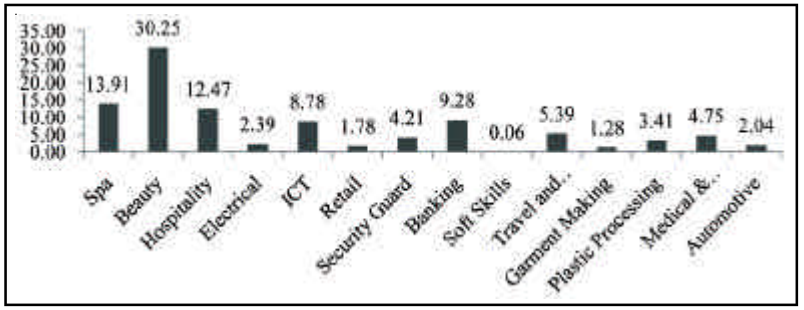


**Figure 1:**
**Trainees Trained under SDI Scheme**


*Source: An Overview of Skill Development & Entrepreneurship, 2016, GoAP*

Figure 1 shows the trainees trained under the SDI scheme. It appears from the figure that about 73 per cent have completed their training, 14 per cent undergoing training[7] and remaining 12.51 per cent were dropped out from the training. Among the total trainees selected, highest was in beauty subject followed by spa, hospitality, banking, information communication technology (ICT), travel and tourism and medical and nursing respectively (Figure 2).

**Figure 2:**
**Percentage Distribution of Trainees attended Skill Development Training**




*Source: Compiled and Computed from An Overview of Skill Development & Entrepreneurship, 2016, GoAP*

In terms of percentage of completion by subject wise, it was found that highest percent of trainees completed their training that opted beauty as their training subject followed by spa, hospitality, banking, travel and tourism, plastic processing and medical and nursing respectively, as shown in Table 2. It also shows subject wise percentage of trainees dropped out from the training among the total dropped out trainees. Here again, dropped out from the subject beauty was highest followed by banking and spa. Similarly, beauty sector constitutes the highest under the category of undergoing training followed by medical and nursing and hospitality respectively.

**Table-2:**
**Percentage of Trainees attended Skill Development Training**

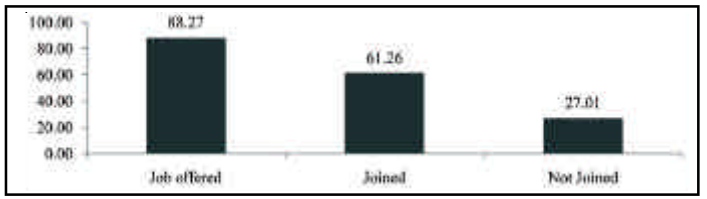
| Sector | Total Trainees participated | Trainees Completed the Courses | Drop Out | Trainees Undergoing Training |
|---|---|---|---|---|
| Spa | 694 (13.91) | 570 (15.58) | 92 (14.74) | 32 (4.53) |
| Beauty | 1509 (30.25) | 942 (25.75) | 169(27.08) | 398 (56.29) |
| Hospitality | 622 (12.47) | 504 (13.78) | 53 (8.49) | 65 (9.19) |
| Electrical | 119 (2.39) | 119 (3.25) | 00 (0.00) | 00 (0.00) |
| ICT | 438 (8.78) | 373 (10.20) | 39 (6.25) | 26 (3.68) |
| Retail | 89 (1.78) | 89 (2.43) | 00 (0.00) | 00 (0.00) |
| Security Guard | 210 (4.21) | 160 (4.37) | 35 (5.61) | 15 (2.12) |
| Banking | 463 (9.28) | 328 (8.97) | 135 (21.63) | 00 (0.00) |
| Soft Skills | 03 (0.06) | 03 (0.08) | 00 (0.00) | 00 (0.00) |
| Travel and Tourism | 269 (5.39) | 220 (6.01) | 24(3.85) | 25 (3.54) |
| Garment Making | 64 (2.18) | 46 (1.26) | 18 (2.88) | 00 (0.00) |
| Plastic Processing | 170 (3.41) | 152 (4.16) | 04 (0.64) | 14 (1.98) |
| Medical & Nursing | 237 (4.75) | 119 (3.25) | 25 (4.01) | 93 (13.15) |
| Automotive | 102 2.04) | 33 (0.90) | 30(4.81) | 39 (5.52) |
| Total | 4989 (100) | 3658(100) | 624 (100) | 707 (100) |

*Source: Computed and Compiled from An Overview of Skill Development & Entrepreneurship, 2016, GoAP*

## Outcome of the Skill Development Training Initiatives

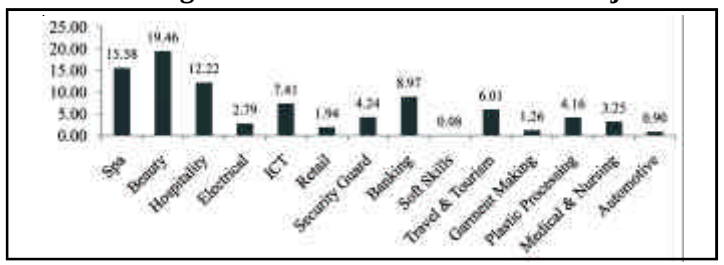
Trainees selected through SDI scheme were sponsored to private vocational training providers for the training with the guaranteed job placement. Accordingly, employment offer were given to the participants that completed their training. About 88 percent of the trainees were offered job in their respective fields (Figure 3). The offer was accepted by about 61 per cent trainees and remaining 27 per cent has declined the job offer. This may be because of less interest in staying outside the home State, as most of the job placements were done outside the home State owing to low employment opportunities in the State. Figure 4 presents employment offer provided to the trainees in different sector. Among the total trainees, employment was offered to around 88.27 per cent trainees and out of that highest percent of job were offered in beauty sector followed by spa, hospitality and banking.

**Figure 3:**
**Job Offered to the Trainees**




*Source: Computed and Compiled from - An Overview of Skill Development & Entrepreneurship, 2016, GOAP*

**Figure 4:**
**Percentage of Job Offered in Different Subjects**




*Source: Computed and Compiled from- An Overview of Skill Development & Entrepreneurship, 2016, GOAP*

Table 3 presents the percentage of trainees accepted and declined the job offer provided in their respective sectors. It appears from the Table that 100 per cent job were offered in subjects such as spa, banking, soft skills, travel and tourism, garment making, plastic processing, medical and nursing, automotive but except automotive, most of the trainees declined the offer. In medical and nursing, soft skills and electrical, the percentage of trainees declined the job offer were about 56, 66 and 51 per cents respectively. On the other hand, more than 50 per cent of trainees have accepted the job offer in all the sectors, except medical and nursing, soft skills and electrical.

**Table -3:**

**Job Offered in Various Trade (in per cent)**

| Sl. no. | Sector | Trainees Completed the Courses | Job offered | Accepted | Declined |
|---|---|---|---|---|---|
| 1 | Spa | 570 (100) | 570 (100.00) | 455 (79.82) | 115 (20.18) |
| 2 | Beauty | 942 (100) | 712 (75.58) | 508 (71.35) | 204 (28.65) |
| 3 | Hospitality | 504 (100) | 447 (88.69) | 318 (71.35) | 129 (28.86) |
| 4 | Electrical | 119 (100) | 102 (85.71) | 50 (49.02) | 52 (50.98) |
| 5 | ICT | 373 (100) | 271 (72.65) | 154 (56.83) | 117 (43.17) |
| 6 | Retail | 89 (100) | 71 (79.78) | 41 (57.75) | 30 (42.25) |
| 7 | Security Guard | 160 (100) | 155 (96.88) | 117 (75.48) | 38 (24.52) |
| 8 | Banking | 328 (100) | 328 (100.00) | 189 (57.62) | 139 (42.38) |
| 9 | Soft Skills | 03 (100) | 03 (100.00) | 01 (33.33) | 02 (66.67) |
| 10 | Travel & Tourism | 220 (100) | 220 (100.00) | 151 (68.64) | 69 (31.36) |
| 11 | Garment Making | 46 (100) | 46 (100.00) | 43 (93.48) | 03 (06.52) |
| 12 | Plastic Processing | 152 (100) | 152(100.00) | 129 (84.87) | 23 (15.13) |
| 13 | Medical & Nursing | 119 (100) | 119 (100.00) | 52 (43.70) | 67 (56.30) |
| 14 | Automotive | 33 (100) | 33 (100.00) | 33 (100.00) | 00 (00.00) |
| **15** | **Total** | **3658 (100)** | **3229 (88.27)** | **2241 (69.40)** | **988 (30.60)** |

*Source: Computed and Compiled from - An Overview of Skill Development & Entrepreneurship,2016, GOAP*

Thus, it is clear that government's effort in skilling and providing livelihood opportunities to the people of State through



SDI scheme is a commendable to a great extent. Many students were provided different types of training under this scheme and also employment, who otherwise would have been outside the ambit of any skill training and without employment at least for some times.

## 6. Capacity Building Training under BADP

As per the information from department of Skill Development & Entrepreneurship, Itanagar, the empanelled Vocational Training Providers (VTPs) have provided training to 3298 people, belonging to the international border area, under the Border Area Development Project (BADP) scheme during the year 2013-2014. The subjects of the training were handicrafts, basic computer, weaving, bee keeping and envelope making etc.

In addition to the said schemes and programmes, department is also planning to start Pradhan Mantri Kaushal Vikas Yojana (PMKVY) and for that uploading of details of various VTPs is already started for the registration process (Department of Skill Development Training & Entrepreneurship, Itanagar).

Besides the above, other departments involved extensively in skill development initiatives[8] in the State are Department of Rural development, Textile, Industry, Agriculture, Horticulture, Tourism, Women and Child Development etc. Further, skill development initiatives are not confined to only one agency or stakeholders. Various agencies, NGO's are also organizing and providing skill development training to the people of the State.

## 7. Conclusion

Skill development, an important strategy for the socio-

economic development, is increasingly preferred in developmental policies. In Arunachal Pradesh, a State of India having many features of backwardness and inherent challenges, many skill development initiatives are going on. The State is imparting such training mainly through different vocational and technical training institutes such as polytechnics, industrial training institutes etc. Apart from such institutes, government is also implementing different programmes like skill development initiative schemes, capacity building under BADP, loan and subsidy schemes. Many NGOs are also engaged in skilling the people in the State. The skill development initiatives in the State are of both long term and short term. The outcome of such initiatives has been recorded only for participants in the SDI scheme and it is found that a good number of them are employed. Thus, in the State skill development is going on and benefiting the people. However, concern authority may take care of issues like proper recording of data which is significant in evaluation of such initiatives and making those more effective and extensive. Further, it is found that some vocational training centre are sponsored by vocational training providers of other states revealing the absence of infrastructure for training in the State which is in conformity with Saini (2015). As per Saini (2015), the access to skill acquisition is uneven due to the absence of formal skill institutions across the country, especially in rural areas. Hence, there is scope for the concerned authority to focus in facilitating the required infrastructure within the State which will certainly enlarge the scope for the people and thereby participation therein.

**Footnotes :**

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5. Undergoing trainees are those that was participating during 2016-2017
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# Rural Economy : Its Contribution to Economic Self-Sufficiency with Special Emphasis on some North-East States

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## ABSTRACT

Rural economy means the way of livelihood of the population residing in the rural areas. It means the ways and means available to the rural masses through which they can make a living. Since India has been pre-dominantly a rural economy since ancient times, the contribution of rural economy to Indian development has a significant importance. This paper attempts to determine the contribution of rural economy on Indian development with special reference to threedistricts of Assam, one district of Manipur and one village of Mizoram by analysing how much of the rural population comprising of adult males and females are engaged in rural economy. The researcher has employed the normative study method by applying simple random sampling technique to select 50 samples of workers, each from Jorhat, Karbi Anglong and Karimganj districts of Assam, Imphal East district of Manipur andNorth Lungpher of Mizoram to analyze the type of rural economic activities they are employed in.The paper also tries to analyse the resulting effect of their involvement on their welfare.

**Keywords**: Rural Economy, types of rural activities, engagement of male and female population, welfare.



### 1. Introduction:

Indian economy is primarily a rural economy to till date with its two-third population and 70% workforce residing in rural areas. Inspite of rapid rise of urbanisation, more than half of India's population has been projected to be rural by 2050. Rural economy also comprises of 46 per cent of national income. In this scenario, growth and development of rural economy and population is a key to overall growth and inclusive development of the country. The primary sector of employment in the Indian rural areas is the agricultural sector. Apart from agriculture and farming practices, they are involved in production of handicrafts, food items, pottery making, silk weaving, animal husbandry and so forth. Even in pre-British period, India was particularly famous for its textile and spice industries. Studies show that even when there was slowdown in the overall economy in India, the rural economy of India still showed growth and helped the economy in difficult times. Thus, the rural economy of India is backbone of the Indian economy.There has been a gradual shift in the occupation of rural areas of India from agricultural to

non-agricultural activities and rural India has witnessed growth of non-farm income in recent times. Thus, there arevarious options available to the local masses to be engaged but the earnings derived from these occupations are not much appealing. Rural development emphasises on improving the quality of life and economic well-being of people living in rural areas. More specifically, inclusive rural development is about improving the quality of life of all rural people covering three different but interrelated dimensions: Economic dimension, Social dimension and Political dimension. Rural development can be achieved by improving the living standards of the rural people by providing food, shelter, clothing, employment and education; increasing the productivity in rural areas and reducing poverty; involving the rural people in planning and development through their participation in decision making and through decentralization of administration; ensuring the distribution of justice and equalization of opportunities in the rural society; providing CC roads, uninterrupted electricity supply, good drainage system, and safe drinking water to every house and Primary Health Center to every village is essential.

## 2. Literature Review:

In the process of economic development, with the transfer of the additional workers from the agricultural sector to the industrial sector, the problems of urban unemployment, underemployment and congestion, the focus of many developing countries shifted back to rural areas with approaches and strategies which were mainly agriculture-centric. A "transitory" situation emerged with employment and income diversification within the rural space in the form of increased non-farm activities (Hymer and Resnick 1969).



India has witnessed rapid transformation in the employment structure and source of income in the past couple of decades, which has never been seen ever before. Nationally representative household survey based studies showed high growth in rural economy and relatively faster growth in non-farm sector than the agriculture sector in rural area. Share of agriculture sector in India's gross domestic product (GDP) has declined from about two-third of the rural national domestic product in 1980-81 to about 14 per cent by 2013-14 (Economic Survey, 2013-14). Globally, it has been realised that agricultural growth also causes non-agricultural growth, and has a differential impact on employment of the unskilled labour, indirectly reduce economy wide labour cost by keeping food affordable (Lanjouw and Lanjouw, 2001).

The roles of non-farm sector can be seen as a pathway for enhancing farmers' income, especially for small and marginal farmers (Kumar & Chahal, 2018). Given the role of rural economy of India in its total economy, there is much scope and hope that the rural economy of India will drive Indian economy towards a 5 Trillion Dollar Plus Economy by the year 2025. The share of rural economy in employment, GDP growth rate, national income and India's foreign trade is a testimony to the fact that the rural economy will be playing a dominant role in making the Indian economy a5 Trillion Dollar Plus Economy (Abdin & Kumar, 2020).

Rural India has been seen to emerge as the saviour of the shattered Indian economy after the COVID-19 pandemic. The consumption demand growth in rural areas boostthe novel COVID-19 pandemic-stricken economy. There is a hope that ultimately rural India which is often perceived to be a cause of distress to the overall economy will see the country through to

an economic growth of 'zero per cent'. The Indian economy is under contraction and reaching a 'zero per cent' growth rate also involves a significant growth in the economy in the current scenario (Mahapatra, 2020).

In North-east India, there has been structural transformation with gradual shift of employment from the farm to the non-farm sector. During the period 1993-94 to 2009-10, the percentage of people engaged in rural non-farm sector has risen from 24.7 per cent to 34.9 per cent (Panda 2012). This structural transformation explains that the participation of the households in non-farm activity is significantly influenced by both development as well as distress factors. The important developmental factors are household income from agriculture, access to credit, and distance from nearest urban centre. Increased income from agriculture (agricultural growth) has positively influenced the growth of RNFE primarily through consumption linkages. Agricultural growth led production linkage diversification seems to be weak. Poverty of households has emerged as one of the important distress factors pushing households to opt for nonfarm activities as a strategy of survival (Panda, 2017).

Thus, there have been certain studies on the contribution and potential of rural economy in the progress of the developing countries, including North-east India. However, the focus has been a little different. This paper simply tries to analyze the contribution of different rural economic activities upon the self sufficiency of the rural masses in five of the rural areas of North-east India and to discuss some remedial measures for the upliftment of the rural economy.



## 3. Objectives:

The study has the following objectives:

1. To analyze the contribution of rural economy upon the economic development of five rural areas in North-east states.
2. To examine how much of the workers are engaged in the rural economy in the particular rural areas under study.
3. To discuss and suggest remedial policy measures to deal with the difficulties arising in the way of progress of the rural economy.

## 4. Study Area:

Three districts, namely Jorhat, Karbi Anglong and Karimganj districts of Assam, Imphal East district of Manipur and North Lungphervillage of Mizoram have been selected for the purpose of the study. They have been considered in view of their economic and geographical characteristics. They are mainly rural in nature comprising of all the main rural livelihood activities ranging from agriculture, horticulture to small scale industries, livestock and poultry farming. Also, the inhabitants who reside in these regions remain mostly engaged in these activities which provide convenience for the study.

## 5. Data sources:

Normative study method has been used to select 250 samples of workers/employees from engaged in different types of rural economic activities from Jorhat, Karbi Anglong and Karimganj districts of Assam, Imphal East district of Manipur and North Lungpher village of Mizoram have been selected for the purpose of data collection. 50 workers from each of these districts have been selected. Primary data has been collected

using random sampling technique from such workers. The required and relevant secondary data have been collected from various research papers, journals and publications, websites and many others. Some books have also been referred for theoretical information on the topic.The study highlightens the significant contribution of rural economy in the development of North-east India along with an insight into the proportion of adult population engaged in these sectors. The area of study is limited to thethree districts, namely Jorhat, Karbi Anglong and Karimganj districts of Assam; Imphal East district of Manipur and North Lungphertown of Mizoram.

## 6. Methodology:

❖ Method : The method used for the present study is Normative survey.

❖ Sample and sampling technique: In the present study 250 samples, 50 adults each from Jorhat, Karbi Anglong and Karimganj districts of Assam, Imphal East district of Imphal and North Lungpherof Mizoramhave been selected for the purpose of data collection. Samples were selected using random sampling technique.These people have been engaged in the respective activities for the past five years from 2015-16 to 2020-21. The 50 workers have been selected from random places in all the five districts where most of the working households are concentrated. Only one worker has been taken if more than one household member is engaged in the same activity. Among these 50 workers, some are engaged in agriculture, some in horticulture, some in small scale industries and the rest in livestock and poultry farming.Thus, primary data has been collected using random sampling technique from such workers.



## 7. Analysis and Interpretation:

**Table:1**

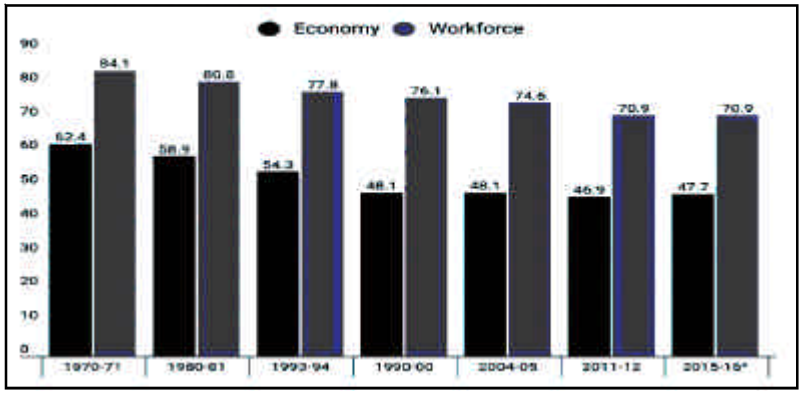
**Population and Agricultural Workers**

| Year | Total Population | Average Annual Exponential Growth Rate (%) | Rural Population | Total Workers | Cultivators | Agricultural Labourers | Total (In Millions) |
|---|---|---|---|---|---|---|---|
| 1951 | 361.1 | 1.25 | 298.5 (82.7) | 139.5 | 69.9(71.9) | 27.3(28.1) | 97.2(69.7) |
| 1961 | 439.2 | 1.96 | 360.1 (82.0) | 188.4 | 99.5(76.0) | 31.5(24.0) | 131.5(69.5) |
| 1971 | 548.2 | 2.2 | 439(80.1) | 180.4 | 78.2(62.2) | 47.5(37.8) | 125.7(69.7) |
| 1981 | 683.3 | 2.22 | 525.5 (76.9) | 244.6 | 92.5(62.5) | 55.5 (37.5) | 148 (60.5) |
| 1991 | 846.4 | 2.16 | 628.7(74.5) | 314.1 | 110.7(59.7) | 74.6(40.3) | 185.3(59.0) |
| 2001 | 1028.7 | 1.97 | 742.5(72.2 | 402.2 | 127.3(54.4) | 106.8(45.6) | 234.1(58.2) |
| 2011 | 1210.9 | 1.5 | 833.7(68.9) | 402.2 | 118.8(45.1) | 144.3(54.9) | 263.1 (54.6) |

*Source: Registrar General of India*

It is evident from Table: 1 that the proportion of workforce engaged in the agricultural sector has been increasing over the years. From 97.2 million populations in the agricultural sector in 1951, it has increased to 263.1 million in 2011. However, it can also be seen that the proportion of population out of the total rural population engaged in the agricultural sector has been decreasing. The cultivators have declined from 71.9 per cent in 1951 to 45.1 per cent in 2011 because the people have shifted from only growing traditional crops like cereals and millet to growing fruits, vegetables and other cash crops over the years which do not come under conventional cultivation. On the contrary, the agricultural labourers have been increasing due to rapid rise in population coupled with jobless growth which has made employment less available leading to even underemployment and disguised employment in the agricultural sector.

**Figure: 1**
**Share of India's Rural Economy In India's Net Domestic Product & Total Workforce**




*Source: Central Statistics Office, National Sample Surveys, National Account Statistics and Periodic Labour Force Survey via India Spend*

It can be seen from Figure 1 that the contribution of rural economy in the Net Domestic Product of the country has been facing ups and downs over the decades. However, the participation of the workforce in the rural economy has not declined much. The rural people have been engaged in the rural economy to a significant extent.

**Table-2**
**Gross State Value Added of Agriculture and Allied Sector at Constant (2011-12) Prices**

(in Lakh)

| Sl. No | State/UT | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | 2018-19* |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Andhra Pradesh | 9400805 | 9783109 | 10835268 | 11219987 | 12151829 | 13939515 | 16344727 | 18107393 |
| 2 | Arunachal Pradesh | 455505 | 472794 | 491472 | 538905 | 507157 | 417404 | 426098 | NA |
| 3 | Assam | 2848113 | 3314074 | 3209159 | 3295165 | 3433875 | 3500560 | 3599931 | NA |
| 4 | Bihar | 6206655 | 6803952 | 5951631 | 5934907 | 6073530 | 6741450 | 7196270 | 7239304 |
| 5 | Chhattisgarh | 2685950 | 2850360 | 2927578 | 3121630 | 3092063 | 3639707 | 3615045 | 3759177 |
| 6 | Goa | 204298 | 195849 | 222419 | 222662 | 208798 | 265914 | 272889 | 265134 |
| 7 | Gujarat | 10736422 | 9255884 | 11713736 | 11714466 | 11529691 | 12606908 | 14072021 | NA |
| 8 | Haryana | 6453886 | 6326499 | 6502514 | 6357661 | 6602221 | 7290918 | 7690826 | 8111367 |
| 9 | Himachal Pradesh | 1162626 | 1244329 | 1371209 | 1327287 | 1440749 | 1384303 | 1343742 | 1398130 |
| 10 | Jammu & Kashmir | 1306347 | 1249071 | 1300874 | 1159250 | 1454647 | 1589803 | 1613431 | NA |
| 11 | Jharkhand | 2233546 | 2364954 | 2321295 | 3033187 | 2171688 | 2680275 | 2808016 | 2927456 |
| 12 | Karnataka | 7558694 | 7173711 | 7691961 | 8021932 | 7231706 | 7538551 | 8396514 | 8306383 |
| 13 | Kerala | 4837594 | 4906807 | 4597159 | 4598265 | 4363785 | 4335472 | 4410011 | NA |
| 14 | Madhya Pradesh | 9107231 | 11339017 | 11320844 | 12025714 | 11975809 | 15238677 | 15603067 | 16484993 |
| 15 | Maharashtra | 15002673 | 14939157 | 16780588 | 14983469 | 14428154 | 17853049 | 18402575 | NA |
| 16 | Manipur | 251623 | 276425 | 288575 | 295331 | 273718 | 290342 | 314268 | NA |
| 17 | Meghalaya | 282868 | 313890 | 326927 | 376920 | 359196 | 373430 | 375215 | NA |
| 18 | Mizoram | 149468 | 145937 | 157013 | 329058 | 335566 | 351946 | 364917 | NA |
| 19 | Nagaland | 373363 | 396443 | 435269 | 452811 | 420256 | 458524 | 462360 | NA |
| 20 | Odisha | 3934537 | 4558109 | 4368529 | 4711024 | 4111533 | 4921400 | 4519810 | 4984236 |
| 21 | Punjab | 7816825 | 7886830 | 8147237 | 7866141 | 7976262 | 8474872 | 8869321 | 8911085 |
| 22 | Rajasthan | 11910303 | 12264217 | 13360426 | 13730589 | 13685850 | 14877814 | 15120309 | 15495341 |
| 23 | Sikkim | 90137 | 93361 | 96740 | 99226 | 103078 | 112249 | 128971 | 138556 |
| 24 | Tamil Nadu | 8773221 | 7818877 | 9161346 | 9836476 | 10091573 | 9928662 | 11207900 | 12356005 |
| 25 | Telangana | 5461488 | 5943354 | 6179205 | 5581067 | 5161495 | 5753395 | 6246757 | 6673812 |
| 26 | Tripura | 511201 | 550569 | 646611 | 670462 | 720113 | 779115 | 886529 | NA |
| 27 | Uttar Pradesh | 18325197 | 19161813 | 19071717 | 18685675 | 19479107 | 20609161 | 21949585 | 22382405 |
| 28 | Uttarakhand | 1330209 | 1355632 | 1339654 | 1335730 | 1312630 | 1366211 | 1386225 | 1412667 |
| 29 | West Bengal | 11710585 | 12156539 | 12150254 | 12694116 | 12766739 | 13237639 | 13924834 | 14044377 |
| 30 | Andaman & Nicobar Islands | 59713 | 61215 | 65791 | 68664 | 65875 | 64970 | 72580 | NA |
| 31 | Chandigarh | 12641 | 12159 | 12389 | 12360 | 13171 | 12539 | 13016 | NA |
| 32 | Delhi | 285663 | 223585 | 208519 | 181518 | 166190 | 171348 | 185593 | 215652 |

*Source: National Statistical Office (NSO)*

**Table 3:**
**Participation in the different rural economic activities in these districts of Assam, Manipur and Meghalaya**

| Rural Activities Districts | Jorhat | Karbi Anglong | Karimganj | Imphal East | N. Lungpher |
|---|---|---|---|---|---|
| **Agriculture** | 18 | 20 | 23 | 19 | 18 |
| **Horticulture** | 11 | 12 | 8 | 9 | 12 |
| **Small-scale** | 13 | 6 | 11 | 10 | 11 |
| **Livestock and Poultry** | 8 | 12 | 8 | 12 | 9 |

*Source: Author's finding on the basis of field study*

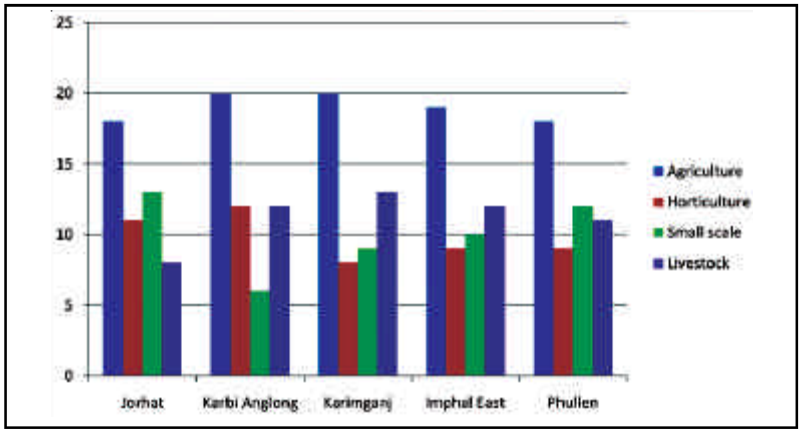
Table 2 shows that the rural economic activities taken into account are Agriculture, Horticulture, Small scale industries and Livestock and Poultry. The rural areas which have been taken into account are Jorhat, Karbi Anglong and Karimganj districts of Assam, Imphal East district of Manipur and North Lungpher of Mizoram. Out of the 50 workers taken into accountin the Jorhat district of Assam;18, 11, 13 and 8 workers are engaged in the Agriculture, Horticulture, Small-scale industries and Livestock respectively. In Karbi Anglong district of Assam, out of the 50 workers; 20, 12, 6 and 12 workers are engaged in the Agriculture, Horticulture, Small-scale industries and Livestock and Poultry respectively. In Karimganj district of Assam, out of the 50 workers; 20, 8, 9 and 13 workers are engaged in the Agriculture, Horticulture, Small-scale industries and Livestock and Poultry respectively. Out of the 50 workers taken into account in the Imphal East district of Manipur; 19, 9, 10 and 12 workers are engaged in the Agriculture, Horticulture, Small-scale industries and Livestock and Poultry respectively. InNorth Lungpher of Mizoram, out of the 50 workers; 20, 8, 9 and 13



workers are engaged in the Agriculture, Horticulture, Small-scale industries and Livestock and Poultry respectively.

Alternatively, it can be seen that the number of workers engaged in the Agriculture sector are 18, 20, 20, 19 and 18 respectively out of the workers taken into accountin Jorhat, Karbi Anglong, Karimganj, Imphal East andNorth Lungpher. In the Horticulture sector, 11, 12, 8, 9 and 9 workers are engaged in Jorhat, Karbi Anglong, Karimganj, Imphal East andNorth Lungpher. 13, 6, 9, 10 and 12 workers are engaged in the Small scale sector in Jorhat, Karbi Anglong, Karimganj, Imphal East andNorth Lungpher. In the Livestock and Poultry sector, 8, 12, 13, 12 and 11 workers are engaged in Jorhat, Karbi Anglong, Karimganj, Imphal East andNorth Lungpher respectively.

**Figure 2:**
**Rural area wise distribution of workforce in different rural economic activities**

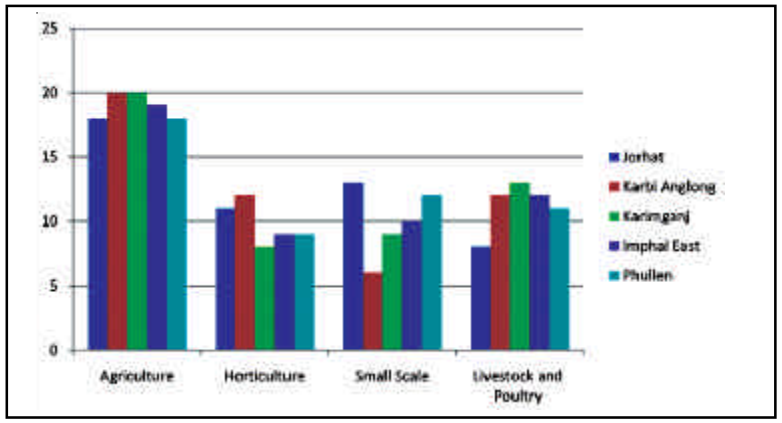



*Source: Author's calculation*

Figure 2 also depicts the same the same facts described in Table 2. In all the rural areas, the highest number of people is engaged

in the agriculture sector. The number of people engaged in the other economic activities varies in all the other areas taken into account.

**Figure 3:**
**Rural economic activities wise rural areas**




*Source: Author's calculation*

Figure 2 depicts that in all the rural areas taken into account, the number of people engaged in the agriculture sector is the highest. In other sectors, there are variations in the number of workers employed.

## 8. Results and Discussion:

From the above analysis and interpretation of the study, it can be found that in all the rural areas, namely Jorhat, Karbi Anglong, Karimganj, Imphal East andNorth Lungpher taken into account, most of the number of workers are engaged in the agriculture sector. It can be concluded that most of the rural people are engaged in the rural sector due to various factors such as traditional dependence on the agriculture sector, less



availability of employment in the other sectors, insufficient progress of the other sectors etc.

Jorhat is known as the "tea capital of the world" and a considerable number of workers are engaged in tea cultivation under agriculture along with other items like paddy, wheat, gram, pea, lentil, mustard, potato, sugarcane and pumpkin etc. Along with agriculture, horticulture has also progressed much in recent years in Jorhat. The number of people engaged in the horticulture sector is also significant in this Jorhat. After agriculture, most of the people are engaged in small scale industries comprising of handloom and textile, handicraft and weaving works, particularly the female population. The number of people employed in the livestock and Poultry sector is the least in Jorhat. In case of livestockand Poultry, the government farms such as District Poultry Farm, Base Pig Breeding Farm, Govt Sheep and Goat Breeding Farm and Govt Livestock Farm and other private farms are hiring workers but their employment level is the lowest compared to all the other rural economic activities taken into account.

In Karbi Anglong, majority of the workers are engaged in Agriculture traditionally. Next to Agriculture, Horticulture and Livestock account for most of the workforce. The least of the workers are engaged in the small scale industries in Karbi Anglong. Being a tribal dominated area, the Buffalo Breeding Project, Cattle Demonstration Farm, Govt Pig Cum Poultry Farm –Unit1, Govt Pig Cum Poultry Farm - Unit2, Govt Pork production Centre Cum Pig Breeding Farm, Duck Breeding Farm cum Demonstration Unit, Govt Poultry Farm, Govt Sheep & Goat Breeding Farm, Fodder Demonstration Farm etc provide employment to a significant section of the population.

In Karimganj, majority of the workers are engaged in agriculture since Karimganj is an agricultural district with tea being the major agricultural product of Cachar region including Karimganj.Sugarcane is also grown for sugar and Gur production.Then the remaining workers are mostly engaged in the small scale industries. The employment scope is not much in the Horticulture and Livestock and Poultry sectors in this district. Moreover, no government farm is available in this district and the private ones are not much employable.

In case of Imphal East, the main occupation of the people is Agriculture and most of the workers are engaged in it. There are 27,000 and 4,100 hectares of land for H.Y.V. (High Yield Variety) and improved local paddy field respectively favouring agriculture to a significant extent. Horticulture is slowly gaining popularity but the number of workers engaged in it is comparatively less than the other sectors. Next to Agriculture, most of the workers are engaged in the Livestock and Poultry activities since most of the population is tribal. The number of workers engaged in the small scale sector is similar to that of the horticulture sector.

InNorth Lungpher, the highest number of the workers is engaged in Agriculture. Horticulture and Small Scale sectors also share significant number of the workers in the district. Very small section of the workers within the region depend upon the Livestock and Poultry sectors due to less availability of such farms in the area.

## 9. Conclusion:

Inthe five rural areasof North-east India taken into account in particular, in spite of the development of different types of rural economic activities, the Agricultural sector continues to



be the most dominant sector of employment with maximum number of the workers employed. In certain parts of the country, the Agriculture sector also comprises of disguised unemployment due to less availability of employment opportunities in the rural areas. Thecontribution of Horticulture to the rural economy is slowly increasing in recent years; however it takes time to shift from the traditional Agriculture sector to the Horticulture sector. The small scale industries have been flourishing in certain parts of the country with its progress limited to those areas. The rural income generated from this sector is not much sufficient to completely give a big push to the rural economy. The rural people are also engaged in the Livestock and Poultry economic activities. The incomes generated from the Government based farms are much significant in this respect. The private farms provide employment to the rural folk but their incomes are too minimal.

The rural economy has much scope for contribution to the national income of the country but it needs proper guidance and direction. The government can play an active role in its development. Some of the schemes launched by the Government of India for the farmers and development of Agriculture and Horticulture are as follows:

- Pradhan Mantri Fasal Bima Yojana (PMFBY)
- Kisan Credit Card (KCC) scheme
- Pashu Kisan Credit Card Scheme
- Paramparagat Krishi Vikas Yojana (PKVY)
- Pradhan Mantri Krishi Sinchai Yojana (PMKSY)
- National Agriculture Market (e-NAM)
- National Mission for Sustainable Agriculture (NMSA)
- Mission for Integrated Development of Horticulture (MIDH)

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# On Climate Resilient Agriculture as a Major Driver to Sustainable Growth of India

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## ABSTRACT

The paper examines the impact of climate change on Indian Agriculture, which has been the prime source of economic development. Climate change is the most alarming environmental phenomena affecting livelihoods as well as production. The present paper also discusses the various mitigation strategies to counter the effects of climate change. Besides, it takes into account $CO_2$ emissions in India that have been affecting the agricultural land and agricultural growth. The paper also aims for providing important sustainable recommendations in order to attain sustainability in our ecosystem.

**Key words:** Indian Agriculture, Climate Change, Carbon Emissions, Mitigation Strategies.



**Introduction:**

Indian agriculture has been experiencing its vulnerability on high monsoon dependence, drought, heat waves and income losses. According to Economic Survey 2017-2018, there has been a long term trend of rise in temperatures, decline in average precipitation, and rise in extreme precipitation events. Besides, the number of dry days is somewhat more due to high temperature and low rainfall. This impact adversely on unirrigated areas as compared to the irrigated areas. It is also estimated that climate change reduces annual agricultural incomes on an average of 15 to 18% and 20 to 25% for unirrigated areas. With the increase in population and economic development, there has been severe environmental degradation undermining the environmental resource base and the environmental deterioration trends of India have been more prominent as compared to other developing countries due to the substantial increase of itspopulation (Ahmed et al., 2011). Indian agriculture is considered as a major significant factor in developmental planning process as it emphasizes on employability of people, availability of food, food security, providing raw materials to various industries such as sugar, textile, herbal and other food processing units. Therefore, agriculture sector is reliable for multi-sector growth as it connects many dimensions from food and nutrition security,

income security to poverty alleviation and increasing trade and its exports mostly.According to Economic Survey 2019-2020, the real annual growth rate in agriculture and its allied sectors is 2.9 per cent (2019-2020) and 2.88 per cent (2014-2015). The small and marginal farmers constituting 87 per cent of the peasants of India are emphasized by the recent innovations and practices for sustainable agricultural growth. The recent report on climate change by Intergovernmental Panel on Climate Change highlighted that the impacts of global warming of 1.5p C is above the pre-industrial levels and related to the severe pathways of global green house gas emissions.

**Literature Review:**

Bushra Praveen and Pritee Sharma (2019) in their study on Climate Change and its impacts on Indian agriculture: An Econometric analysis assessed the impact of climate change on land productivity for major food and nonfood grain crops in India. They compiled data for 50 years (1967–2016) using 15 crops across India to estimate the variation of agriculture production for each crop by different variables such as temperature and rainfall estimation. The results indicate that land productivity decreases with an increase in annual average temperature in most of the crops. The adverse impact of climate change on agricultural production indicates food security threat to small and marginal farming households and adversely affected due to climatic fluctuations.

According to R. K. Mall, Ranjeet Singh, Akhilesh Gupta, G. Srinivasan and L. S. Rathore (2005) on their study of impactof climate change on Indian agriculture presents an overview of the state of the knowledge of possible effect of the climate variability and change on food grain production in India.



Raymond Guiteras (2009) in his study on the impact of climate change on Indian agriculture estimated the impact of climate change on Indian agriculture. A 40-year district-level panel data set covering over 200 Indian districts to estimate the effect of random year-to-year variation in weather on agricultural output. The panel estimates incorporate farmers within-year adaptations to annual weather shocks. These estimates, derived from short-run weather effects, are relevant for predicting the medium-run economic impact of climate change if farmers are unable to adapt quickly. The projected climate change over the period 2010-2039 reduces major crop yields by 4.5 to 9 percent. The long-run (2070-2099) impact is dramatic, reducing yields by 25 percent or more in the absence of long-run adaptation. The results suggest that climate change is likely to impose significant costs on the Indian economy unless farmers can quickly recognize and adapt to increasing temperatures. Such rapid adaptation may be less plausible in a developing country, where access to information and capital is limited

Virginia H. Dale (1997) studies the relationship between land-use change and climate change. Land-use change is related to climate change as both a causal factor and a major way in which the effects of climate change are expressed. As a causal factor, land use influences the flux of mass and energy, and as land-cover patterns change, these fluxes are altered. Projected climate alterations will produce changes in land-cover patterns at a variety of temporal and spatial scales, although human uses of the land are expected to override many. The study shows that in recent centuries land-use change has had much greater effects on ecological variables than has climate change; the vast majority of land-use changes have little to do with climate change or even climate; and humans will change land use, and

especially land management, to adjust to climate change and these adaptations will have some ecological effects. Therefore, an understanding of the non climatic causes of land-use change (e.g., socio- economics and politics) are necessary to manage ecological functions effectively on regional and global scales.

According to Fatemeh Sayyadi, Reza Moghaddasi and Saeed Yazdani (2018) in their study on how climate change affects land use pattern: an Iranian provincial experience observed that Climate change is exacerbating the challenges faced by the agriculture sector especially in arid and semi-arid regions. Climate change-induced increases in temperature, rainfall variation (both spatial and time) and the frequency and intensity of extreme weather events are adding to pressure on the global agriculture system. The study specifies a spatial econometric model to determine the major drivers of land use change, with emphasis on climate variables, in three bordering provinces of Iran during 2004–2016. Results indicate that changes in the usage of land and adaptation to climate change occur through time, but these changes have a major locative dependence on the nearby areas. In most of the regions under study, the increase in temperature exerts negative impacts on the proportion of lands devoted to grass and agriculture. Cropland value and farmer income have indirect and direct impact on the share of agricultural lands, respectively. Land slope is also indirectly related to urban and agricultural land allocation. Provision of more supports to farmers through direct payment and price support policies aiming at preserving of agricultural lands is recommended.

According to E. Koomen, H. de Moel, E. G Steingrover, S.A.M. Van Rooij and M Van Eupen (2014) in their study on land use and climate change studies the effect climate change



has on land use. It aims to provide an integrated outlook on a climate-proof future for the Netherland.

According to Rohitashw Kumar and Harender Raj Gautam (2014) in their study on Climate change and its impact on agricultural productivity in India observed that climate change has a serious impact on the availability of various resources on the earth especially water, which sustains life on this planet. Changes in the biosphere, biodiversity and natural resources are adversely affecting human health and quality of life. Throughout the 21stcentury, India is projected to experience warming above global level.

The Green House Gases (GHGs) include water vapour, carbondioxide (CO), Ozone (O ), Methane (CH), and nitrous oxide (NO). These gases absorb energy and make the earth warm. The emissions take place in the initial stages of various productions, use of agricultural inputs, farm machinery, irrigation, increasing livestock population. Therefore, climate change has many significant effects on the socio-economic life of the individuals and the environment that protects and supply food to us.

**Objectives and Methodology:**

This paper therefore studies the impact of climate change on agriculture in India and secondly, provides a brief account on mitigation strategies to counter the effects of climate change. This study is entirely based on secondary sources such as World Development Indicators, FAOSTAT, Indian Agricultural Research Institute, Economic surveys, IPCC reports, and other government websites and reports.

**Analysis:**

India is the third-largest emitter of greenhouse gases after

China and the United States. India emitted 2,299 million tonnes of carbondioxide ($CO_2$) in 2018, according to a report by the International Energy Agency. This accounts for 7 per cent of global GHG emissions. Agriculture and livestock account for 18 per cent of gross national emissions. A majority of agricultural GHG emissions occur at the primary production stage and are generated through the production and use of agricultural inputs (mainly water, fertilizers, and pesticides) farm machinery, soil disturbance, residue management and irrigation. While the agriculture sector is responsible for climate change due to GHG emissions, it is also severely impacted by the effects of changing climate. Climate change is threatening India's agricultural growth with frequent dry spells, heat waves, and erratic rainfall. Agriculture accounts for 70 percent of freshwater withdrawals; producing more with less water can address water scarcity. "For example, an extreme temperature shock in unirrigated areas reduces yields by 7 per cent for kharif and 7.6 per cent for rabi," the survey said.

**Table 1:**

**Weather Variability in Indian Agriculture**

| | Extreme Temperature shocks | Extreme Rainfall shocks |
|---|---|---|
| Average Kharif | -4.0% | -12.8% |
| Kharif Irrigated | -2.7% | -6.2% |
| Kharif Un-irrigated | -7.0% | -14.7% |
| Average Rabi | -4.7% | -6.7% |
| Rabi Irrigated | -3.0% | -4.1% |
| Rabi Un-irrigated | -7.6% | -8.6% |

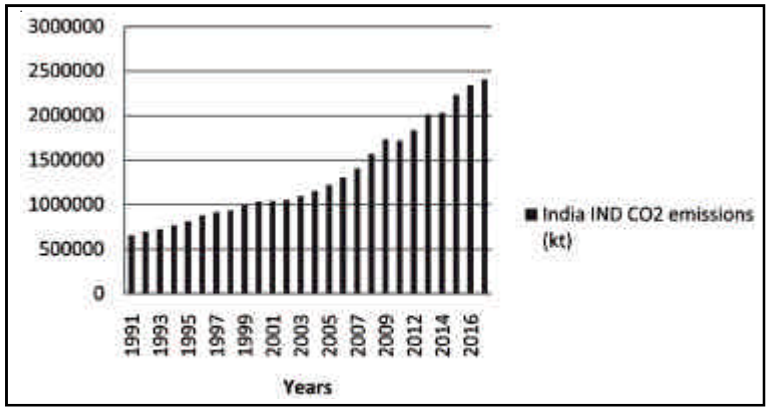
*Source : Economic Survey*

Green house gas emissions are showing no signs of falling, as they must to meet the goals of the Paris Agreement and the 2030 Agenda for Sustainable Development. The world is in



danger of missing the target of limiting global warming to 1.5 °C this century, set out in the Paris Agreement. Agriculture emits around one quarter of greenhouse gases, but it holds almost half of the solutions to global climate goals. As the latest reports show, climate change is already having profound consequences. Oceans are warming and acidifying, threatening fish stocks. Longer, more intense droughts are imperiling freshwater supplies and crops. Extreme weather events that damage infrastructure, wipe out harvests, and erode natural resources are hitting the livelihoods of smallholder farmers, fishers and foresters, who have contributed least to climate change. Without action, the changing climate will affect food availability and hinder access to food by disrupting the livelihoods of millions of rural people. It will expose urban and rural poor to higher and more volatile food prices. It will cause forced migration and jeopardize the Sustainable Development Goals (SDGs).

**Figure 1: $CO_2$ emissions (kt)**

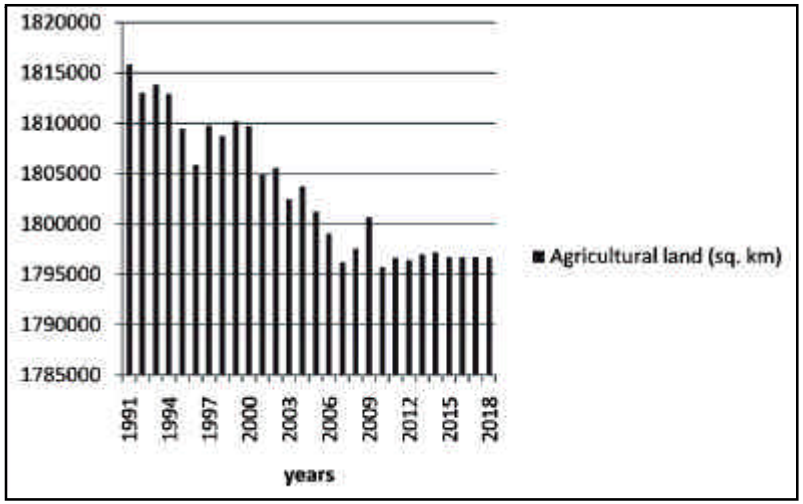



*Source: World Development Indicators*

In the figure 1 above represents $CO_2$ emissions (kt) where it has been estimated in the year 1991, CO2 emissions were

about 658189.8 kt that increased gradually along the years. Moreover, it has been estimated about 1738646 kt in 2009 and then slowing down in 2010 say 1719691 kt. However, CO2 emissions increasing which is about 2407672 kt in 2016 according to the World Development Indicators.

**Figure 2:**
**Agricultural land (sq.km)**

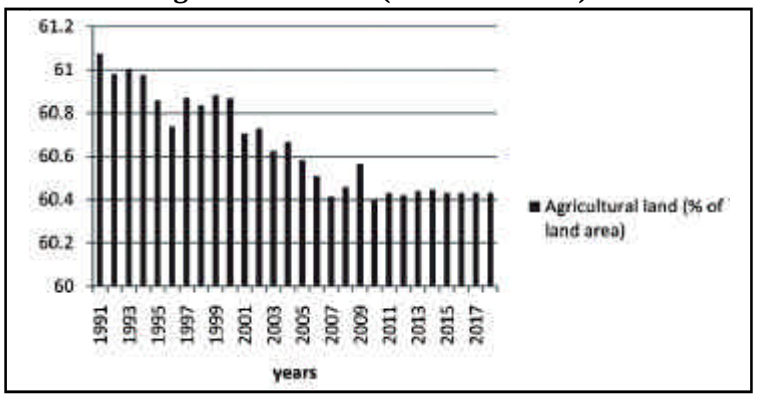



*Source: World Development Indicators*

From the above figure 2 that represents agriculture land (sq.km) implying a transitive no.s as in 1991, it was estimated about 1815860 sq.km, 1813050 sq.km in 1992, 1813820 sq.km in 1993, 1812910 sq.km in 1994, 1809450 sq.km in 1995. Later on, in 2009, it was estimated as 1800680 sq.km, 1795730 sq.km in 2010, 1796700 sq.km in 2011, 1796420 sq.km in 2012, 1796980 sq.km in 2013, 1797210 sq.km in 2014, 1796740 sq.km in 2018.



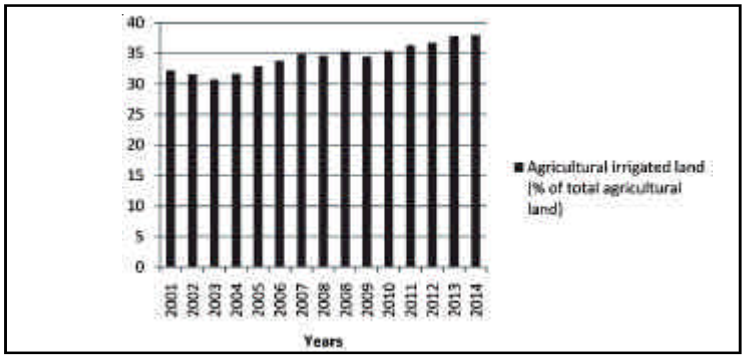
**Figure 3:**
**Agricultural land (% of land area)**




*Source: World Development Indicators*

From the above figure 3 that represents agricultural land (% of land area) indicating a decreasing percent in the recent years. In the year 1991, it was estimated about 61.07% of agricultural land, 60.97% of agricultural land in 1992, 60.86% in 2000, 60.44% in 2014 and then there has been a stagnancy about 60.43% in the years 2015, 2016, 2017 and 2018.

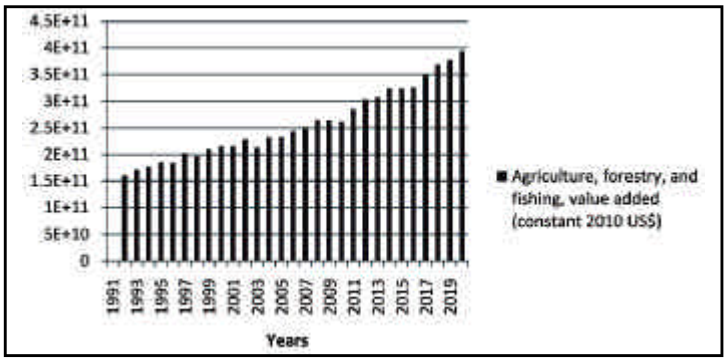
**Figure 4:**
**Agricultural irrigated land (% of total agricultural land)**




*Source: World Development Indicators*

In the figure 4 that represents agricultural irrigated land (% of total agricultural land), indicated that in the year 2001, it was estimated about 32.20% agricultural irrigated land of the total agricultural land. It also showed a fall in the years 2002, 2003 that again took a pace up to 32.86% in 2005. It was then estimated about 35.34% in 2009, 36.32% in 2012, and 38.05% in 2015.

**Figure 5:**
**Agriculture, forestry, and fishing, value added (constant 2010 US$)**




*Source: World Development Indicators*

In the above figure, Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing as well as cultivation of crops and livestock production. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3 or 4. According to World Bank estimates, Agriculture, forestry, and fishing, value added (% of GDP) in India was reported at 16.02% in 2019.
In India, we are experiencing increasing trend of $CO_2$ emissions along with agriculture irrigated land and agriculture value added. Of course, the concept of energy poverty and energy demand requires more concentration for improving the productivity level of land and crops as well.



Agriculture releases to the atmosphere a significant amount of $CO_2$, CH4, and N2O (Cole et al., 1997; IPCC, 2001a; Paustian et al., 2004). CO2 is released largely from microbial decay or burning of plant litter and soil organic matter ( Smith 2014b; Janzen, 2004). Growth in land productivity is also expected to continue, although at a declining rate, due to decreasing returns from further technological progress and greater use of marginal land with lower productivity. Use of these marginal lands accelerates the risk of soil erosion and degradation, with highly uncertain consequences for $CO_2$ emissions (Lal, 2004a; Van Oost et al., 2004). Further improvements in productivity will require higher use of irrigation and fertilizer, increasing the energy demand (moving water and manufacturing fertilizer; Schlesinger, 1999). In addition, irrigation and N fertilization can increase GHG emissions (Mosier, 2001). Also the changes in policies ( e.g, subsidies), and regional patterns of production and demand are causing an increase in international trade of agricultural products. This is expected to raise $CO_2$ emissions because of excessive use of energy for transportation. Moreover, there is an emerging trend for the use of agricultural products (e.g., bio-plastics, bio fuels and biomass for energy) as substitutes for fossil fuel-based products. This has the potential to reduce GHG emissions in the future.

To meet the Sustainable Development Goals on poverty and hunger, agriculture and food systems need to be sustainably boost productivity and efficiency.

- Food and agriculture needs to produce 49 percent more food by 2050, but it is already a major driver of, and hugely vulnerable to, climate change. It emits around a quarter of greenhouse gas emissions and supports around 2.5 billion people.

➢ Climate impacts such as extreme weather events, spreading pests and diseases, loss of biodiversity, degrading ecosystems, and water scarcity will worsen as the planet warms. These impacts will damage food security and livelihoods and lead to forced migration.

Nature-based solutions are important. They help mitigation, adaptation and resilience, conserve and restore ecosystems, and ensure nature contributes to resilient livelihoods, green job generation and rural poverty reduction.

➔ Reducing deforestation and restoring degraded forests and landscapes are cost-effective, rapid ways to cut emissions by over 5 gigatonnes.
of carbon dioxide equivalent each year – about ten percent of total 2018 emissions – while boosting biodiversity and healthy ecosystems.

➔ Restoring agricultural land and degraded soils can remove up to 51 gigatonnes of carbon dioxide from the atmosphere in total and raise food production by 17.6 megatonnes per year.

➔ Protecting and restoring coastal and marine ecosystems – such as mangroves, salt marshes, seagrass beds, seaweeds and coral reefs – can provide protection against waves.

➔ Reducing food losses from production to retail, which FAO estimates costs USD 400 billion a year, can bring further cuts in emissions and gains in agricultural productivity.

**Challenges**

◆ Over 820 million people were undernourished in 2018, while agriculture provides livelihoods for 2.5 billion people.

◆ Climate change could push 122 million more people, mainly farmers, into extreme poverty by 2030.



◆ Climate change is projected to increase cereal prices 29 percent by 2050.

◆ Agriculture absorbs 26 percent of the economic impact of climate disasters, rising to 83 percent for drought in developing countries.

◆ Water scarcity affects 40 percent of the population. For every 1 °C rise, 500 million extra people will face a 20 percent dip in renewable water resources.

◆ Transboundary animal and plant pests and diseases are spreading faster with climate change. Plant diseases alone cost the global economy USD 220 billion annually.

◆ Agriculture, forestry and other land use cause almost one quarter of human greenhouse gas emissions. Tropical deforestation and forest degradation account for 11 percent.

◆ A third of global soils are degraded, releasing 78 gigatonnes of carbon dioxide into the atmosphere, and costing over 10 percent of GDP through lost biodiversity and ecosystem services.

◆ Livestock supply chains account for 14.5 percent of human emissions.

◆ The ocean has absorbed over 90 percent of human-induced warming and 30 percent of carbon dioxide emissions. In some Western and Central Pacific island states, small-scale fisheries' harvests could fall up to 50 percent by 2050.

◆ Around 14 percent of food, worth USD 400 billion, is lost post-harvest before it reaches retailers. Total food losses and waste cause 8 percent of greenhouse gas emissions, according to earlier estimates.

Human-induced warming reached approximately 1°C (*likely* between 0.8°C and 1.2°C) above pre-industrial levels in 2017, increasing at 0.2°C (*likely* between 0.1°C and 0.3°C) per

decade. Global warming is defined as an increase in combined surface air and sea surface temperatures averaged over the globe and over a 30-year period. Unless otherwise specified, warming is expressed relative to the period 1850–1900, used as an approximation of pre-industrial temperatures in AR5. For periods shorter than 30 years, warming refers to the estimated average temperature over the 30 years centred on that shorter period, accounting for the impact of any temperature fluctuations or trend within those 30 years. Warming greater than the global average has already been experienced in many regions and seasons, with higher average warming over land than over the ocean. Most land regions are experiencing greater warming than the global average, while most ocean regions are warming at a slower rate. Depending on the temperature dataset considered, 20–40% of the global human population lives in regions that, by the decade 2006–2015, had already experienced warming of more than 1.5°C above pre-industrial in at least one season.This report assesses projected impacts at a global average warming of 1.5°C and higher levels of warming. Global warming of 1.5°C is associated with global average surface temperatures fluctuating naturally on either side of 1.5°C, together with warming substantially greater than 1.5°C in many regions and seasons , all of which must be considered in the assessment of impacts. Impacts at 1.5°C of warming also depend on the emission pathway to 1.5°C. Very different impacts result from pathways that remain below 1.5°C versus pathways that return to 1.5°C after a substantial overshoot, and when temperatures stabilize at 1.5°C versus a transient warming past 1.5°C.

India submitted its Nationally Determined Contribution (NDC) under the Paris Agreement on a "best effort basis" keeping in mind the developmental imperatives of the country.



In its NDC, India promised to reduce its emission intensity of GDP by 33 to 35 per cent below 2005 levels by the year 2030; 40 per cent of cumulative electric power installed capacity would be from non-fossil fuel sources by 2030 and increase its forest cover and additional carbon sink equivalent to 2.5 to 3 billion tons of carbon dioxide by 2030. The Paris Agreement is to be implemented in post-2020 period in line with the guidelines adopted under Paris Agreement Work Programme.

**Agricultural Residue Burning – A Major Concern**

Burning of agricultural wastes in the fields is a practice that results in a number of environmental problems. India, being the second largest agro-based economy with year-round crop cultivation, generates a large amount of agricultural waste, including crop residues. Open burning of crop residues in the agricultural fields has become an environmental concern in India, particularly during paddy harvesting season. Varieties of surplus crop residues are burnt especially in northern States of Punjab, Haryana, UP, and Rajasthan depending on the agro-climatic region; however, about 50 per cent of all crop residue burnt in the country are residues of rice crop (TIFAC, 2018). Use of combine harvesters leaves the crop residues in field, and in order to clear the fields for the next crop in easiest way, farmers' burn the residues. About 178 million ones of surplus crop residues are available in the country (TIFAC, 2018). Burning of these residues leads to rise in pollutant levels and deterioration of air quality.

**Emphasizing soil health management:**

Agriculture is one of the climate sensitive sectors that need to protect for sustainable growth and development. Hence, the

bigger side of sustainable agriculture is the quality of soil. In fact, the quality of soil depends on soil organic matter, which is very much responsive to global warming. High soil organic matter reflects high productivity and improves the quality of soil such as absorption of water, reduction in surface run-off, soil erosion.

❖ **Soil Management:** Conservation of soil is as important as the conservation of various natural resources such as fossil fuels, trees, etc. It has been observed long before that the humans are very responsible to conserve their ground to make useful things out of that for their survival. Without proper soil conservation, the fertile land can even turn into a dust bowl or a permanent desert. Therefore, appropriate measures must be undertaken to conserve the soil and land. Most importantly, soil erosion in the hilly areas and surged topography transports organic materials, rock sediments that can affect the quality of soil. In addition, the matter of leaching can cause the movement of dissolved substances through the soil and can even remove the valuable nutrients available to the soil. Therefore, it has both the good and the bad side of the cause. There is the need to improve root penetration and widen moisture conservation to lessen soil erosion. For this, the role of farmers can have a pivotal role in adopting certain strategies to counter soil erosion; as such, they can use contour ridges, use-fertilizing methods to increase the tree densities in the semi-arid areas. These will maintain a good health of the crops by reducing desertification in most areas. While conserving the soil moisture, use of natural mulches can help in moderating the soil temperatures, keeps far from harmful pests and diseases. Therefore, education of the farmers as well as agricultural financing can be a great indulging factor to generate more productivity of soil, land.



❖ **Sequestration of Carbon:** Sequestration of carbon is a process of capturing carbon or storing the atmospheric carbon dioxide for long-term basis in order to mitigate global warming. This process slows down the atmospheric and marine accumulation of various green house gases released by burning fossil fuels.

❖ **Conservation of Agriculture:** Unlike the conventional system, the conservation-based agriculture (CA-based system) produces more and even lowers the cost of production (about 23%). The CA-based system even increases the level of productivity of irrigation waterand even moderates the level of temperature i.e., canopy temperature by 1-4 degree celcius as compared to the conventional production systems. Thus, the system may be called as a green solution in order to attain nutritional security through efficient and innovative techniques in agriculture.

❖ **Nutrient Management:** There is a need to balance the use of fertilizers carried on every holdings in an efficient manner by adopting the strategy of 4Rs, i.e., right nutrient, right quantity, right time, and right method of application. It is also important to balance out the proper nutrients based on soil tests. The application of integrated nutrient supply system suggests using the fertilizers in conjunction with organic manures and biofertilizers. This results in the efficiency of nutrient use that reduces the NO emissions, mineral fertilizers. The use of nitrification inhibitors will help in the regulation of leaf color chart that will ensure the proper use of N-fertilizers. The adoption of organic farming can really help in minimizing the level of GHG emissions. Moreover, the integrated nutrient management suggests using biofertilizers, green manures, neem, karanj, vermicompost, organic manures, nitrification inhibitors,

etc. along with the use of fertilizers that eventually improves the quality of soil with proper essential nutrients for the growth process of various crops. It is also very important to lower the dependence of nitrogen fertilizers, Rhizobium cultures in pulses, Azotobacter in rice, wheat, millet, cotton, sugarcane, potato, etc. It helps in lowering the cost on fertilizers based on the benefits associated with the symbiotic and asymbiotic nitrogen fixation.

❖ **Diversification of Crops:** Crop diversification is an important and priority adaptation measure to combat climate change for both irrigated and non-irrigated areas. It serves as a measure of insurance at the time of high temperature risks and variability of rainfall.

❖ **Mixed cropping:**The growing of two or more crops in the same field can be termed as mixed cropping or intercropping. Mixed cropping is mostly observed in India where many crops are grown together which includes cereals (maize, sorghum), nuts (groundnuts), legumes (beans), etc. Taking different varieties of the same crop and scheduling different planting dates can be considered as an important adaptation measure to mitigate climate change. Mixing crops has many advantages regarding maturity period, drought tolerance, input requirements, etc.

Besides, the adoption of integrated cropping systems can make a climate resilient agriculture through agro-forestry, risk-coping production systems, crop rotations, crop-livestock association, vegetative buffer strips, crop-fish systems, hedges, farm landscaping, etc.

**Conclusion:**

The food and agricultural sectors need to be at the centre of our global response to climate change. Around 90 percent of



the countries' Nationally Determined Contributions (NDCs) include the agricultural sectors – which clearly demonstrates the strong demand for climate action in these sectors, and underlines FAO's central role in supporting such action. Enhancing member countries' capacities to respond to the effects of the changing climate is at the core of FAO's mandate and of its corporate Strategy on Climate Change. As a provider of technical knowledge and expertise, FAO is supporting countries in developing and enhancing their NDCs in the Agriculture, Forestry, and Other Land-Use (AFOLU) sectors. This is within the broader context of achieving the Paris Agreement and the 2030 Agenda for sustainable development. Agriculture is both part of the problem and a key part of the solution. Linking up climate action with sustainable development perspectives and the implementation of the SDGs is the cornerstone of transformation. Focusing support on the most vulnerable – small-scale farmers, women and youth – and consolidating different approaches in a tailor-made and comprehensive manner will help to address poverty, hunger, food security, and climate change simultaneously.

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# Environmental Impacts of Oil and Gas industry of Assam- with Special Reference to Baghjan Oil Spill

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## ABSTRACT

The Oil and Gas industry is defined to include exploration, extraction, transportation and processing of crude oil and natural gas. Exploration can be generally thought of as the process of finding mineral resources. The oil industry, recognizing its responsibilities as members of the communities in which it operates, will generally be represented in any reliable community effort to control environmental pollution. The industry has technical personnel, technical know-how, and a desire to cooperate. It insists, however, in proceeding on the basis of established facts, on the basis of sound scientific and engineering principles, and with due regard to economics. The oil industry has supported and will continue to support research that is considered important to solving environmental pollution problems and will also support sound legislation that will lead in that direction. The objective of the study is to present the environmental impcts of the Oil and Gas Industry of Assam.

**Key words:** oil exploration, Petroleum refining, environment.

## 1. Introduction:

The oil industry, recognizing its responsibilities as members of the communities in which it operates, will generally be represented in any reliable community effort to control environ mental pollution. The industry has technical personnel, technical know-how, and a desire to cooperate. It insists, however, in proceeding on the basis of established facts, on the basis of sound scientific and engineering principles, and with due regard to economics. The oil industry has supported and will continue to support research that is considered important to solving environmental pollution problems and will also support sound legislation that will lead in that direction. It believes that the public's health must be protected. The production, transportation, and marketing divisions of the petroleum industry generally have environmental pollution problems, in those instances where problems occur.

## 2. Objectives:

1. To measure the environmental impacts of oil exploration, production and refining of Assam.
2. Impact of major oil spills of Assam

## 3. Data Source and Research Methodology

The study will be based on the secondary data to be collected from a number of sources. The data will be collected from the Annual Report of Guwahati Refinery, IOCL; Annual Report of Digboi Refinery, IOCL; Annual Report of Bongaigaon Refinery, IOCL; Annual Report –Ministry of Petroleum and Natural Gas, Government of India; Indian Petroleum and Natural Gas Statistics, Ministry of Petroleum and Natural Gas, Economic and Statistic Division; Annual Report of Numaligarh Refinery Limited, Annual Report of OIL, Annual Report of ONGC.



## 4. Environmental impact of Oil and Gas industry of Assam: a review of their emperical studies

Environmental pollution in the petroleum industry arises from various sources which range from drill cuttings, drilling mud and effluents to other major sources such as oil spillage and gas flaring and refinery operations. Oil spillage and gas flaring remain major environmental challenges in the petroleum industry. Exploration and production of petroleum have caused local detrimental impacts to soils, surface and ground waters and ecosystems in most part of the world. These impacts arose primarily from the improper disposal of some of the large volumes of saline water produced with oil and gas, from accidental hydrocarbon and produced-water releases, and from abandoned oil wells that were orphaned or not correctly plugged. Impacts and ground-surface disturbances, in the order of several acres per well, can also arise from related activities such as site clearance, construction of roads, tank batteries, brine pits and pipelines, and other land modifications necessary for the drilling of exploration and production wells and construction of production wells and construction of production facilities. A sound waste management system may be accomplished through hierarchical applications of the practices of source reduction, reuse, recycling treatment and responsible disposal such as land filling, burial, surface discharge, land spreading or land farming and underground injection (Olajire, 2014). Siddiqui (2015) states that oil refineries are major polluters, consuming large amounts of energy and water, producing large quantities of waste waters, realizing hazardous gases into the atmosphere and generating solid waste. The oil industry holds a major potential of hazards for the environment, and may impact it at different levels: air, water, soil and consequently all living being on our planet. Other

environmental impacts include intensification of the green house effect, acid rain, poorer water quality and groundwater contamination, it may also contribute to biodiversity loss a well as the destruction of the ecosystems. Refinery can generate pollutions which may be solids, liquid effluents and gases.

Refineries are the intensive consumers of energy and water used to carry out the processes. In their storage and refining processes, refineries emit pollutants to the atmosphere, to the water bodies and to the soil, to the extent that environmental management has become a necessity for refineries. From storage and from the refining processes, they generate emission to the atmosphere, to the water bodies and to the soil. The type of air emissions to the environment from refineries is well defined. The main polluting substances are: Sulphur dioxide (SO2), Oxides of nitrogen (NOx), Carbon monoxide (CO), Volatile Organic Compounds (VOC), in particular hydrocarbons (excluding methane), Particulate Matters (PM), including metals and their compounds, Substances proved to possess carcinogenic properties. Processing of crude oil requires large volumes of water, a large portion of which is continually recycled, but some of which is moderately or highly contaminated, requiring primary, secondary and sometimes tertiary treatment. Almost every major refining operation produces a wastewater stream containing pollutants. Reduction in water usage sometimes may be more cost-effective in reducing the quantity of wastewater discharge than water reuse. A major process change that can reduce wastewater production is the substitution of air-cooling devices for water –cooling devices. Petroleum refinery generates a wide variety of solid waste. Basically, refinery solid waste streams fall into two main groups i.e., intermittently generated and continuously generated. Intermittent wastes are generally



those that result from cleaning within the process areas and off-site facilities of the refinery (GOI, 2010). Although the principal raw material input to petroleum refineries is crude oil, they use and generate an enormous number of chemicals, some of which leave the facilities as discharges of air emission, wastewater or solid waste. Pollutants generated typically include ammonia(NH3), carbon dioxide(CO2), carbon monoxide(CO), hydrogen sulphide(H2S), metals, nitrogen oxides(NOx), particulates, spent acids, sulphur oxides(SOx), volatile organic compounds(VOC) and numerous organic compounds (GOI,2010)

## 5. Environmental Impacts of Oil Exploration and Production

Oil and gas exploration and production (E & P) operations have the potential for a variety of impacts on the environment. These “impacts” depend upon the stage of the process, the size and complexity of the project, the nature and sensitivity of the surrounding environment and the effectiveness of planning, pollution prevention, mitigation and control techniques.

The environmental impacts arising out of E & P are Atmospheric impact, Aquatic impact, terrestrial impacts, ecosystem impacts and Potential emergencies. Atmospheric impacts arises from flaring, venting, and purging gases, combustion processes such as diesel engines, fugitive gases from various sources, airborne particulates from soil disturbance. Flaring of produced gas is the most significant source of air emissions, particularly where there is no infrastructure or market available for the gas. Aquatic impacts arises from produced water, drilling fluids, cuttings and well treatment chemicals, process, wash and drainage water, sewerage, sanitary and domestic wastes and, spills and leakages. Terrestrial impacts

arises from physical disturbance as a result of construction, from contamination resulting from spillage and leakage or solid waste disposal and, access roads. Ecosystem impacts arises through change in water, air and soil/sediment quality and through disturbance by noise, extraneous light and changes in vegetation cover. These may directly affect the ecology. Potential emergencies are spills, blow out, explosion, fires, natural disasters, war and sabotage. (E & P Forum/UNEP, 1997). Significant waste streams specific to onshore oil and gas development activities include: drilling fluids and drilled cuttings, produced sand, completion and well work-over fluids, and naturally occurring radioactive materials (NORM). Because drilling waste may contain chemical additives or hydrocarbons, it impacts vegetation, flora and fauna, and water bodies if released in an uncontrolled manner into the environment. Loading of contaminants in the receiving environment also takes place when the method of disposal is discharge to the environment. (GRI, 2012). The produced sand originating from the reservoir and separated from the formation fluids during hydrocarbon processing can be contaminated with hydrocarbons; depending on the field reservoir characteristics, NORM may precipitate as scale or sludges in process piping and production vessels. During seismic surveys, construction activities, drilling and production, transportation oil and gas development activities can also generate noise. Project footprints resulting from exploration and construction activities may include seismic tracks, well pads, temporary facilities, such as workforce base camps, material storage yards, workshops, access roads, airstrips and helipads, equipment staging areas, and construction materials extraction sites (including borrow pits and quarries). It also leads to loss of, or damage to, terrestrial



habitat, creation of barriers to wildlife movement, soil erosion, and disturbance to water bodies including possible sedimentation, the establishment of non-native invasive plant species and visual disturbance (E & P Forum/UNEP, 1997; IFC, 2007). Top soil is an important component of the environment which remains at higher risk but is given less priority for prevention from contamination during E & P.

## 6. Environmental management

The harmful effects generated from various sources of oil and gas upstream can be mitigated if taken care with appropriate precaution, budget and willingness. All the three forms; liquid, gaseous and solid, of pollutants are generated from various sources in the industry.

Flaring and venting of natural gas is a waste of a valuable energy resource, contributing to emissions of greenhouse gases (GHGs) and air pollutants.

Produced water contains a complex mixture of inorganic (dissolved salts, trace metals, suspended particles) and organic (dispersed and dissolved hydrocarbons, organic acids) compounds. The alternatives may include injection into the reservoir to enhance oil recovery, and injection into a dedicated disposal well drilled to a suitable receiving subsurface geological formation; other possible uses includes irrigation, dust control, or use by other industry considering chemical nature. Gray and black water from showers, toilets and kitchen facilities should be treated. Separate drainage systems for drainage from process areas that could be contaminated with oil (closed drains) and drainage water from non-process areas (open drains) should be available with sluice gates to the extent practical. Non-hazardous and hazardous wastes routinely generated at onshore facilities including general office and packaging wastes, waste oils,

paraffins, waxes, oil contaminated rags, hydraulic fluids, used batteries, empty paint cans, waste chemicals and used chemical containers, used filters, fluorescent tubes, scrap metals, and medical waste, among others can be segregated into non-hazardous and hazardous wastes for consideration for re-use, recycling, or disposal. Waste management planning should establish a clear strategy for wastes that will be generated including options for waste elimination, reduction or recycling or treatment and disposal, before any wastes are generated (IFC 2007). Some alternatives to treat disposal of drilling fluids and drilled cuttings are injection of the fluid and cuttings mixture into a dedicated disposal well, into the annular space of a well, storage in dedicated storage tanks or lined pits prior to treatment, recycling, and/or final treatment and disposal; On-site or off-site biological or physical treatment to render the fluid and cuttings nonhazardous prior to final disposal using established methods such as thermal desorption in an internal thermal desorption unit to remove NADF for reuse, bioremediation, land farming, or solidification with cement and/or concrete. As per MoEF Notification (GSR 546 (E) dated 30th December 2005), for disposal of Drill cutting (DC) and drill fluids from on shore installation following should be followed; DC originating from onshore or locations close to shoreline and separated from water based mud (WBM) should be properly washed and unusable drilling fluids (DF) such as WBM and oil based mud (OBM), synthetic base mud (SBM) should be disposed off in a well designed pit lined with impervious liner located off site or on site. Additional leachate collection system and final disposal routes for the nonhazardous cuttings solid material should be established, and may include use in road construction material, construction fill, or disposal through landfill including landfill



cover and capping material where appropriate (IFC, 2007).

Using high efficiency solids control equipment or using slimhole multilateral wells and coiled tubing drilling technique, Volumes of drilling fluids and drilled cuttings could be minimized. Careful selection of fluid additives and fluid system is affective in pollution prevention and control measures for spent drilling fluids and drilled cuttings (IFC, 2007). Noise impacts may be estimated by the use of baseline noise assessments for developments close to local human populations. For significant noise sources, noise dispersion models may be conducted to establish the noise level guidelines. Decommissioning and restoration of onshore facilities usually includes the complete removal of permanent facilities and well abandonment, including associated equipment, material, and waste disposal or recycling. Timely completion of final reclamation is as important as the initial planning. Revegetation alone does not constitute successful reclamation. Restoration of the original landform is a key element in ensuring that the effects of oil and gas development are not permanent. To achieve final reclamation, the well site may be recontoured to original contour or to a contour that blends with the surrounding landform, stockpiled topsoil redistributed, and the site revegetated (API, 2009). About 150mm loose top soil may be removed before site preparation using mechanical means like dozer and saved at a nearby place for later use during site restoration.

## 7. Environmental Impacts of Oil Refineries

Petroleum refineries are considered as one of the highly polluting industrial sector. The present crude throughput capacity is about 7.ooo Million Metric Tonnes per Annum (MMTPA) in

Assam. Normally, in any refinery, crude oil is processed in Crude Distillation Unit, consisting atmospheric distillation and vacuum distillation columns. The atmospheric column operates at atmospheric pressure and the products obtained from different trays are LPG, Naphta/ Gasoline, Aviation fuel, Turbine fuel/ Kerosene and High Speed Diesel. In their storage and refining process, refineries emit pollutants to the atmosphere, to the water bodies and to the soil, to the extent that environmental management has become a necessity for refineries. The type and quantum of the pollutants, generated from an oil refinery, will depend on type of crude and processes in use. The major pollutants emanated are emission of Sulphur Dioxide (SO2), volatile organic compounds (VOC), oxide of nitrogen (NOx) and particulate matter(PM); liquid effluent; and solid waste including oily sludge. It is, therefore, necessary to deal with emission and effluent generated from various unit processes to effectively prevent and control the environmental pollution.

## 8. Environmental standards of Refineries

Environmental standards, notified in 1988 under Environmental (Protection), Act, 1986, covered effluent standards for six parameters(Ph, Oil& Grease, Phenol, Sulphide, BOD and Suspended Solids) and mass based emission standards only for SO2 in respect of three process units ( Atmospheric Distillation, Catalytic Cracking and Sulphur Recovery).

In view of the expansion of the refineries with more complex configuration and new developments in pollution control technologies, the standards were updated and revised standards were notified in March 2009 under Schedule- 1 of Environmental ( have been upgraded with inclusion of new parameters; and emission standards have been upgraded with inclusion of new parameters; and emission standards are notified



for relevant pollutants ( SO2, NOx, H2S, Ni, V, etc) for various process units ( e.g. furnaces, FCCU, SRU). In order to regulate fugitive emission of VOC in refineries, standards have also been prescribed for petroleum storage tanks, equipment leaks, loading- unloading, maintenance and repairing schedule, wastewater treatement plant, etc.

## 9. Review of Sources and Pollution from Refinery Operations

During the last decade, many developments have taken place in the technologies for oil refining process and pollution abatement programmes in this sector. Oil refineries handles large quantities of raw materials and also intensive consumers of energy and water, used to carry out processes. In their storage and refining process, refineries emit pollutants to the atmosphere, to the water bodies and to the soil, to the extent that environmental management has become a necessity for refineries.

### 9.1 Air Pollution

Power plants, boilers, heaters and catalytic cracking are the main source of emissions of carbon monoxide and dioxide, nitrogen oxides ( NOX), Sulphur oxides (SOX), and Particulate matter(PM). Refinery processes require a lot of energy; typically more than 60% of refinery emissions are generated in the production of energy for the various processes. Ni & V are also generated in emission of furnaces, boilers and FCC regenerator. Sulphur recovery units (SRU), off gas treatment unit and flaring are the main sources of SO2. The general range of SO2 emissions are 0.143-0.892 kg/t and NOx emissions 0.010-0.8 kg/t observed in Indian refineries.The FCC regenerator installed in other Indian refineries throughout the ages so far, has not been utilised in any of the refineries located in Assam. Moreover, in other Indian

refineries two or more SRU's are being used but in Assam it has not executed more than one SRU.

The major pollutant generated from various refinery operations can be summarised as follows.

**Table 1.1: Air emission by refineries and their sources**

| POLLUTANT | SOURCE |
|---|---|
| SO2 | Process fumaces/ Boilers Gas turbines SRU's FCC regenerators Flare system Incinerators Decoking operation |
| CO | Process fumaces/ Boilers Gas turbines FCC regenerators Flare system Incinerators Cold vent |
| CO2 | Process fumaces/ Boilers Gas turbines FCC regenerators Flare system Incinerators |
| NOx | Treating units Process fumaces/ Boilers Gas turbines FCC regenerators Flare system Incinerators |
| Particulate Matter | Process fumaces/ Boilers FCC regenerators Coke plants Incinerators, Decoking, Flare |
| VOC | Storage & handling, Loading(inci.barges) Oil/water separation systems Fugitive emissions(leaks) Vent Flare Air blowing blowdown systems |
| CH4 | Storage and handling( loading) Cold vents Leaks |
| HALON | Firefighting equipment |



| POLLUTANT | SOURCE |
|---|---|
| CFC | Refrigeration Airco systems |
| Ni | Same with PM and SO2 |
| Benzene | Same with VOC |
| PAH | Same with VOC |

*Source: GOI, 2010*

The industry is recognized as among the largest sources of volatile organic compound (VOC) and organic hazardous air pollutants ( HAP). Volatile Organic Compound (VOC) emissions which evaporate at ambient temperature and contribute to the formation of 'Summer Smog' and Odour nuisance. It also contribute in green house emissions by formation of Ozone. Benzene has been considered as highly carcinogenic compound and has severe health impact. The main sources of VOCs from refineries are vents, flares, air blowing, blow-down systems, fugitive emissions from piping systems, wastewater systems, storage tanks, loading and unloading systems, storage and handling. Earlier due to absence of any environmental regulation for VOC, adequate steps were not taken to control VOC emission. The range of emission found in European refineries is from 600 to 10000 tonnes of VOC emitted per year. The specific emission range found is from 50 to 6000 tonnes of VOC per million tonnes of crude oil processed. Diffuse VOC emission sources such as seals from pumps, compressors, valves, flanges and leaks in pipelines may contribute20-50% to the total VOC emissions. Valves are considered to account for approximately 50-60% of fugitive emissions from equipment leaks.

Factors driving these releases of hydrocarbons are equipment design, quality of the sealing system, maintenance

program and properties of the line contents. Poorer designs (with wider tolerance), poor sealing systems (e.g. leak-prone valve packing) and limited maintenance lead to higher emissions. Other pollutants considered are carbon monoxide (process furnaces/ boilers, gas, gas turbines, catalytic gracker regenerators, flare system, incinerators, cold vents), methane (storage & handling, cold vents and leaks) and halon from firefighting equipment. H2S, NH3, CS2, dioxins and HF also contribute to the air emission from a refinery.

## 9.2 Liquid Effluents

During the processing of crude oil, large volumes of water are used that result generation of high amount of liquid effluents. Generally Indian refineries consumes high amount of raw water (0.3-2.0 $m^3$/t of crude processed) for production of petroleum products. Most of the Indian refineries have effluent generation less than 0.5$m^3$/t of crude processed. More than 95% of this wastewater is recycled/ reused in cooling, green belt development and fire fighting. Some refineries have also achieved the zero discharge. The refinery wastewater streams mainly comprise process water, which is generated in refinery units as a consequence of stream injection and/or washing hydrocarbon fractions with water, cooling water blow-down and contaminated storm water. Process water contains high COD, dissolved organics, hydrogen sulphide, ammonia and specific contaminants. The storm water or surface run-off, contains free oil and solids as COD while cooling water blow down have high amount of dissolved solids and oil & grease. A typical refinery effluent have major concentrations of oil & grease, chemical oxygen demand (COD), biochemical oxygen demand ( BOD), suspended solids, phenols, sulphides, cyanide and ammonia. The other parameters which have less concentrations



are total kjeldahl nitrogen (TKN), P, Cr, Pb, Hg, Zn, Ni, Cu, V, benzene, benzo (a)- Pyrene etc.

**Table 1.2**

**Liquid Effluents by refineries and their sources**

| POLLUTANT | SOURCE |
|---|---|
| BOD, COD,Oil | • Process Wastewater<br>• Cooling tower blowdown<br>• Tanks drainage and runoff<br>• Ballast water<br>• Spent caustic from treating units<br>• Organic wastes |
| Phenolics and Sulphides | • Process Wastewater from Cracking Units<br>• Spent caustic from treating units<br>• Crude storage tanks drains |
| Suspended solids | • Process Wastewater<br>• Cooling tower blowdown<br>• Ballast water<br>• Chemical treatment plants<br>• Tank bottom drainage |
| NH3 and H2S | • Process Wastewater from Cracking Units(FCU, Coker, Hydrocracker etc.)<br>• Hydrodesulphurisation and Treating Units |
| Heavy metals | • Process Wastewater<br>• Tanks drainage<br>• Residual Oily Sludges<br>• Catalytic processes |

*Source: GOI, 2010*

## 9.3 Solid and Hazardous Waste

Generally, the amount of waste generated by petroleum refineries is relatively small, in comparison of raw material and products. But the waste generated may present a significant risk to human health and environment, if not disposed/treated properly. Oil refinery waste normally covers three categories of materials:

- Sludge, both oily (e.g. tanks bottoms) and non-oily (e.g. from wastewater treatment facilities),
- Other refinery wastes, including miscellaneous liquid, semi-liquid or solids wastes (e.g. contaminated soil, spent

catalysts from conversion processes, oily wastes, incinerator ash, spent caustic, spent clay, spent chemicals, acid tar) and

- Non-refining wastes, e.g. domestic, demolition and construction.

**10. Environmental Concerns and Approaches**

Earlier emission of SO2 and other parameters like COD, BOD, suspended solids and oil & grease in liquid effluents only were considered major environmental concern. In recent years, refinery configuration got changed with addition of newer process units like DHT, DHDS etc. For producing cleaner automotive fuels. More efficient SRU and wastewater technologies have also come in use. Besides, fugitive emission of VOCs, NOx etc. started getting due attention. In this changed scenario, environment management in petroleum refineries needs shift from conventional to more pragmatic approaches. The emerging approaches to control environmental pollution from refineries are as follows :

**11. Major Oil Spills in Assam**

**Fire in Dikom- 15 producing well of OIL(Assam), 15th September 2005.ing Well**

In Dikom in 2005 Gas Leakage was observed from Dikom -15 producingwell of OIL at around 2.30 PM on 13.09.2005. Attempt was made to control the leakage but could not succeed and subsequently on 15.09.2005 at 11.50 AM there was a sudden explosion and well caught fire. The fire continued for 20 days and OIL had to take help of M/S Boots and Coots, Houston. More than 3,000 people were evacuated from surrounding radius of 3 KM.



**Baghjan blow-out**

On 27th May 2020 around 10.20 AM, a blow-out occurred in a well operated by OIL (BJN-5) in the Baghjan area under Tinsukia district, Assam. On the same evening, oil began leaking out of the well, along with the gas. The leak continued uncontrolled from the well, for 12 days, while OIL announced that they did not have the expertise to control the leak and had to fly in experts from Singapore and the United States to deal with the situation.The blowout happened while workover operations were going to produce gas from a new sand (oil and gas-bearing) reservoir at a depth of 3,729 metres. The oil well, which has been operational since 2005, was producing around 100,000 (1 lakh) Standard Cubic Metre per day of gas from a depth of 3,870 metres.

On the afternoon of 9th June, the alarming situation turned into a catastrophe when the oil well caught fire and exploded into a raging inferno. The oil and gas leapt to a height of 50m after the explosion, and as reported by eyewitnesses, could be seen from 10km away. It has severely impacted the lives of communities in this region, who are already dealing with financial hardship due to COVID19 restrictions, and whose livelihoods are largely dependent on fishing and agriculture.

**Impact on Wildlife**

Together, the Maguri-Motapung Beel Wetland and Dibru-Saikhowa National Park are a part of the larger Dibru-Saikhowa landscape, known worldwide for the unique assemblage of species found here, many of which are endangered, andendemic. This landscape comprises a mosaic of many ecosystems like wetlands, swamp forests and grasslands.

Locals have been uncovering and documenting the damage done by this disaster. Several have recorded photos of birds –

dead and live, coated with oil. Dead fish have been floating up in the Beel, which is coated with a layer of oil.

**Effects**

Soon after the event of the 27th May, dense particles or condensates from the blow-out have turned the local atmosphere misty. Rain-like droplets have fallen on the vegetation leading to the formation of a sticky layer of oil. Initially, these impacts were seen in the 1 kilometer radius area of the well but now it has extended upto almost 2 kilometers.

**Destruction of Fisheries**

For most of the families in and around the oil exploration site, fishing/fishery culture is the primary source of livelihood and oil residues suspended on the water bodies are already leading to disastrous impacts.

Located in the 860 meters from the boundary of Dibru-Saikhowa National Park and 100 meters upstream of Maguri–Motapung wetland, the Baghjan area is crisscrossed by many water bodies and a thick layer has already formed on these water bodies. As a result of the spillage, aquatic species have died in large numbers. These deaths can happen due to the oil floating on the surface of the water thus blocking oxygen and light. This disaster will also impact the future of aquatic species in the area as this happens to be the fish breeding season too.

The Baghjan oil spill poses a serious threat to the rich biodiversity of Dibru-Saikhowa National Park. Dibru-Saikhowa and the satellite areas are known for rich diversity of orchids and endangered animals, white winged wood duck (Deo Hanh), the Feral Horse and Hoolock Gibbons. It is now feared that this will lead to the extinction of many endangered species of flora and fauna and the environmental damage will be near irreversible.



**The oil-spill also poses a threat to Maguri–Motapung Beel, a world-famous wetland.**

This wetland is a major source of livelihood for the villagers in the near vicinity and home to numerous species of local and migratory birds. The contamination of this wetland will spell doom for the livelihood of people living off fishing from the wetland and greatly affect the migratory patterns and density of bird species that live or visit the area.

Due to its unique ecosystem and rich variety of aquatic and bird species, this wetland is a paradise for bird-watchers and research scholars around the world. Due to this unique ecosystem a promising industry of eco-tourism and environmental learning with its rich diversity is already thriving in the area and this oil-spill will suffer gravely.

This oil spill also increases the risk of skin infection. When oil sticks to plants and animals, the probability of bacterial, dirt and other substances sticking to it increases thus exposing them to infection. Imagine your hand being rubbed with oil and how easily dirt sticks to it. Same can happen to plants and animals, only that they can't clean themselves.

The oil spill at Baghjan shows that OIL has failed to maintain any ethical and technical standards in its operations in the state. The callousness OIL has endangered the lives thousands of people at Baghjan, committed gruesome murder of endangered mammal like Gangetic Dolphin and other aquatic species and has erased a humbly balanced rural economy.

**12. Conclusion**:

Various environmental issues are always associated with exploration, production and refining of crude oil. In recent times the social impact of operations has also been recorded. Broadly these issues are manifested at both local and global levels

including habitat protection and biodiversity, air emissions, marine and freshwater discharges, incidents and oil spills, and soil and groundwater contamination. Assam Shelf Basin is spread along the Brahmaputra River from Dhubri in the southwest to Dibrugarh in northeast with marginal ingress into Arunachal Pradesh with an area is 56,000 sq. km. Although a gamut of statutory provisions are there to safeguard the environment and social concerns but their proper implementation is still lacking. It is therefore important to understand the link between exploration and development of oil fields, refining and requirement of environmental management.

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# Food Security, Food Production and Environmental Protection of the Nation: An Analytical Study in Indian Agriculture with Special Reference to Assam


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## ABSTRACT


Agriculture contributes substantially to the output and employment of a predominantly agricultural and over-populated country like India. Agriculture sector occupies centre stage to sustain food security. Although, Indian agriculture provides food for a large section of World population and occupies first or second ranks in the production of different crops, productivity levels are much lower as compared to many countries. Growth of foodgrains production has fallen short of population growth during the last decade. The ratio of foodgrains to non-foodgrains declined from 74:26 in 1970-71to 66:34 in 2010-11. The extension of non-foodgrains production at the cost of foodgrains production may hamper the availability of foodgrains and food security of the nation in the long run.

Productivity of agricultural crops and growth rates of

agricultural production in Assam are comparatively lower than the national average (except for a few crops). Average yield of total foodgrains in Assam was 1857kg/ha compared to 2129kg/ha in India (Agricultural Statistics at a Glance, 2018).

Use of modern inputs in Indian agriculture is comparatively lower than the developed countries and it is highly skewed among the regions in India. Inefficient overuse of water in the fields results in water logging and salinization. Desperate applications of modern hybrid variety of seeds will impacts in local environment and ecology and sometime uncertainty in production. Improvements of macro level infrastructure like, agriculture markets, rural roads and rural electrification, etc. also bring sustainability in agriculture and environment.

Deteriorating soil health is a major constraint limiting productivity in agriculture. The present system of fertilizer subsidy which is based on subsidization of products rather than nutrients, contributes to the problem.

Transforming agriculture from major cereal (rice/wheat) dominated cropping systems to more diversified systems, especially by promoting secondary crop production (particularly into high value crops) may be concerned to food security. With the globalization, incentive for raising commercial crops has also improved.

Study suggested giving greater focus to research in strategic areas which would help to evolve cropping systems suited to various agro-climatic zonesthat can reduce the gap between the yields realized on the ground and yields that can be achieved using best practices in farm conditions. Focus research on raising the yield potential in rain-fed areasthat reduces dependency on irrigation and hence low environmental degradation.

***Key words:*** *food security, foodgrains, agricultural productivity, input use, changes in cropping pattern, NFSM, environment protection.*



## 1. Introduction:

Food security means availability of sufficient foodgrains to meet the domestic demand as well as access, at the individual level, to adequate quantities of food at affordable prices (National Food Security Act, 2013). It is said to exist when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2009).

Agriculture contributes substantially to the output and employment of India. Agriculture is the backbone of our food, livelihood and ecological security system and above allit is very soul of our sovereignty. Poverty alleviationis best served by growth of agriculture sector. According to a different estimate made by erstwhile Planning Commission (2013a, b, c), Government of India, total 21.92 percent population lied below the poverty line. In United Nations estimate in 2019, about 28 percent people of the country are poor and 190 million people are under nourished. India ranked 94$^{th}$ out of 107 countries in the Global Hunger Index,2020.Although, Indian agriculture provides food for a large section of World population (17.5%) and occupies first or second ranks in the production of different crops, productivity levels are much lower as compared to many countries. The average production of rice per hectare in India is around 1756 kg compared to 5470 kg of North Korea. The average yields of wheat in the Netherlands (7716kg/ha) and Ireland are more than three times India's yield rates (2117kg/ha) (Mahadevan, 2003). In 2016, China produced 6866kg paddy in a hectare while India can produced only 3790kg/ha. Similarly, yield of wheat in China was 5396kg/ha compared to 3034kg/ha in India; in maize, yield in India was 2616kg/ha compared to

10960kg/ha in USA and in pulses, yield was only 588kg/ha in India compared to 2011kg/ha in Canada (Agricultural Statistics at a Glance, 2018). The demand for foodgrains in the country will expand by more than 2.5 percent per year. The foodgrains sector has to grow by 3.75 percent annually to match provision of foodgrains according to the norm set by the National Food Security Act, 2013. The compound annual growth rate (CAGR) of foodgrains production decreased from 2.46 percent during the period 1970-71 to 1990-91 to 1.85 percent during 1990-91 to 2010-11.The ratio of foodgrains to non-foodgrains declined from 74:26 in 1970-71to 66:34 in 2010-11. Ashok Gulati and Kavery Ganguly of International Food Policy Research Institute opined that "the demand for foodgrain is growing at 1 to 2 percent while the demand for non-foodgrains is witnessing a growth of 5 to 6 percent" (FAO, India). Demand for non-foodgrains is more income elastic and they enjoy relatively higher price advantage over the foodgrains (Sawant and Achuthan, 1995). The extension of non-foodgrains production at the cost of foodgrains production may hamper the availability of foodgrains and food security of the nation in the long run.

Steadily declining size of agricultural holdings particularly in foodgrains production is a key fact about the evolution of India agriculture.Improving performance of agriculture and diversifying produce as well as reducing vulnerabilities of small and marginal farmers are important. It also includes improving targeting, cost efficiency and nutrition effectiveness of the nationwide food-based social safety nets. Studies in Bongaigaon and Goalpara districts show that there is a significant positive relationship between land size and production of rice.

We have evaluated the implications of the situations in terms of production of food grains, modern input uses, labour



requirements, land entailments and environmental impacts in the study.It is also alarming to think about flora, fauna,land, air, water and development schemes around us,if we want to assure our food security.Rest parts of the paper is organised as follows:

Section-2 calibrates the methods undertaken for the study and a brief description of the sources of data used in this paper. Section-3 states the aim and objectives of the study. The results of our study have been discussed in section-4. Section-5 gives an account of environmental impacts of high inputs uses. A brief conclusion is drawn based on our results in section-6.

## 2. Methods and data sources:

Basically secondary data were used collected from various reports, articles and government publication. Some primary data collected from two districts of western Assam during 2016 were also used to supplement the findings.The primary data were collected from 184 rice farmers in Goalpara and Bongaigaonby multistage sampling. We used OLS and stochastic frontier production functions to estimate the production function of rice in two districts.Land size, labour, seeds, fertilizers, irrigation, credit and investment, fragmentation of landholding, extension services,etc. were taken as parameters of riceproduction function. To measure environmental implications of NFSA (i.e. GHG emission), we have considered the version 8 databases of Global Trade Analysis Project(GTAP) the reference year 2007 and GTAP databases, 2001.The water pollution data has been taken from Chakraborty and Mukhopadhyay (2014) for the year 2007.

## 3. Aims and Objectives:

Whether food security of the nation is assured and can it create any environmental cause for the nation is the main aim

of the study. The study will intended to focus on the following objectives:

(1) To evaluate food security and foodgrains productivity

(2) To highlight present scenario of growth of food production in India and Assam

(3) To assess use of modern inputs in agriculture and its environmental impacts.

## 4. Results and Discussions:

### 4.1 Foodgrains production in India:

India is the first in the World in the production of milk, pulses; second in rice, wheat, sugarcane, groundnut, vegetables, fruits, etc.But the growth rate of cereals gradually declined from more than 4 percent during 1951 to 1967 to less than 2 percent during 2002 to 2007. There was a high fluctuation in the growth rate of pulses and oilseeds during 1951-1967 to 2007-2012. Agricultural growth in the country has missed the target rate of 4 percent per annum during the entire period of 1951 to 2012. Table 1, 2, 3 and 4 shows the trends of growth of cereals, and trends of production, area and yield of major foodcrops in India respectively.

**Table-1:**

**Trends in cereals crop growth in India from 1951 to 2018 (%/pa)**

| Crops/ Period | 1951-67 | 1968-80 | 1981-90 | 1991-96 | 1997-2002 | 2002-07 | 2007-12 | 2012-18 |
|---|---|---|---|---|---|---|---|---|
| Cereals | 4.19 | 3.43 | 3.42 | 2.36 | 1.49 | 1.28 | 2.24 | 1.86 |

*Source: (i) Agriculture for Inclusive Growth, 2011, (ii) CSO, Press Note May, 31st 2012 (iii) Agricultural Statistics at a Glance, 2018.*

Growth rate of cereals gradually declined from more than 4 percent during 1951 to 1967 to less than 2 percent during 2002 to 2007 and during 2012-18.



**Table-2:**

**Trends in production of food grains in India from 1970-71 to 2017-18: (MMT)**

| Crops | 1970-71 | 1980-81 | 1990-91 | 2000-01 | 2006-07 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | CAGR* | CAGR** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rice | 42.2 | 53.6 | 74.3 | 85.0 | 93.4 | 96.0 | 104.3 | 105.23 | 106.65 | 105.48 | 104.41 | 109.70 | 112.92 | 2.87 | 1.63 |
| Wheat | 23.8 | 36.3 | 55.1 | 69.7 | 75.8 | 86.9 | 93.9 | 93.51 | 95.85 | 86.53 | 92.29 | 98.51 | 99.70 | 4.29 | 2.57 |
| Maize | 7.49 | 6.96 | 8.96 | 12.04 | 15.10 | 21.73 | 21.76 | 22.26 | 24.26 | 24.17 | 22.57 | 25.90 | 28.72 | | |
| Total Cereals | 96.6 | 119.0 | 162.1 | 185.7 | 203.1 | 226.3 | 242.23 | 232.57 | 245.79 | 230.87 | 235.22 | 251.98 | 259.6 | 2.62 | 1.93 |
| Pulses | 11.8 | 10.6 | 14.3 | 11.1 | 14.2 | 18.2 | 17.09 | 18.34 | 19.25 | 17.15 | 16.32 | 23.13 | 25.23 | 0.97 | 0.85 |
| Total Foodgrains | 108.4 | 129.6 | 176.4 | 196.8 | 217.3 | 244.8 | 259.32 | 257.13 | 265.041 | 252.02 | 251.54 | 275.11 | 284.83 | 2.46 | 1.85 |

*Note: ^: Fourth Advance Estimate; * CAGR 1970-71 to 1990-91 in %; ** CAGR 1990-91 to 2010-11 in %.*

*Source: Economic Survey, 1988-89, 1992-93, 1998-99, 2007-08, 2009-10 and 2012-13; Agricultural Statistics at a Glance, 2018*

**Table-3:**

**Trends of gross area under major foodcrops in India from 1970-71 to 2017-18:**

(in million hectares)

| Crops | 1970-71 | 1980-81 | 1990-91 | 2006-01 | 2005-06 | 2008-09 | 2010-11 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | CAGR* | CAGR** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rice | 37.6 | 40.1 | 42.7 | 44.7 | 43.7 | 45.5 | 42.9 | 42.75 | 44.14 | 44.11 | 43.50 | 43.99 | 43.79 | 0.64 | 0.02 |
| Wheat | 18.2 | 22.3 | 24.2 | 25.7 | 26.5 | 27.8 | 29.1 | 30.00 | 30.47 | 31.47 | 30.42 | 30.79 | 29.58 | 1.43 | 0.95 |
| Maize | 5.85 | 6.01 | 5.90 | 6.61 | 7.89 | 8.2 | 8.55 | 8.67 | 9.07 | 9.19 | 8.81 | 9.63 | 9.47 | 0.09 | 1.90 |
| Total Cereals | 101.8 | 104.2 | 103.2 | 100.7 | 99.2 | 100.7 | 100.3 | 100.2 | 99.83 | 100.75 | 98.31 | 99.79 | 97.58 | 0.07 | -0.14 |
| Pulses | 22.6 | 22.5 | 24.7 | 20.3 | 22.4 | 22.1 | 26.4 | 25.26 | 25.21 | 23.55 | 24.91 | 29.45 | 29.99 | 0.45 | 0.33 |
| Total Foodgrains | 124.3 | 126.7 | 127.8 | 121.0 | 121.6 | 122.8 | 126.7 | 125.0 | 120.78 | 124.30 | 123.22 | 129.23 | 127.56 | 0.14 | -0.04 |

*Note: * CAGR 1970-71 to 1990-91 in %; ** CAGR 1990-91 to 2010-11 in %.*

*Source: Economic Survey, 1988-89, 1992-93, 1998-99, 2007-08, 2009-10 and 2012-13, Agricultural Statistics at a Glance, 2018*

**Table-4:**

**Trend of yield per hectare of major foodcrops in India:**

(kg/ha)

| Crop | 1970-71 | 1980-81 | 1990-91 | 2000-01 | 2005-06 | 2008-09 | 2009-10 | 2010-11 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | CAGR* | CAGR** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rice | 1123 | 1336 | 1740 | 1901 | 2102 | 2178 | 2125 | 2239 | 2661 | 2416 | 2391 | 2400 | 2498 | 2578 | 2.21 | 1.27 |
| Wheat | 1307 | 1630 | 2281 | 2708 | 2619 | 2907 | 2839 | 2989 | 3117 | 3146 | 2750 | 3034 | 3200 | 3371 | 2.82 | 1.36 |
| Maize | 1279 | 1359 | 1518 | 1822 | 1958 | 2414 | 2024 | 2542 | 2566 | 2676 | 2652 | 2563 | 2689 | 3052 | 0.86 | 2.61 |
| Coarse | 949 | 1142 | 1371 | 1844 | 1968 | 2183 | 2075 | 2256 | 2396 | 1968 | 2016 | 1936 | 2042 | 2193 | 2.52 | 1.85 |
| Pulses | 524 | 473 | 578 | 544 | 598 | 659 | 630 | 691 | 789 | 764 | 728 | 655 | 786 | 641 | 0.49 | 0.90 |
| Total Food grains | 872 | 1023 | 1380 | 1626 | 1715 | 1909 | 1798 | 1930 | 2129 | 2120 | 2028 | 2001 | 2129 | 2233 | 2.32 | 1.69 |

*Note: * CAGR 1970-71 to 1990-91 in %;*

*** CAGR 1990-91 to 2010-11 in %,*

*Source: Economic Survey, 2010-11, 2012-13; Agricultural Statistics at a Glance, 2018*

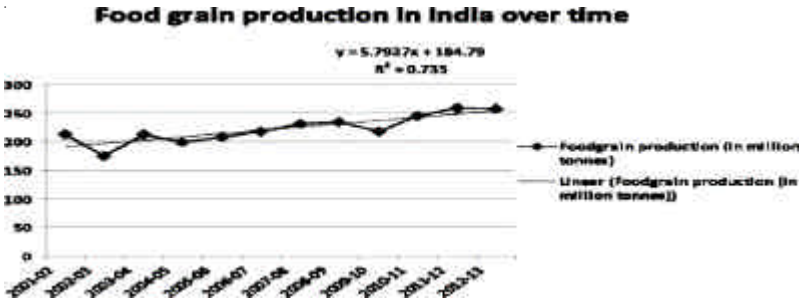


*Fig-1: Graphical representation of food grains production in India over time.*

## 4.2 Foodgrains production in Assam:

Agriculture forms the backbone of Assam's economy. Over 70 percent population of Assam gets their means of livelihood from the agriculture. The Net Cultivated Area (NCA) was 27.74 lakh hectares (or 35.80% of total geographical area and 67.86%of total cropped area) in 2016-17. The area sown more than once (within the year) recorded 13.63 lakh hectares in 2011-12 and the percentage of area sown more than once to net area sown in the state increased from 41.2 percent in 1991-92 to 48.51 percent in 2011-12 (Economic Survey, Assam, 2014-15). The average size of operational holding is 1.10 hectares and more than 83 percent of the farmers are small and marginal farmers (Agricultural Census, 2010-11). Land under still water and water logged area jointly constitute 1.78 lakh hectares or 2.27 percent of total geographical area of the state. About 23 percent of the net sown area is either flood or drought prone. Land not available for cultivation has increased from 24.73 lakh hectares (31.53%) to 26.20 lakh hectares (33.38%) during 1991-92 to 2011-12 due to increase of land in non-agricultural uses. Assam has about80000 hectares cultivable waste land. Assam is lagging behind in agricultural performance to the national average as well as to some of the states in India. This backwardness is present in different fronts such as growth of production, farm size, yield, input use, etc. Growth rates of agricultural production in the state are lower than the all India level.The percentages of land area and production of foodgrains of Assam compared to all-India figures was 2.07 and 1.94 respectively during 2017-18 (Agricultural Statistics at a Glance, 2018).Production of total foodgrains in Assam increased by 20.7 percent during the period 2001-02 to 2011-12 or 1.88 percent per year while in all India it increased by 2.32 percent per year during the period. According to Statistical Abstract, India (2018), average yield of total foodgrains in Assam was 2095kg/ha in 2017-18 compared to 2233kg/ha in India. The yield gap between state average and the national average has been rapidly increasing, which poses a serious policy challenge.Assam produced only 2107kg rice per hectare compared to 2578kg per

hectare in India in 2017-18. In comparison to Punjab, Haryana, Tamil Nadu and other high rice growing states of India, the productivity of rice in Assam is low.

Until the early years of planning (till the nineteen sixties), Assam was a food surplus state, but due to excessive growth of population and, the slow rate of growth in agricultural production, Assam is now categorized as a food deficit state (Das, 2012). In the initial phase of Green Revolution (1962-65 to 1980-83), annual compound growth rate of agriculture in Assam was better than in other states of eastern region and even higher than all India average. In post-liberalization period (1990-93 to 2003-06), deceleration of agricultural growth (output) in Assam was more prominent (0.67% of CAGR) than in other states of eastern region and in all India level (1.74% of CAGR). Total production of pulses gradually declined from 74 thousand MT during 1998-99 to 73 thousand MT in 2011-12.

**Table-5:**
**Estimated CAGRs of production of foodgrains, non-foodgrains and all crops in Assam and India during 2001-02 to 2010-11 (in %)**

| Crops | CAGR in Assam | CAGR in India |
|---|---|---|
| Foodgrains | 1.90 | 1.95 |
| Non-foodgrains | 1.30 | 2.90 |
| All Crops | 1.60 | 2.43 |

*Source: (i) Goswami (2014); (ii) Author's calculation*

The basic feature of the cropping pattern in Assam is the predominance of foodcrops, mainly rice. As a staple food for the inhabitant of Assam, share of rice in total cereals stood at 97.5 percent in 2011-12. Besides natural causes, rice production in the state has been hampered by input and service constraints.



**Table-6:**
**Decadal Compound Growth Rates of Area, Production and Yield of Rice in Assam westernfrom 1950-51 to 2013-14 : (in %)**

| Period | Area | Production | Yield |
|---|---|---|---|
| 1950-51 to1960-61 | 1.04 | 1.57 | 0.52 |
| 1960-61 to 1970-71 | 1.41 | 1.98 | 0.54 |
| 1970-71 to 1980-81 | 1.43 | 2.42 | 0.82 |
| 1980-81 to 1990-91 | 1.05 | 2.63 | 1.70 |
| 1990-91 to 2000-01 | 0.47 | 2.03 | 1.79 |
| 2000-01 to 2013-14 | -0.40 | 1.97 | 2.02 |
| 1970-71 to 2013-14 | 0.55 | 2.29 | 1.66 |
| 1990-91 to 2013-14 | -0.04 | 2.00 | 1.93 |

*Source: Calculated by the Author*

The average size of operational holding in Assam is smaller than in all India which is a sign of lack of consolidation of land holding in agriculture. It has declined from 1.47 hectares in 1970-71 to 1.10 hectare in 2010-11, in spite of increase in operated area from 28.82 lakh hectares to 29.99 lakh hectares. The acreage shares of winter rice and autumn rice in total rice area have been continuously declining due to flood damage or risk of frequent floods. Summer rice, which used to occupy about 6 percent in 1970s, comprised 16 percent of the total area under rice in recent years. But its cultivation is high input oriented which may cause environment concern.Other foodgrains like pulses, wheat and other cereals cover near about 6 percent of the total area of cultivation in the state (Economic Survey Assam, 2011-12).As per agricultural experts, production

of pulses should be about 17 percent of foodgrains. In Assam, however, the area under pulses has remained almost in constant at around 4 percent of the TCA under foodgrains as against 8 percent in the country as a whole.

Flood, water logging, uneven distribution of rainfall and soil erosion are major sources of instability of rice production in the state.The area expansion when juxtaposed by productivity increase enhanced the importance of *Boro* rice in rice economy in Assam.From the latter half of the 90's a new variety of paddy known as *Iri*paddy cultivation is becoming popular among *char* and low land areas of Assam. This variety of paddy is undertaken with HYV seeds, high doses of chemical fertilizers, employing large number of agricultural labour and substantial amount of water.The area under hybrid variety of rice covers 8 percent of total rice area in 2013-14 in Assam (Economic Survey, Assam, 2014-15). Recently a new initiative for increase in rice production in Assam, System of Rice Intensification (SRI) method of cultivation was introduced.

Agricultural Statistics at a Glance (2013) mentioned that the cost of production of paddy in Assam was Rs.824.34/ per quintal in 2010-11. If minimum support price of rice is assured at Rs.1080/- per quintal, farmers can earn surplus of Rs.255.66/ per quintal. Based on the calculations of profitability and income share, rice-only system has been found inadequate to meet the household needs, yet the cultivation of rice could hardly be neglected because rice has been important for household food security.From the primary survey we observed that as far as rice cultivation is concerned, farmers in both the districts-Goalpara and Bongaigaon earn negative profit and farms are with very small pieces of land.



**5. Use of modern inputsand infrastructurein Indian agriculture:**

Use of modern inputsis comparatively lower than the developed countries and it is highly skewed among the regions in India. The availability of assured irrigation continues to be the essential precondition for the adoption of new seed-fertilizer technology in most crops. It is particularly important to focus research on raising the yield potential in rain-fed areas because it reduces dependency on irrigation. It leads to low environmental degradation. Inefficient over use of water in the fields results in water logging and salinization.Deteriorating soil health is a major constraint limiting productivity in foodcrops. The present system of fertilizer subsidy contributes to the problem because there is excessive subsidy on nitrogen compared to potassium and phosphates, and no subsidy at all on micronutrients. The result is excessive use of nitrogenous fertilizer which depletes the soil of other micronutrients, reduce soil productivity overtime.The successful application of fertilizers requires plentiful drainage. Where irrigation facilities enjoy a limited spread, the use of fertilizers is also thin (Ray, 2007).However, excessive and beyond permissible level of fertilizer application may have harmful effect on the soil quality, deplete the ground water level and create health hazard problems. For example, excessive use of fertilizer in Punjab and Haryana has caused deficiency of the micronutrient zinc in the soil, which is affecting productivity of the soil (Sidhu and Dhillon, 1997).

Seed replacement is another major problem constraining crop productivity. The replacement of native seeds by imported hybrid seeds or cash crops resulted in more and more exploitation of ground water since these crops need more

water. The over exploitation of the groundwater in turn resulted in the depletion of ground water level leading to famines and poverty. Desperate applications of modern hybrid variety of seeds will impacts in local environment and ecology. The high yielding hybrid seeds are vulnerable to pest attacks resulting in more use of pesticides (Chand, 1999).

In case of Assam, use of modern input in foodcrops still not at environmental health hazard compared to other states in India.Although the fertilizer use in Assam is growing but compared to Punjab and all India average it is negligible. In 2009-10, farmers in Punjab used fertilizers 236.9kg/ha, but Assam has used only 59.1kg/ha. In 2011-12, consumption of fertilizer in the state was 74.58kg per hectare against 141.30kg/ha in national average. Similarly, consumption of chemical pesticides in Assam is also very low compared to national average. Percentage of irrigated cropped area is quite small and unirrigated cropped area both in *kharif* and *rabi* season was considerably high compared to all India figure.In 2011, the percentage of area under irrigation in the state was only about 15 percent of the gross cropped area or 20.7 percent of net cropped area (Directorate of Economics and Statistics, Govt. of India, 2012). In Punjab, irrigation coverage was 98 percent of total cropped area in 2012-13.Area of foodgrains under irrigation was only 4.6 percent in Assam compared to 47.8 percent in Indiain 2010-11.Procurement of crops at MSP in Assam is very poor. Fund allotted for extension services is not sufficient; participation rate in the programmes of public extension services is poor in the state. Seed replacement rates in Assam are much below recommended levels. In 2013-14, total rice area under HYV seeds had reached to 63.5 percent in Assam compared to 96 percent in Punjab and about 78 percent in India.



Modern purchasable inputs made agricultural capital and energy- intensive and market oriented. The outcome was twofold: on the one hand, initially the production increased but after a certain stage the returns started diminishing; further addition of inputs did not bring about the corresponding increase in production. On the other hand, increased use of these inputs caused multiple environmental problems and depletion of genetic stock due to use of high yielding varieties.

Improvements of macro level infrastructure like, agriculture markets, rural roads and rural electrification, utilize ground water, etc. also bring sustainability in agriculture and environment. Lacks of organized market, storage infrastructure also create problems to the peasants. Small farmers often sell immediately at low prices right after the harvest to middlemen. Destroy or damage the crops produced due to lack of accessible infrastructure or supportive price is reported time to time in the state.

**6. Crop diversification in India agriculture and food security:**

A major change which has taken place in the recent years is in the cropping pattern and crop composition. Transforming agriculture from major cereal (rice/wheat) dominated cropping systems to more diversified systems, especially by promoting secondary crop production may concern to food security. The decline in the profitability of traditional crops and an increase of the same in case of non-traditional high value crops, especially in the 1990s has been reported by Barghouti et al., (2004) as the most important economic factor influencing crop diversification. Farmers preferred non-foodcrops to foodcrops due to gradual commercialization of Indian agriculture. Replacement of foodgrains production by bio-fuel and medicinal plants, adverse

climate change, acquisition of cultivable land for establishing industrial Special Economic Zones (SEZ), etc. create threat to food security in India. With the globalization, agriculture is playing an important part in exports; incentive for raising commercial crops has also improved. Extension of cash crops like, tea, rubber plantation or floriculture, medicinal and aromatic plants, pulm tree in Assam may convert the foodgrains area to these crops. These are mostly monocrops in nature and arrest the diversity in crops.

**7. Estimation of rice production function:**

In the estimation of production function of rice with respect to various parameters by field data, we find that land has a positive and statistically significant influence on the rice output. Roughly, the co-efficient of log of land lies in the neighbourhood of 1. This indicates that 1 percent increase in land input leads to about 1 percent increase in output. In case of traditional variety of winter rice, labour affects output significantly and in a positive manner. The co-efficient is found to be little less than 1. This implies that farms in Assam although small do not suffer from an over-supply of labour. In case of modern rice,fertilizer is found to be statistically significant. Public extension services raise the output of modern rice, which was expected. Summing up, it appears land and labour are the most important factors as far as rice production is concerned. Other factors are important in fewer instances. In the estimation of modern variety rice, there seems to be over-use of water, as the irrigation co-efficient is coming to the negative.

**8. Environmental impacts of modern input uses and NFSA**:

The increase in foodgrains production has wide spread



repercussions. Most of the chemical fertilizers usedin modern agro-ecosystems containmacronutrients, i.e. nitrogen, phosphorusand potassium (NPK). But excessiveaddition of NPK to the agro-eco systems causes the plants to draw more micronutrients as well from the soil and thuscaused micronutrient deficiency in soils. Zincdeficiency, for example, in large tracts ofhigh yielding belt of Punjab and Haryanahas depressed the productivity of theland. In this paper we have identified environment and land usage impact of imposing NFSA in sideline.The NFSA aims to provide subsidized foodgrains to approximately two thirds of India's population under Targeted Public Distribution System (TPDS). However, recent studies suggesting that food subsidies have little effect on nutrition.The study also assessed the environmental impact of this act focusing on various environmental indicators such as additional land requirement, labour generationindirect impact on other sectors such as chemicals and chemical products, mineral fuels.

Due to NFSM additional pressure on environment and land cannot be ignored. Any increase in production activities usually leaves strong impact on environment in terms of generation of pollutants (both air and water).The additional land requirement due to imposition of NFSA is substantial (35005.4 ha) and significant. The economy is likely to generate additional GHG emissions of 10.38 million metric tons of CO2 equivalent,the N2O emission is likely to increase on average by 7.85 percentdue to this act. The other indicators of GHG emissions such as CO2 and CH4 are also likely to add around 1 percent due to NFSA. A significant generation of water pollution is also expected (Sengupta and Mukhopadhyaya, 2016).

Barooah (2013) focused that in the near future, agricultural

system in Assam will also be increasingly challenged by water scarcity and climate change. The degradation of agricultural land due to soil erosion through surface run off and flood during the rainy season is a very serious and recurrent problem and excessive deposition of silt during the flood on the agricultural field is a common problem in the state. The *RashtriyaBarhAyoh* has identified 31.05 lakh hectares of flood prone area in the state (Economic Survey, Assam, 2010-11). In 2008-09, chronically flood prone area and chronically drought prone area in Assam were 475060 hectares (17.58% of the NSA) and 93,817 hectares (3.47% of the NSA) respectively. The management of vast fallow areas in *rabi* season (over 80% of cultivable areas) has been a major policy challenge in Assam. In the hill districts of Assam, the traditional practice of shifting (*jhum*) cultivation is still the predominant mode of farming. The practice of shifting cultivation is believed to be one major reason for lower agricultural productivity in these districts (Goswami, 2014) and caused environmental degradation in the locality. HYPERLINK "https://agrifoodecon.springeropen.com/articles/10.1186/s40100-016-0048-7"

**9. Suggestions and conclusion:**

For sustainable foodgrains production in the economy, the nation should consider the improvement of agriculture productivity as well as to minimize the environmental effect by introducing more sustainable farming practice.What is needed would be increase in productivity rather than increase in acreage area. For this to happen, use of fertilizers, pesticides, intense irrigation and modern agricultural equipments would be required. The entire system has to upgrade significantly.

It is suggested to give greater focus to research in strategic areas which would help to evolve cropping systems suited to



various agro-climatic zones.It reduce the gap between the yields that are actually being realized on the ground and yields that can be achieved with the existing varieties using best practices in farm conditions. We must exploit the large scope for yield improvement which is reflected in the large gap. This will require better assessment of location-specific potentials and constraints, and more effective extension. It would be wiser to ensure optimal utilization of fallow lands and reap the benefit of increased production.

Chemicals & chemical products, mineral fuels, livestock products and other oilseed & crops are most important from demand perspective. The minimum support price of foodgrains should be sufficiently high to restrain it. Otherwise, foodgrains production would decrease and the food security of the country would be jeopardised.

There could also be a re-allocation of farm land from non-foodgrains to foodgrains sector. But that may have negative repercussion on availability of non-foodgrains and cash crops like tea, jute, rubber etc. Replacing cultivation of cash crops by foodgrains is not always feasible. It depends a lot on the texture of soil, its fertility and local climate.

Limited availability of land constrained the output levels.In this scenario it implies that greater land availability could be an important policy intervention. As far as the second possibility is concerned (diversion of land from other uses), we need to have an idea of how much land is being used in different purposes. Table 7 presents the data of area under different categories of use in Goalpara and Bongaigaon districts.

**Table-7:**
**Class-wise volume of land in Goalpara and Bongaigaon districts in 2011-12:**

| Districts | Geographical Area | Forest Land | Area under non-agricultural uses | Barren and uncultivable land | Permanent pastures and other grazing land | Cultivable waste land | Total fallow land |
|---|---|---|---|---|---|---|---|
| Goalpara | 184262 ha | 29683ha (16.11%) | 29727ha (16.13%) | 32538 ha (17.66%) | 3576 ha (1.94%) | 675 ha (0.37%) | 559 ha (0.30%) |
| Bongaigaon | 151999 ha | 44ha (0.03%) | 28226 ha (18.57%) | 28226 ha (18.57%) | 5157 ha (3.39%) | 3900 ha (2.57%) | 9221 ha (6.07%) |

*Note: Parenthesis indicates percentage of total geographical area.*
*Source: Statistical Hand Book, Assam*

From the table 7 it is observed that the total amount of fallow land is not available in great quantity in Goalpara (0.3%). It is 6 percent of the total land area in Bongaigaon. This land can be diverted if that does not adversely affect the local communities or the environment. A larger source of land could be barren and uncultivable land. In Goalpara and Bongaigaon their share is 18 percent to 19 percent approximately. Government can take some concrete measures to reclaim less fertile lands to turn them to productive purposes.

Accessibility of the material inputs in terms of affordable price, and making sure that they are supplied at the right time and in assured quality must be guaranteed. Mechanization in farming, through greater use of capital, should enhance crop output in these specific cases.It is necessary to restructure the fertilizer subsidy to make it nutrient based. It is also necessary to expand the network of soil testing laboratories in the state.Financial inclusion of the cultivators should be enhanced. Accessing micro finance facilities could be made easier for the small and marginal farmers. Public extension services were found to be important.

India faces the challenge and pressure to feed over 1.3 billion people. Despite economic growth and self-sufficiency



in foodgrains production, high levels of poverty, food insecurity and malnutrition persist in India (WFP, 2015). The Impact on environment including air and water pollution as well as land requirement has also been observed. There is a bigger threat of increasing productivity using fertilizers and pesticides. The problem of ecological hazard may creep in which could foil the entire production process. Thus, the concepts of integrated nutrient management and integrated pest management have gained popularity. The direct and indirect pollution intensities are sizeable which can cause serious damage to our ecosystem and human health. Restrict on conversion of agricultural land to non-farm activities becomes essence.

Another important constraint of food security in India is the availability of fresh water for cultivation. Gross water demand for all users in India is estimated to grow up from 750 BCM in 2000 to 1027 BCM by 2025(Brahmanand et al, 2013). Hence increase in production of foodgrains would entail significant requirement of fresh water, which may not be available in future.If government agencies function, if suitable policies are undertaken, as recommended above, productivity could be improved and environmental components of the nation will healthy.

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# A Study on the Problemes and Prospects of Traditional Pig Farming for Livelihood in Zunheboto Town in the State of Nagaland

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## ABSTRACT

A study has been undertaken to appraise the in depth scenario of traditional pig Farming systems and to identify the problems where scientific intervention could be initiated for further improvement in production. Survey was conducted with designed questionnaire in Zunheboto district of Nagaland state. A total of 30 respondents were interviewed on different aspects of demand and supply of pig meat (pork), problems face by traditional pig farmers and government intervention associated with pig husbandry. Majority of pig farmers belong to lower income group, small and medium land holding capacity and low education level. The major constraint faced by the farmers includes high cost of feed and low financial problem. Moreover, none of the respondents was aware of government scheme and

subsidies while only few avail government training. The demand and supply level of pig was considerably high or normal. These findings suggest that the traditional pig farming in Zunheboto town need proper government intervention to make them aware of the modern and scientific ways, avail schemes and subsidies to support them financially and means to extract more economic benefit from pig farming.
**Key words :** Traditional, Farming, Scientific Education, Financial etc.

## Introduction

Agriculture is the mainstay in the economic life of the people. Agriculture includes various allied activities, such as forestry, fishery, animal husbandry etc. Animal husbandry includes poultry, dairy, piggery etc. Like poultry and dairy, piggery or pig farming is also an important occupation and it can be utilized in generating income as well as employment in this backward region of the country.

Pig is rated as one of the best meat-producing animals in the world. It has a number of biological advantages over other meat producing animals owing to high prolificacy, efficient mothering ability, faster growth rate, higher feed conversion efficiency, shorter generation interval and higher dressing percentage. Also, people need a nutritious diet to keep them healthy. As meat has been proved over the years to be a source of high-quality nutrients and protein, the demand for Pig meat (pork) will certainly rise. For these reasons pig farming is considered to be a profitable enterprise. In all the developed countries pig production is being carried out by the effluent



sections of the society whereas in developing countries, especially in humid tropical regions, it is the weaker and lower sections of the community who take it up on a small scale. Pig rearing is complementary to intensive crop production and it can be taken up very well with mixed farming with other crops. Better economic return can only be expected with certainty through integration of pigs with other farming systems. Thus, pigshave occupied an important place in the integrated farming system.

## Pig Farming in India

India is quite rich in livestock. A good amount of our national income is coming out of livestock. India's vast livestock population offers tremendous potential for meeting domestic demand for milk, egg, meat wool, etc. As per Annual report 2018-19 of the Department of Animal Husbandry, Government of India, the livestock sector contributes4.11% GDP and 25.6% of total agriculture GDP.In recent years, the livestock sector has begun to be regarded as a source of new employment, especially for marginal and small farmers and agricultural labourers by offering subsidiary occupation to supplement their family income. In India, the animal husbandry sector provides large self-employment opportunities. According to the National Sample Survey organisation's latest survey (NSS 61st round) 5.5% of the workforce in the country was engaged in the Animal Husbandry sector in 2004-05. Animal husbandry is receiving importance because it has huge employment potential to tackle serious problems of unemployment and underemployment of weaker sections of society as well as for providing subsidiary occupation of farmers. Apart from other livestock farming, pig farming is also one of the important livestock components in India. In India most of the families, irrespective of the size of

their land holdings, own some livestock. The landless and the small-scale farmers are found to be highly benefited by piggery, which not only provide meat at a comparatively cheap rate but also generate self-employment. Pig farming is one of the lucrative and profitable livestock businesses. Among the meat producing livestock, the pig is the only animal, which can contribute a lot to the development of the Indian meat industry. The Government of India has been extending great help to the weaker sections of the society by arranging subsidies and loans for pig farming through various schemes such as National livestock mission (NLM), Rural backyard development for pigs, Animal Husbandry Infrastructure Development Fund (AHIDF), etc.As pig farming needs nominalinvestment, it can be taken up as a cottage industry. Moreover, in recent years, with the introduction of pure breed stock and improved methods of breeding, feeding management and meat handling, this industry is expected to play a significant role in the economic development of the country.

**Pig Farming in Nagaland**

Nagaland, one of the hilly states of Eastern Himalaya, is inhabited by tribal communities which are mostly non-vegetarian and hence, the demand for animal protein is much more compared to other parts of the country. Majority of the population of Nagaland rear pigs as an integral part of their livelihood. There is growing demand for pig meat (pork) in Nagaland and much of this demand is met from the imports from other states of India. Major flows of piglets are imported from Myanmar and other neighbouring states. Data in 2012 of the Department of veterinary and animal husbandry of Nagaland showed that 76% of pigs are imported. Most of the population consume meat and also there is no taboo associated with



consumption of any kind of meat. According to the report given by National Sample Survey (NSS) 66$^{th}$ round 2009-10, pork was the most commonly consumed meat in Nagaland as Per capita consumption of pork in 7 days was about 240gm. Backyard piggery is a common trend in rural households. One or two local or crossbredpigs are fattened for domestic consumption during feast, festival and other ceremonial occasions or sold to satisfy family demands. The marketing of meat and meat products is not organised and is still at a state of infancy. Pork is marketed in villages by slaughtering one or two pigs once in a week or at special occasions. In spite of several opportunities in pig based entrepreneurship, the pig farmers' faces several challenges. An in-depth investigation of the views, beliefs, perception and constraints in traditional pig farming is essential for introducing any scientific intervention for further improvement in the existing production system for transforming the subsistence production to a profitable enterprise. The present study was conducted to appraise the scenario of traditional pig production and its impact on rural livelihood in Zunheboto town, Nagaland.

**Literature Review**

In Nagaland, basically there is no systematic study on pig farming. However, there are some studies on different aspects of piggery. A lot of workhas been done in other parts of the country.

**Rout and Singh** (1974) reported that the quantitative and qualitative characters of livestock greatly influenced the marketing prices of the animals.

**Saseendran and Rajagopalam (1981)** found that the feed efficiency and economics of rearing of indigenous pigs in farm condition was higher in comparison to exotic pigs for male and

female respectively. They further observed that the cost of production of indigenous stock was much higher than that of exotic pigs.

**Mishra and Sastry (1985)** stated that the development of animal industry depends on four basic factors, viz, breeding, feeding, management and health coverage for which fifth factor i.e. marketing may be added in view of the fact that the fate of the modem animal industry depends on a sound system of marketing the animals as well as their product.

**Srinivas et al (1994)** observed by rearing altogether 15 pigs i.e. three different groups of five pigs each and they were raised on three different rations i.e. concentrated garbage, kitchen waste and scavenging. After three months of rearing, the pigs were slaughtered and the findings revealed that the pork sample of garbage and kitchen waste was rich in fattiness. That was thought to be a better change as the Indian consumers showed preference for fatty pork.

**Kalita*et al* (2001)** studied the growth performance of indigenous pigs of Assam and their crosses with Hampshire in terms of body weight at different ages. They found that the indigenous pigs were inferior in growth performance. Sex had no effect on body weight.

None of the aforementioned works exactly resembles our present research investigation on "A study on the problem and prospect of traditional pig farming for livelihood in Zunheboto, Nagaland". As such my work is expected to add something new to the existing literature on various aspects of piggery.

**Research Objective**

1. To explore the demand and supply condition of pig farming.

2. To investigate the problem of traditional pig farming.



3. To examine the government intervention for improving living condition of the pig farmers

**Methoodology**

The study is based on both primary as well as secondary data. The study area is confined to the district of Zunhebotoin Nagaland State. The primary data has been collected through interview schedules and personal investigation. Primary data was collected from 30 respondents in the area on a household basis through direct interviews with the local people at their convenient time. Hence the study followed the convenience sampling technique. Secondary data were collected from the internet, magazines, articles and published books. Regarding the analysis part, simple statistical technique or percentage calculation, frequencies have been done with tabulator manners, pie diagram, bar diagram and graphical presentation.

**Data Analysis and Interpretation**

The main sources of meat in the studyare chicken, duck, goat, pig and cattle. Of these pig meat (pork) accounts for the largest share of the meat production scenario of the study area. Demand and supply condition of piggery has been examined as follow

**Table 1:**

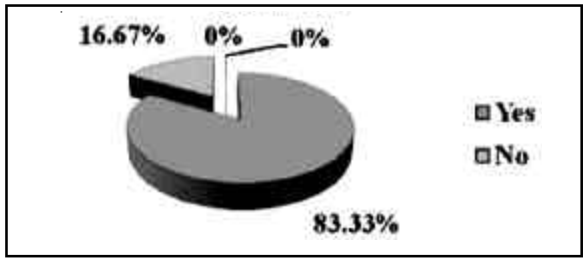
**Consumer Satisfaction with the Supply of Pig Product**

| PARTICULARS | NO. OF RESPONDENTS | PERCENTAGE |
|---|---|---|
| YES | 25 | 83.33% |
| NO | 5 | I6.67% |
| TOTAL | 30 | 100% |

*Source : Author survey*

**Figure-1**

**Consumer Satisfaction**




*Source : Author survey*

The above table.1 and fig.1 show that consumer satisfaction is high from the supply of pig products(pork meat) by the pig farmers. It shows that 83.33% i.e. 25 of the respondents are able to fulfil the demand made by the consumers. While 16.67% i.e. 5 number of respondents are not able to fulfil the consumers' demand.

**Table 2:**

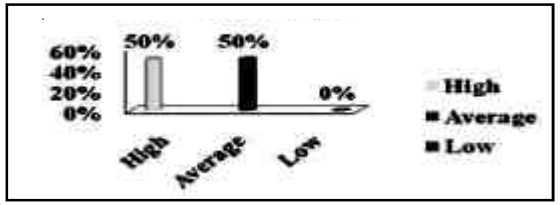
**Demand Level of Pig Product (Pork Meat)**

| PARTICULARS | NO. OF RESPONDENTS | PERCENTAGE |
|---|---|---|
| HIGH | 15 | 50% |
| AVERAGE | 15 | 50% |
| LOW | 0 | 0% |
| TOTAL | 30 | 100% |

*Source : Author survey*

**Figure 2:**

**Demand Level of Pig Product (Pork Meat)**




*Source : Author survey*



From the above table.2 and fig.2, we can see that the demand for pork meat is equally high as well as average with 15 numbers of respondents at 50% and there is no shortage, as the supply of pork is available all through the year, satisfying the consumers.

**PROBLEMS:**

**TABLE 3:**

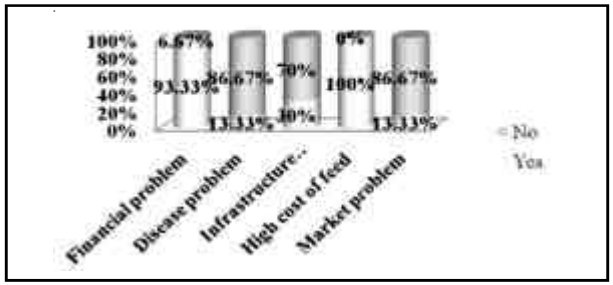
**Problems Faced by Respondents**

| PARTICULARS | | NO. OF RESPONDENTS | PERCENTAGE |
|---|---|---|---|
| FINANCIAL PROBLEM | YES | 28 | 93.33% |
| | NO | 2 | 6.67% |
| DISEASE PROBLEM | YES | 4 | 13.33% |
| | NO | 26 | 86.67% |
| INFRASTRUCTURE PROBLEM | YES | 9 | 30% |
| | NO | 21 | 70% |
| HIGH COST OF FEED PROBLEM | YES | 30 | 100% |
| | NO | 0 | 0 |
| MARKET PROBLEM | YES | 4 | 13.33% |
| | NO | 26 | 86.67% |

*Source : Author survey*

**Figure 3:**

**Problems Faced**




*Source : Author survey*

**Financial problem:** From the above table 3 and fig.3, it shows that most of the respondents were poor small farmers as

93.33% of the respondents lack financial problems and only 6.67% of the respondents are financially stable.

**Disease problem:** From above table 3 and fig.3 it shows that the study area is environment friendly for pig farming as most of the respondents i.e 86.67% do not face disease outbreak while 13.33% of the respondents havefaced the problem of disease outbreak.

**Infrastructure problem:** From the above table 3 and fig.3, it shows that 30% of the respondents face poor infrastructure problems and 70% of the respondentsdo not face poor infrastructure problems. The availability of woods in the region makes them self sufficient to build infrastructure for pig farming.

**High cost of feed problem:** From the above table 3 and fig.3, it shows none of the respondents were unable to afford the price of pig food products in the market due to being financially poor.

**Market problem:** From the above table 3 and fig.3, it shows that 13.33% of the respondents face the problem of inadequate market for piggery and 86.67% of the respondents sell most of their products on occasions or on demand by customers so they do not face market problems.

**Government intervention**

Various actions carried out by the government for improving the living condition of the pig farmers.

**TABLE 4:**

**Government Intervention**

| PARTICULARS | | NO. OF RESPONDENTS | PERCENTAGE |
|---|---|---|---|
| TRAINING | YES | 2 | 6.67% |
| | NO | 28 | 93.33% |
| SCHEMES | YES | 30 | 0% |
| | NO | 0 | 100% |
| SUBSIDIES | YES | 30 | 0% |
| | NO | 0 | 100% |

*Source : Author survey*



**FIGURE 4:**

**Government intervention**


*Source : Author survey*

**Training:** From the above table 4 and fig.4, The Government intends to provide assistance to poor but only 6.67% of the respondents are aware of government training or awareness whereas 93.33% are not aware of any government training.

**Schemes:** From the above table 4 and fig.4, there are many Schemes for livestock and Animal husbandry but none of the respondents are aware of government schemes that are launched for pig development from time to time.

**Subsidies:** From the above table 4 and fig.4,Variousloans and subsidies are available for the animal husbandry sector but none of the respondents was aware of Government subsidies.

**Finding, Recommendation and Conclusion :**

**Finding**

- It has found that all the respondents are economically backward as all of them fall under BPL.
- Majority of the respondents are daily wagers and most of the respondent's annual income falls at the range of below 1lakh.
- It is found that the respondents have been farming pigs in their own land and for sale purposes within their area.
- In the survey it has been found that the respondents use

household waste, corn, soybeans and leaves are provided to the pigs as feed.

- The demand for pig products (pork meat) is high or normal according to the information provided by the respondents but there is no fall in demand, as the supply of pork is available all through the year, satisfying the consumers.
- The product of pig (pork meat) is self-marketed
- There is a seasonal rise in demand for pork meat during the month of Christmas festival which falls in the month of December. The Christmas festival is celebrated by all the respondents, as they are all Christian religion.
- Inadequate finance and high cost of feed is the problem faced by most of the respondents while disease outbreak, poor infrastructure and inadequate market are affecting some few respondents.
- Majority of the respondents are not aware of government training and do not avail any schemes or subsidies from the government.

**Recommendation**

Based on various research findings and observations the following suggestions and recommendations for improvement of piggery in Nagaland in general and the Zunheboto town in particular has been forwarded;

- The Government should arrange for extensive publicity in respect of economic benefits as none of the respondents are aware of schemes and subsidies.
- Training should be imparted to the traditional pig farmers to make them aware of the modern and scientific\technological ways and means to extract more economic benefit from pig farming.
- There is a need for better coordination among farmers,



community, civil society, NGOs and government in designing a public policy in order to improve the transparency, quality and effectiveness of a policy or scheme.

- Scheme should be tailor made as per local condition and requirement. so that the schemes are effectively implemented.
- Like other animals, disease is a common factor in pig farming and it requires proper attention. Concerned department should take up prompt treatment of sick pigs or piglets to reduce economic loss.
- A farmer should be made aware and always be encouraged to take loans from the banking sector. The process for getting loan from the bank should be simplified so that the needy farmers can avail loan easily which will also encourage the unemployed youths to come forward for taking piggery as their means of livelihood.
- At present there is a lack of modernized slaughter houses. Modern scientific principles should be applied in processing, preservation, packaging and transportation of pork and pork products.
- Compulsory inspection of pigs should be done by qualified veterinary doctors.
- Awareness on quality pig rearing should be done through mass communication media and organizing seminars, workshops etc. among the farmers.

**Conclusion**

From this study it is concluded that the pig husbandry is still solely dependenton a small-scale production system. In Zunheboto town, pig farming was confined as a traditional profession of only the tribal people. The production system is

traditional with zero to minimum input involvement and low remuneration. Considering the demand of pork in the region, immense opportunities prevail in improvement of productivity through adopting scientific interventions in routine management and health care services. Increased demand for pork by the growing population and family income, while low productivity and intensification of pig production is an opportunity for enhancing the development of pig production in the region for improving the livelihood of marginalized farmers.

However, systematic studies on the pig sub-sector are necessary. Appropriate interventions on technical, institutional and policy initiatives for the improvement of breeds, feed availability, disease control, and food safety should be implemented. Entrepreneurship development in major sectors like feed formulation and supply, establishing pig breeding units, artificial insemination facilities, mobile vaccination services, pork processing and use of pork by-product could make the enterprises a profitable one and generate employment opportunities for farmers and youth engaged in this livestock sector.

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# Socio-Economic Condition of Tea Garden Workers in Assam: A Study in Chapanala Tea Estate

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## ABSTRACT

Tea is one of the most popular beverages in the world. Assam's tea is world famous. The state produces more than 50 percent of the tea produced in India and about 1/6$^{th}$ of the tea produced in the world. A large number of workers are engaged in the tea gardens of Assam. But, due to poor socio-economic condition, illiteracy, overcrowded, poor health facilities and miserable living standard makes the workers helpless. Therefore, an attempt has been made to examine the socio-economic condition of the tea garden workers in Chapanala Tea Estate of Nagaon district, Assam. The study is mainly based on primary data collected from 50 sample tea garden workers in Chapanala Tea Estate. Interview schedule has been used in collecting primary data through personal interview method. Simple Random Sampling technique has been adopted to select the sample tea garden workers. The analysis has been made using simple statistical tools like percentages, ratios, averages, etc.The study reveals that the socio-economic condition of the tea garden workers is not encouraging in the tea estate studied.

**Keywords:** Chapanale Tea Estate, Socio-economic condition, Tea garden workers, Assam.



### 1. Introduction:

Tea is one of the most popular beverages in the world. China, India, Kenya, Sri Lanka and Turkey are the principal producers of tea. In terms of tea production, China stands first followed by India. The major tea producing states in India are Assam, West Bengal, Tamil Nadu and Kerala.

Assam's tea is world famous. The state produces more than 50 percent of the tea produced in India and about 1/6$^{th}$ of the tea produced in the world (Dey, B.K., 2019:74). There are 101850 tea gardens in Assam. The total area under tea cultivation is 337690.35 ha of land and total production of tea is 651910 ('000 kg) in the state (Statistical Hand Book, Assam, 2019:150).This sector provides average daily employment to more than 6.86 lakh persons in the state, which is around 50 percent of the total average daily number of labour employed (on an average 11.1 lakh labour employed per day) in the country (Baishya, D., 2016:552). "Assam tea industry is India's largest tea industry and second largest tea production region in the world after China" (Narzary, S., 2016:1).

In Assam, tea is grown both in the Brahmaputra and Barak valley. The tea gardens are mostly found in Tinsukia, Dibrugarh, Sibsagar, Jorhat, Golaghat, Nagaon and Sonitpur districts.A large

number of labour forceare engaged in all sphere of work in the tea gardens of Assam. They are quite backward. Illiteracy, prejudice and superstition are high among them. Socially they are less exposed. Their pecuniary condition is also very pathetic. Due topoor socio-economic condition, illiteracy, overcrowded, poor health facilities and miserable living standard makes the workers helpless. "The working class in the tea gardens of Assam is perhaps the most exploited class in the organized sectors of economy" (Dey, B.K., 2019:74). Realizing this situation, a study on thesocio-economic condition of the tea garden workers in Chapanala Tea Estate is made.

**2. Review of Literature:**

*Majumder, S.C. & S.C. Roy (2012)* examined the socio-economic condition of the Tea Plantation Workers in Bangladesh. The study showed poor working environment for workers, with low wages, low job security, inadequate housing and even drinking water facilities in the study area.

*Sarkar, S.C. (2013)* made a study on the condition of tea garden workers of Jalpaiguri district in Colonial India. The study revealed discouraging condition of children and women workers in the tea gardens. They could not maintain their family smoothly, and compelled to borrow money from the money lenders. The researcher also suggested to set up a department to look into the welfare of the tea garden workers.

*Devi, P. (2014)* conducted a study on thesocio-economic status of the tea garden women workers in Sonitpur district of Assam. The researcher found that 61 percent of the women workers were in the age group of 30-40 years, 72.25 percent were illiterate, 83 percent were married, 92 percent had their monthly wages of Rs. 1000-5000 and 63 percent women workers



had 'pucca' while 37 percent of them had 'kachha' type of housing facilities in the selected four Tea Garden areas of the district.

*Bhuyan, B. & A. Sharma (2016)* made a study on thelivelihood pattern among the tea garden labourers in MaijanRajgarhBorline of Maijan Tea Garden under Dibrugarh district of Assam. The study revealed poor living condition among the tea garden labourers in the study area.

*Debnath, S. & P. Debnath (2017)* examined the socio-economic condition of the tea garden workers of West Tripura district with special reference to Meghlipara Tea Estate. The study found that socio-economic condition of the tea garden workers in the district was not encouraging.

**3. Study Area:**

The area of the study is Chapanala Tea Estate which is situated inNagaon district of Assam.It is located about 30 kilometres towards east from the district headquarter Nagaon.Chapanala Tea Estate was established in 1864. The tea estate is surrounded by Champawati River in the East, Jiajuri Tea Estate in the West, Matiapahar Tea Estate in the North and Chapanala Hill in the South. The total area of the tea estate has 110 hectares of land. There are 160 workers in the tea garden. Among them, 120 are permanent and 40 are casual workers.

**4. Rational for Selecting Chapanala Tea Estate:**

Chapanala Tea Estate is one of the oldest tea gardens of Nagaon district. Besides, no scientific studies regarding socio-economic condition of the workers working in this tea garden have been conducted till now. Therefore, the researcher has chosen Chapanala Tea Estate deliberately as a study area for the present study.

**5. Objective of the Study:**

The objective of the study is to examine the socio-economic condition of the tea garden workers in Chapanala Tea Estate.

**6. Data Base and Methodology:**

The study is mainly based on primary data. Secondary data are also incorporated where necessary. The field survey was conducted during the period from 1st March, 2021 to 15th March, 2021.

Primary data have been collected from 50 sample tea garden workers residing in inside and outside the Chapanala tea estate. Out of them, 30 are male and 20 are female. Simple Random Sampling technique has been adopted to select the sample tea garden workers. "Simple Random Sampling refers to that sampling technique in which each and every unit of the population has an equal chance of being selected" (Gupta, S.P. 1991:E-4.9).Interview schedule has been used in collecting primary data through personal interview method. Likewise, Purposive Sampling technique has been applied in selecting the study area. "In this type of sampling, items for the sample are selected deliberately by the researcher; his choice concerning the items remains supreme" (Kothari, C.R. 2008:59).

Secondary data have been collected from different journals, periodicals, books, different studies and reports prepared by the Government and Non-Government organizations. Apart from these, relevant data/information have also been collected through informal discussion with the official staff of the tea estate. Besides, internet has also served as an important source of secondary data.

The primary data which are collected from the sample respondents have been tabulated to analyse the socio-economic



condition of the tea garden workers. The analysis has been made using simple statistical tools like percentages, ratios, averages. Further, diagrammatic representation of data is also incorporated to strengthen the field data.

**7. Scope of the Study:**

The scope of the study is restricted to examine the socio-economic condition of the tea garden workers in the study area. Although, the area of the study is confined to Chapanala Tea Estate of Nagaon district, Assam, the review of literature has been presented in the state as well as the national and international perspectives too.

**8. Significance of the Study:**

The findings of the study will help the tea garden authority to understand the problems, if any, faced by the tea garden workers in the study area. It is expected that the results of the study will also help the policy makers in formulating scientific policy for the welfare of the tea garden workers in future.

**9. Limitations of the Study:**

- Only thoseworkers who haveengaged in plucking, pruning and plantation activities in the studied tea gardenhave been taken into consideration for the study.
- The sample tea garden workers have provided the required data from their memory. Hence, it may suffer from recall bias.
- Findings in the studyare made on the basis of opinions and responses of the sample tea garden workers interviewed.
- The study focuses on a particular tea garden of Nagaon district of Assam. Hence, it may not be applicable in any other tea gardens located in different parts of India and abroad.

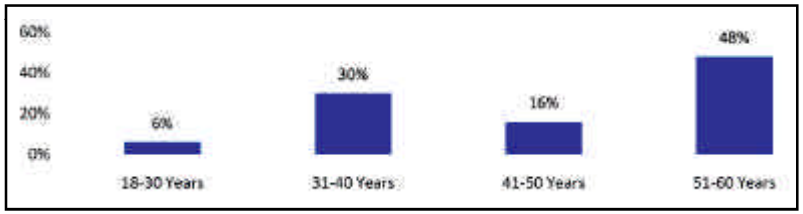
## 10. Results and Discussion:

### 10.1 Age Structure:

For the purpose of the study, age of the sample tea garden workers has been classified into four groups- 18-30 Years, 31-40 Years, 41-50 Years and 51-60 Years. Table: 1 reveals that out of 50 sample tea garden workers interviewed, 6 percent of the workers are in the age group of 18-30 years, 16 percent of them are 41-50 years, 30 percent are 31-40 years and remaining 48 percent of them belong to the age group of 51-60 years. No worker below the age of 18 years is reported to work in the tea garden. Thus, it is clear that majority of the workers belong to the age group of 51-60 years in the tea estate.

**Fig: 1**

**Age-wise Distribution of Sample Tea Garden Workers**




*Source: Field Survey*

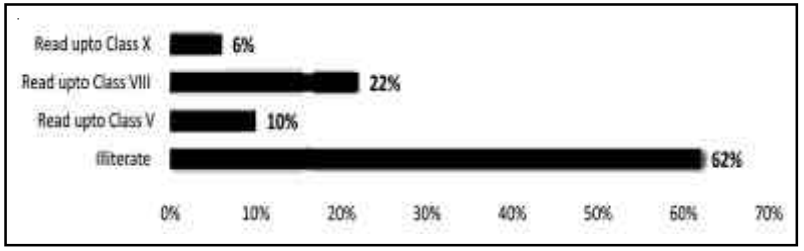
### 10.2 Educational Status:

In the study, educational status of the sample tea garden workers has been confined to Illiterate, Read upto Class V, Read upto Class VIII and Read upto Class X. From the field survey it is observed that out of 50 sample tea garden workers, 62 percent of the workers are illiterate, 10 percent of them read upto Class V, 22 percentread upto Class VIII and only 6 percent are found to read upto Class X. This shows discouraging educational background among the sample tea garden workers interviewed.



**Fig: 2**

**Educational Status-wise Distribution of Sample Tea Garden Workers**



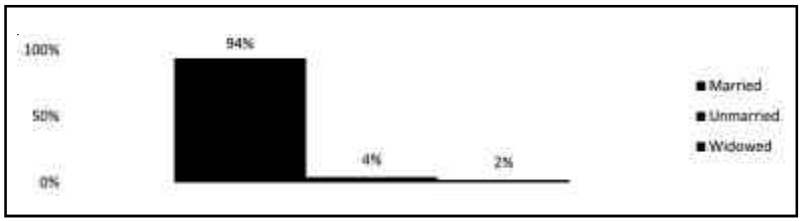

*Source: Field Survey*

### 10.3 Marital Status:

For the purpose of the study, marital status of the sample tea garden workers has been confined to Married, Unmarried and Widowed. Table: 1 reveals that majority of the sample tea garden workers are married. They constitute 94 percent of the total workers interviewed. Unmarried and Widowed workers are also found, which constitute 4 percent and 2 percent respectively. This implies that there is a domination of married people among the tea garden workers in the study area.

**Fig: 3**

**Marital Status-wise Distribution of Sample Tea Garden Workers**




*Source: Field Survey*

## 10.4 Family Type:

In the present study, family type of the sample tea garden workers has been categorised as Nuclear Family and Joint Family. "A nuclear family can be defined as a household consisting of two married, heterosexual parents and their legal children (siblings). Joint family can be defined as members of a uni-lineal descent group (a group in which descent through either the female or the male line is emphasized) live together with their spouses and offspring in one homestead and under the authority of one of the members" (Bansal, S.B. et.al 2014:641-642).

It is observed from Table: 1 that out of 50 respondents, 76 percent of them are coming from nuclear family and remaining 24 percent are from joint family. This indicates increasing trend of nuclear family system in the tea garden area too. Thus, it can be concluded that majority of the tea garden workers belong to the nuclear family in the tea estate studied.

**Fig: 4**

**Family Type-wise Distribution of Sample Tea Garden Workers**


*Source: Field Survey*



**Table: 1**

**Socio-Economic Indicator-wise Distribution of Sample Tea Garden Workers**

| Sl.No. | Socio-Economic Indicators | | Numbers | Percentage |
|---|---|---|---|---|
| 1 | Age Structure | 18-30 Years | 3 | 6.0 |
| | | 31-40 Years | 15 | 30.0 |
| | | 41-50 Years | 8 | 16.0 |
| | | 51-60 Years | 24 | 48.0 |
| 2 | Educational Status | Illiterate | 31 | 62.0 |
| | | Read upto Class V | 5 | 10.0 |
| | | Read upto Class VIII | 11 | 22.0 |
| | | Read upto Class X | 3 | 6.0 |
| 3 | Marital Status | Married | 47 | 94.0 |
| | | Unmarried | 2 | 4.0 |
| | | Widowed | 1 | 2.0 |
| 4 | Family Type | Nuclear | 38 | 76.0 |
| | | Joint | 12 | 24.0 |
| 5 | Family Size | Less than 4 Members | 11 | 22.0 |
| | | 4 to 6 Members | 23 | 46.0 |
| | | More than 6 Members | 16 | 32.0 |
| 6 | Housing Status | Own | 14 | 28.0 |
| | | Tea Garden Authority | 36 | 72.0 |
| 7 | Dwelling Unit | Pucca | 29 | 58.0 |
| | | Kachha | 21 | 42.0 |
| 8 | Fuel Used for Cooking | Firewood | 36 | 72.0 |
| | | LPG | 14 | 28.0 |
| 9 | Sources of Lighting Used | Electricity | 48 | 96.0 |
| | | Kerosene | 2 | 4.0 |
| 10 | Sources of Drinking Water Used | Tube-well | 39 | 78.0 |
| | | Well | 11 | 22.0 |
| 11 | Sanitation Facility | Sanitary Toilet | 28 | 56.0 |
| | | Non-sanitary Toilet | 22 | 44.0 |
| 12 | Monthly Family Income | Rs. 3000-3500 | 3 | 6.0 |
| | | Rs. 3501-4000 | 5 | 10.0 |
| | | Rs. 4001-4500 | 41 | 82.0 |
| | | Rs. 4501-5000 | 1 | 2.0 |
| 13 | Household Property | Television | 31 | 62.0 |
| | | Mobile phone | 39 | 78.0 |
| | | Bi-cycle | 17 | 34.0 |
| | | Cow | 14 | 28.0 |
| | | Goat | 10 | 20.0 |
| | | Hen | 23 | 46.0 |
| | | Duck | 5 | 10.0 |

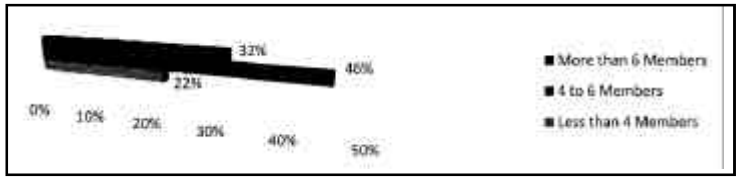
*Source: Field Survey*

### 10.5 Family Size:

In respect of family size, sample tea garden workers has been classified into three categories- workers having Less than 4 Members, workers having 4 to 6 Members and workers having More than 6 Members. It is observed from Table: 1 that out of 50 sample drawn, majority of the tea garden workers (46 percent) have 4 to 6 members in their families. Similarly, out of the total sample drawn, 32 percent of them have more than 6 members in their families. Further, the percentage of sample tea garden workers having less than 4 members in their families is 22 percent. Thus, it is clear that majority of the tea garden workers have 4 to 6 members in their families in the study area.

**Fig: 5**

**Family Size-wise Distribution of Sample Tea Garden Workers**




*Source: Field Survey*

### 10.6 Housing Status:

In respect of housing status, sample tea garden workers has been classified into two categories- workers lived in Own House and workers lived in Tea Garden Authority House. It is observed from Table: 1 that out of 50 sample tea garden workers, 28 percent of them have lived in their own houses and 72 percent have lived in the houses provided by the tea garden authority. Thus, it can be concluded that majority of the tea garden workers have lived in the houses provided by the tea garden authority in the study area.



**Fig: 6**

**Housing Status-wise Distribution of Sample Tea Garden Workers**

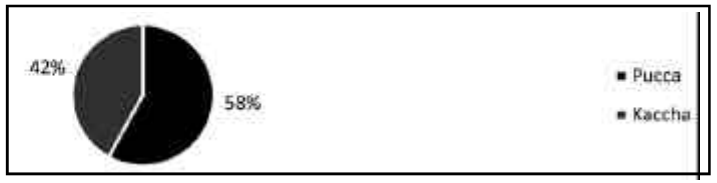

*Source: Field Survey*

### 10.7 Dwelling Unit:

In the present study, dwelling unit of the sample tea garden workers has been divided into two categories- Pucca and Kachha. Out of 50 sample drawn, it is found that 58 percent of the sample tea garden workers are residing in pucca dwelling unit, while, 42 percent of them are residing in kachha dwelling unit. Thus, majority of the tea garden workers are residing in pucca dwelling unit in the study area.

**Fig: 7**

**Dwelling Unit-wise Distribution of Sample Tea Garden Workers**



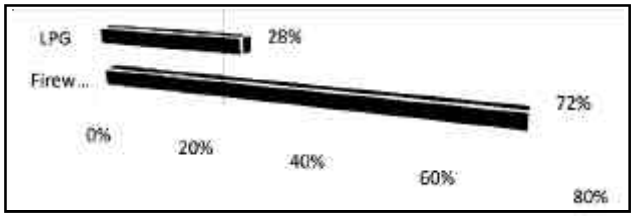

*Source: Field Survey*

### 10.8 Fuel Used for Cooking:

In respect of fuel used for cooking, sample tea garden workers have been divided into two categories- Firewood user and LPG

user. From Table: 1, it is observed that 72 percent of the sample workers have used firewood for cooking and remaining 28 percent have used LPG. This means that majority of the tea garden workers have used firewood for cooking in the tea garden.

**Fig: 8**
**Fuel Used-wise Distribution of Sample Tea Garden Workers**

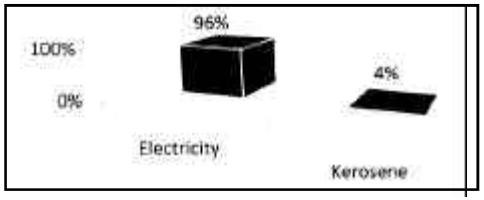



*Source: Field Survey*

**10.9Sources of Lighting used:**

In respect of lighting used, sample tea garden workers have been divided into two categories- Electricity user and Kerosene user. From the data presented in Table: 1, it is seen that 96 percent of the sample tea garden workers have electricity connection in their houses. The percentage of Kerosene user workers is minimal, i.e. only 4 percent. This implies that majority of the tea garden workers have electricity connection in their houses in the tea garden.

**Fig: 9**
**Sources of Lighting Used-wise Distribution of Sample Tea Garden Workers**



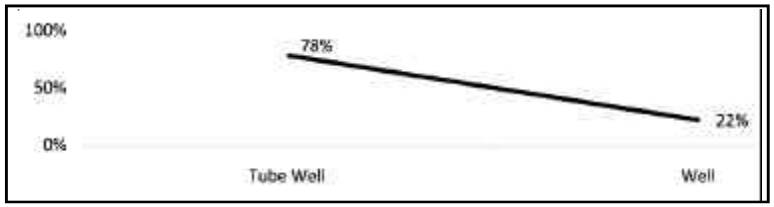

*Source: Field Survey*



**10.10 Sources of Drinking Water Used:**

In the study, sources of drinking water has been confined to Tube Well and Well. The data presented in Table: 1 shows that out of 50 sample drawn, 78 percent of the workers have collected drinking water from tube well and remaining 22 percent of them have collected from well. Thus, it is clear that majority of the tea garden workers have used tube well as a source of drinking water in the tea estate studied.

**Fig: 10**
**Sources of Drinking Water Used-wise Distribution of Sample Tea Garden Workers**

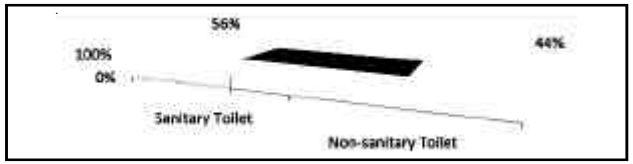



*Source: Field Survey*

**10.11 Sanitation Facility:**

In respect of sanitation facility available in the workers' households, sample tea garden workers have been classified into two categories- Sanitary Toilet user and Non-sanitary Toilet user. It is observed from Table: 1 that 56 percent of the sample tea garden workers have used sanitary toilet for urinate and defecate. The percentage of sample tea garden workers who have used non-sanitary toilet is not less, i.e., 44 percent of thetotal sample drawn. This is harmful for the health of the workers. Thus, it can be concluded that majority of the tea garden workers have used sanitary toilet in the tea estate.

**Fig: 11**
**Sanitation Facility-wise Distribution of Sample Tea Garden Workers**

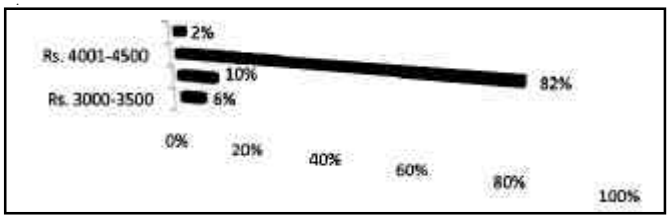



*Source: Field Survey*

**10.12 Monthly Family Income:**

For the purpose of the study, monthly family income of the sample tea garden workers has been classified into four groups- Rs. 3000-3500, Rs. 3501-4000, Rs. 4001-4500 and Rs. 4501-5000. It has been observed from the data shown in the Table: 1 that 82 percent of the sample tea garden workers' family have earned between the income range of Rs. 4001-4500 per month. Similarly, 10 percent of the sample workers' family have earned Rs. 3501-4000 per month and 6 percent of them have earned Rs. 3000-3500 per month. The percentage of sample tea garden workers' family who have earned between the income range of Rs. 4501-5000 is minimal, i.e., 2 percent only. Thus, it can be concluded that majority of the tea garden workers' family have earned between the income range of Rs. 4001-4500 per month in the tea garden.

**Fig: 12**
**Monthly Family Income-wise Distribution of Sample Tea Garden Workers**




*Source: Field Survey*



**10.13 Household Property:**

In the study,household properties possessed by the sample tea garden workers have been confined to TV, Mobile phone, Bicycle, Cow, Goat, Hen and Duck. The survey result reveals that 62 percentof the sample tea garden workers possess TV, 78 percent of the workers possess Mobile phone and 34 percent of them possess Bi-cycle. Besides, 28 percent of the sample tea garden workers possess Cow and 20 percent of them possess Goat. Further, 46 percent of the sample tea garden workers possess Hen and only 10 percent of them possess Duck. Thus, it can be concluded that majority of the tea garden workers possess Mobile phone in the tea garden.

**11. Suggestions:**

- No school is seen in the tea estate. Therefore, at least one school needs to be established for the greater interest of the workers' children.
- Although one dispensary is available in the tea garden area, yet it needs to be improved.
- Pure drinking water and proper sanitation facilities need to be ensured for the workers.
- The daily wages of the workers need to be increased to make them financially independent.
- Special plans and policies need to be undertaken for the welfare of the tea garden workers in future.

**12. Conclusion:**

Thus, from the above discussion, it can be concluded that the socio-economic condition of the tea garden workers is notencouraging. Illiteracy among the tea garden workers is very high. A sizeable number of workers have used non-sanitary

toilet. The percentage of workers who have used 'Well' as a source of drinking water is not minimal. This is harmful for the health of the workers. Moreover, the monthly income of the tea garden workers is very less to live a better life. Therefore, the need of the hour is to uplift them socially, economically and even culturally so that they can live with dignity and honour in our society.

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