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10TH STATISTICS DAY, 2016

Special Issue

on

Agriculture & Farmer's Welfare

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Foreword

The 10th issue of Annual journal of Directorate of Economics and Statistics, Odisha “SAMIKSHYA-2016 ” is placed before you. SAMIKSHYA is not merely a fact based journal of socio economic issues. It makes an independent evaluation of current sectoral issues and development in scientific notes with extensive statistical and economic analysis. SAMIKSHYA-2016 is a special issue on agriculture & farmer’s welfare sector to honour the national theme of Statistics Day 2016. A galaxy of experts on the subject area shared their expertise, experiences and academic excellence to enrich the journal with new heights. The research/ resource papers of the journal expect to deliver decisive feedback for policy issues. SAMIKSHYA is a mirror journal of DE&S. It makes a symbolic attempt to highlight the strength, weakness, opportunities and threats of sectoral issues and offer potential solutions to the system.

I acknowledge with sincere gratitude’s to the valued contributions of Paper writers. We are seemingly skilled and updated by their path showing knowledge sharing through research papers. The Editors of the Journal made untiring and timely efforts to prepare, edit and complete “SAMIKSHYA-2016” with successful notes. Their contributions are gratefully acknowledged.

I wish SAMIKSHYA-2016 a great success.



(Dushasan Behera)
Director

Edited by:

Dr. Subhakanta Pattnaik

Dr. Dillip Ray

Sri Bigyanananda Mohanty

Dr. Sujata Priyambada Parida

Editors' Pen...

SAMIKSHYA-2016 bears wider producer and user interface with its research insights. Directorate of Economics and Statistics, Odisha continues to build up a strong edifice of acquisition, processing and dispersal of information system with scientific temper. Its statistical and economic estimates and analysis assume direct bearing on the planning & development process of the State. It adds new dimension to the data production, storage and dissemination with the contribution of professional economists and statisticians. The experts from statistics and economics fields contributed significantly to enrich the contents of SAMIKSHYA. The views expressed in the journal are those of the individual writers. Their valued contributions are gratefully acknowledged. The constructive views of esteemed Readers shall be highly appreciated.

- Editorial Board

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Observation of 10th Statistics Day,2016 ***(29th June 2016)***

***By Directorate of Economics & Statistics, Odisha,
Planning & Convergence Department,
Government of Odisha***

Concept Paper

A) Backdrop

- ✓ Observation of 'Statistics Day' is an international annual event.
- ✓ By the declaration of United Nation's Statistics Division, different nations observe the Statistics Day on different dates of the year as per the subject specific significance or recognition in their respective countries.
- ✓ India observes Statistics Day on 29th June every year to honour the Birth anniversary of Prof.Prasant Chandra Mahalanobis, who is regarded as the founder father of Administrative Statistics in India.
- ✓ The 10th Statistics Day is being observed on 29th June 2016 all over India.
- ✓ The objective of Statistics Day is 3-fold
 1. Emembrance of visionary contribution of Prof Mahalanobis, the founder father of statistics,
 2. Promotion of statistical literacy and capacity among civil servants, technocrats, academia, civil society organization and general public etc.
 3. Symposium on the National theme of the Statistics Day.
- ✓ The national theme of 10th Statistics Day 2016 is " Agriculture & Farmer's Welfare".

B) Brief Description on 3-fold Objectives of Statistics Day

Visionary contribution of Prof Mahalanobis:

- i. Prof Mahalanobis (1893-1972) was born on 29TH June 1893 in West Bengal.
- ii. Completed degree in Mathematics & Physics from Cambridge University.
- iii. Turned to statistics being inspired by his Tutor W. H. Macaulay on 'Biometrika'.

- iv. He was mathematician, Physicist and Scientist by academics, but statistician by profession.
- v. His major contribution to the world of statistics:
 - ✓ 1st paper on statistics: Anthropological observation on Anglo Indians of Calcutta - published in records of Indian Museum.
 - ✓ Meteorological statistics.
 - ✓ Discovery of probable errors in agricultural experiments,
 - ✓ Working with R. A. Fisher, the global theorist on statistics,
 - ✓ Working on prevention and solution of flood problems with new statistical parameters and methods,
 - ✓ Working on Karl Pearson's coefficients to measure biological affinities,
 - ✓ Prepared seminal Paper on D Square statistic,
 - ✓ He established large scale sample survey on crop yield estimation and National Sample Survey.
 - ✓ He founded Indian Statistical Institute, Kolkata
 - ✓ The 2nd 5-year plan was based on his 4 sector growth model, called Mahalanobis model of growth,
 - ✓ He was Chief statistical Advisor to Government of India and Honorary President & Fellow to many national and International statistical organizations.
 - ✓ He received Padma Vibhushan award for his phenomenal contributions to world of statistics and economic planning.
 - ✓ He died in 28th June 1972

Promotion of Statistical literacy

- ✓ Interactive discussions and debate on importance of statistics in socio-economic-cultural-political issues and development,

- ✓ Evaluate the operation & performance of all the central & state sponsored administrative statistics & economics schemes and surveys under the Directorate of Economics & Statistics, Odisha,
- ✓ Promote Producer – user interface on statistical data through dissemination and round table discussions etc,
- ✓ Find out new solutions to advanced statistics by linking information technology and remote sensing technology etc.

Symposium on the National theme of the Statistics Day.

- The current year national theme is “ Agriculture & Farmer’s Welfare”,
- A State level workshop will be conducted on the theme,
- Statisticians, economists, researchers, planners, agricultural & environmental scientists, academia and other experts will participate in the deliberations,
- A special issue of Annual Socio-economic Journal of DE&S, Odisha relating to the current year theme will be released and discussed.

About the Directorate of Economics & Statistics(DE&S) ,Odisha:

- Established in 1958.
- The apex government organization and nodal authority of all administrative statistics system of Odisha.
- About 30 technical statistics and economics Divisions relating to statistical surveys, schemes, capacity buildings, macro economics, economic statistics, statistical infrastructures, IT & networking etc are functioning under the Directorate with field functionaries at district and block level.
- Some of the major statistics and economic schemes of DE&S, Odisha are as follows
 - ✓ State Income
 - ✓ Crop Survey
 - ✓ National Sample survey
 - ✓ Annual survey of Industry
 - ✓ Price
 - ✓ Publications

- ✓ Economic census
- ✓ Minor irrigation census
- ✓ Agriculture census
- ✓ Computer networking
- ✓ Economic Survey
- ✓ Capacity building at Regional Institute of Planning, Applied Economics & Statistics(RIPAES) etc.

Directorate of Economics and Statistics, Odisha moves ahead with a mission, vision & commitment with core values of service & integrity.

Agriculture Profile of Odisha

Sl. No	Indicator	Unit	Value (2014-15)
1	GSDP of crop sector (Current price) in 2011-12 base at basic prices	Rs lakh	4343747
2	GSDP of crop sector (constant price) in 2011-12 base at basic prices	Rs lakh	3180016
3	Share of crop sector to GSDP at current price	percent	14.73
4	Growth rate of crop sector at constant prices	percent	12.34
5	Share of agriculture & allied sector(crop, livestock, fishery, forestry) to GSDP at current prices	percent	21.33
6	Net sown area (NSA)	000' ha	5496
7	Share of NSA to total geographical area	percent	35
8	Share of area under food grains production to total cultivated area	percent	91.66
9	Share of area under rice production to total cultivated area	Percent	74
10	Share of area under HYV paddy to total paddy area	Percent	91
11	Total food grain production	TMT	10527
12	Total rice production	TMT	9845
13	Average yield rate of rice	Quintals Per hectare	23.63
14	Cropping intensity	percent	164
15	Irrigation potential created	Lakh hectares	51.54
16	Fertilizer consumption	Kg/ha.	59
17	Area of operational holdings of all social groups	Lakh hectare	48.52 (2010-11)
18	Share cultivators & agricultural labourers to total workers	Percent	62(2011)

Estimation of Crop Area and Yield at State and National level based on reduced sample sizes

*Kaustav Aditya
Hukum Chandra*

Abstract

The estimates of area and yield rate of agricultural crops assume prime importance in agricultural statistics. The crop area statistics are collected on complete enumeration basis in land record States and in non-land record States like West Bengal, Odisha and Kerala, area statistics are collected through sample survey. The estimates of yield rates of principal food and non-food crops are obtained on the basis of Crop Cutting Experiments (CCE). During the past few years, a total number of approximately nine lakh CCE covering 52 food and 16 non crops were planned in different States. The number of CCEs is on the rise and leads to different types of non sampling errors, which affect data quality. To tackle such problem, Government of India constituted Vaidyanathan Committee to revamp the system covering 90 thousand CCE in 15 thousand villages. This paper attempts to highlight the detail study and methodology to be followed for improvement of existing system.

Introduction

Agriculture plays a vital role in the Indian economy. Over 70 per cent of the rural households depend on agriculture as their principal means of livelihood. Agriculture along with fisheries and forestry accounts for one-third of the nation's Gross Domestic Product (GDP) and is its single largest contributor. Agricultural exports constitute a fifth of the total exports of the country. In view of the predominant position of the Agricultural Sector, collection and maintenance of Agricultural Statistics assume great importance. India has a well-established and internationally acknowledged Agricultural Statistics System. It is a decentralized system with the State Governments – State Agricultural Statistics Authorities (SASAs) to be more specific – playing a major role in the collection and compilation of Agricultural Statistics at the State level while the Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare (DESMOA) at the Centre is the pivotal agency for such compilation at the all-India level. The other principal data-gathering agencies involved are the National Sample Survey Office (NSSO) under Ministry of Statistics and Program Implementation, Government of India and the State Directorates of Economics and Statistics (DESs). The Agricultural Statistics System is very comprehensive and provides data on a wide range of topics such as crop area and production, land use,

irrigation, land holdings, agricultural prices and market intelligence, livestock, fisheries, forestry, etc. It has been subjected to review several times since independence so as to make it adaptive to contemporary changes in agricultural practices.

From the point of view of collection of crop area statistics, the States in the country are divided into three broader categories: i) States and Union Territories (UTs) which have been cadastrally surveyed and where area and land use statistics are built up as part of the land records maintained by the revenue agencies (referred to as "Land Record States" or "Temporarily Settled States"). The system of land record is being followed in large number of states and UTs. These States/UTs account for about 86% of reporting area; ii) the states where area statistics are collected on the basis of sample surveys (normally known as "Non land Record States" or "Permanently Settled States" which are three in number viz. Kerala, Odisha and West Bengal). A scheme for Establishment of Agency for Reporting Agricultural Statistics (EARAS) has been introduced in these three states which envisages, inter-alia, either the estimation of areas by complete enumeration or through sample surveys in a sufficiently large sample of 20% villages/ investigators zones. These states accounts for about 9% of reporting area; and iii) in hilly districts of Assam, the rest of the states in North-Eastern Region, Sikkim, Goa, UTs of Andaman & Nicobar Islands, Daman & Diu and Lakshadweep where no reporting agency had been functioning, the work of collection of Agricultural Statistics is entrusted with the village headmen (5%). While the crop area statistics are collected on complete enumeration basis in respect of states in category (i) above, on ad-hoc methods based on impressionistic approach in case of states in category (iii) above, a scheme for Establishment of Agency for Reporting Agricultural Statistics (EARAS) has been introduced in the three states in category (ii) above.

In India, estimates of yield rates of principal food and non-food crops are obtained on the basis of Crop Cutting Experiments (CCEs) conducted in majority of States/UTs under the national program of crop estimation survey. At present, over 95 per cent of the production of food grains is estimated on the basis of yield rates obtained from the crop cutting experiments conducted on scientific basis spread over 29 States /UTs. The DES, MoA&FW, Government of India, releases estimates of area, production and yield in respect of principal crops of food grains, oilseeds, sugarcane, fibers and important commercial and horticulture crops. These crops all together account for nearly 87 per cent of agriculture output. The estimates of crop production are obtained by multiplication of area estimates by corresponding yield estimates. Therefore, the estimates of area and yield rates assume prime importance in the entire gamut of agricultural statistics. The need for timely, reliable and comprehensive statistics on area and crop production assumes special significance in

view of the vital role played by the Agricultural Sector in the Indian Economy. The primary responsibility for collection of statistics of land use and area under crops following prescribed procedures rests with the various State authorities. The yield rates of principal crops are estimated through general crop estimation survey (GCES) conducted by State agencies following scientific techniques of random sampling. During past few agricultural years, a total number of 9,00,000 (approximately) crop cutting experiments (CCEs) covering 52 food and 16 non-food crops were planned in different States/UTs as compared to 1,73,097 CCEs planned during 1973-74. The number of crop cutting experiment is on the rise and as such different types of non-sampling errors etc have affected the data quality. In order to overcome this problem, Improvement in Crop Statistics (ICS) scheme has been in operation but desired improvement in data quality is not forthcoming.

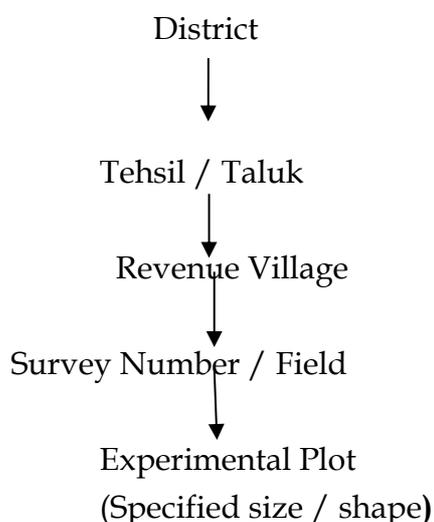
To tackle this problem, the Government of India had constituted a Committee on Improvement of Agricultural Statistics under the chairmanship of Professor A. Vaidyanathan. The Committee recommended to revamp the existing system by setting up of National Centre for Crop Statistics (NCSC) for generating reliable and unbiased estimates of land use, crop area and yield at the State and National level through enumeration of sample crops in a sample of 15,000 villages with 90,000 crop cutting experiments (CCEs). The broader objectives studied were to (i) review the problems in implementing the methodology and procedures prescribed for the collection/estimation of data on land use, cropping and yields and suggest measures to solve them; (ii) assess the potential of remote sensing techniques to collect these data and to indicate how to utilize this potential; and (iii) suggest institutional framework for Improvement of Agricultural Statistics. In order to implement the Professor Vaidyanathan Committee's recommendations to strengthen the existing system, a pilot study with the specific purpose of examining the reliability of estimates of crop area and crop production at state and national level on the basis of sample sizes recommended by the Vaidyanathan committee report was under taken by ICAR-Indian Agricultural Statistics Research Institute (ICAR-IASRI), New Delhi 12. The study is taken up with the objective to estimate the crop area and yield at the state and national level only for major food grain crops based on the sample sizes recommended by the Prof. Vaidyanathan committee report.

Area of Study and Methodology

Under this pilot study, the IACR-IASRI is considering 5 states, preferably one each from Northern, Southern, Eastern, Western and Central region of the country which are Assam, Uttar Pradesh, Karnataka, Gujarat and Odisha. Among the states selected 4 states

falls under the TRS scheme and one state under EARAS Scheme and the hilly districts of Assam corresponds to “No Land Record” states. For crop area estimation IACR-IASRI has employed a stratified three stage sampling design and for the estimation of average yield, a stratified four stage random sampling design. Under this sampling design, within each State, district wise list of Tehsils/Taluks/RI Circles/CD Blocks/Anchals etc. (sampling frame) was prepared. Out of this frame, a random sample of Tehsils/Taluks/RI Circles/CD Blocks/Anchals etc. was selected at the first stage. At the second stage, list of villages among the selected Tehsils/Taluks/RI Circles/CD Blocks/Anchals etc. was prepared and a sample of revenue villages was selected. From each selected village, 100 survey numbers was selected randomly using equal probability without replacement sampling design in the form of clusters of 5 survey numbers and enumerated completely to estimate the crop area. The selected 100 survey numbers constitutes the crop wise frame for selection of plots for conduct of the crop cutting experiments. From the crop wise list of survey numbers 2 Survey numbers were randomly selected for the purpose of crop cutting experiment. In each selected village, 6 crop cutting experiments (CCEs) - 2 CCEs each on 3 major food grain crops is going to be conducted in an agricultural year in the Kharif and the Rabi season.

The sampling design has been indicated as follows:



As the survey is proposed to be conducted in 5 States, namely, Assam, Gujarat, Karnataka, Odisha and Uttar Pradesh and the recommended a sample size as per Prof. Vaidyana than committee report is of 15,000 villages throughout India, accordingly, on the basis of States gross cropped area, a sample of size 4,700 villages were allocated to these 5 States namely Assam (300 village), Gujarat (900 village), Karnataka (1000 village), Odisha (500 village) and Uttar Pradesh (2000 village). Accordingly, for area estimation 470000 Survey Numbers/Fields (= 4700 V x 100 Survey Numbers/Fields) have to be randomly

selected and their area under crop recorded. For yield estimation, a total of 4,700 V x 6 CCEs = 28,200 CCEs is proposed to be conducted in these 5 States. For data collection work paper based schedules/questionnaire were formulated to take into account the proposed methodology. Three schedules were developed. The data collection work was initiated in the states and filled in schedules were obtained at the state headquarters.

Implementation

The field data collection work for Kharif and Rabi season of AY 2015-16 in the four States namely Assam, Odisha, Uttar Pradesh, and Karnataka has been completed. To digitize the collected data, a data entry software was prepared. Trainings were imparted to the state officials of the 4 above mentioned states about the data entry operation using data entry software and data entry work is going on in all the 4 states. The data entry for crop area enumeration was almost over in all the 4 states. An Android based data collection software was developed under this project. The software is named as Mobile Assisted Personal Interviewing (MAPI) software. Using this MAPI software data collection work can be done using any android based smart phone or tablet and as it is based on Android version 4.1. The goal in application development is to create the best possible software in the least amount of time. This software is developed using Core java Technology. The Java platform is a suite of programs that facilitate developing and running programs written in the Java programming language. A Java platform will include an execution engine (called a virtual machine), a compiler and a set of libraries; there may also be additional servers and alternative libraries that depend on the requirements. Java is not specific to any processor or operating system as Java platforms have been implemented for a wide variety of hardware and operating systems with a view to enable Java programs to run identically on all of them. Some glimpses of the MAPI software in the following figures:

Figure 1



Figure 2



Figure 3



The MAPI software is deployed for primary data collection work in the state of Uttar Pradesh in two districts namely Pratapgarh and Bulandsahr for Rabi 2015-16. The data collection work will be done in two tehsils in all the selected villages in the two districts. For initiation of data entry work using MAPI software a Two days training cum workshop was organized during March 18-19, 2016 at IASRI for the field investigators and district officials of the two districts. The data collection work through MAPI software was completed and we received the data collected through that software whereas data collected through paper based surveys are still awaited.

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Food subsidy in India increase due to rising economic cost of handling food grains through procurement, distribution and storage as well as increase in procurements.

Committee for Agricultural cost & Prices (CACP), India Report.

Impact of Global Warming on Agriculture with Reference to Odisha

Dr. Bijay Ketan Patnaik

Global warming is a global phenomenon. The major cause of global warming is the emission of green house gases like carbon dioxide, methane, nitrous oxide etc to the atmosphere mainly from burning of fossil fuels. The major sectoral contribution to green house gases in India is from energy sector, which contributes 58%, followed by industrial sector contributing around 22%. Agriculture sector is responsible for 17% emission of total green house gases specifically methane. Global warming is the biggest threat facing mankind to-day, since it affects every walk of life. It refers to the increase in the earth's temperature, being manifested in vagaries of nature such as high rainfall leading to flood, irregular and scanty rainfall leading to drought, prolonged heat wave, cyclone etc. These observed variation in pertaining to climate is termed as 'climate change'.

Odisha is one of the most vulnerable states to climate change. Situated along the east coast of the country and bounded by 480 kms long sensitive coast line the state is a periodic recipient of climate risks such as cyclone and coastal erosion. Odisha's economy has been classified as agriculture, industry and services sector as per the Reserve Bank of India classification. The agriculture sector includes agriculture and animal husbandry, forestry and fisheries. If we have a look at the land use pattern of the state, out of the 155710 sq.kms of total geographical area, forest and tree cover spreading over 58472 sq. km and net agricultural shown area of 54960 sq.km. covers around 72% of the total land mass of the state. So, Odisha could safely be described as an agrarian state. Though over the years till 2011-12 the states GSDP in this sector is continuously declining and shown improvement in subsequent years but this sector still provides employment directly or indirectly to more than 60% of the state's population. In this sense though not primary the agriculture sector is still the mainstay of state's economy.

Agriculture activities are hyper-sensitive to climate and weather conditions Odisha is rainfall dependant for its most non irrigated land which sustain mostly rainfed agriculture. Rice, invariably a water dependant crop is the main crop of the area covering 50% of the gross cropped area. In the last two decades, the rainfall pattern has become very much irregular probably due to global warming and

related climate change. The average rainfall in the state is 1482 millimeter. But average annual rainfall has decreased between 1950 to 1990 by 19 to 225 mm in sample districts and this change is not uniform. Monsoon is quite erratic. Most of the rain our state gets is due to cyclonic depression in the Bay of Bengal. Low pressure has become more frequent and intense and the rain fall pattern without being properly spread over the rainy season has become abnormal and unpredictable. Out of average annual rain fall of around 1500 mm required to be spread over 70 rainy days during monsoons, around 500-700 mm rain comes within a span of 3 to 4 days which caused immediate flood followed by drought in the aftermath period.

Floods have become annual ritual with the monsoon of 2001 leading to worst even flood recorded in Odisha in the past century as 25 of the 30 districts were inundated. Ironically, Odisha also suffered some of its worst droughts in the same years which affected more than two third of the states district. Surprisingly during the year 2004 and 2005, even with a less average annual rainfall most parts of the state was engulfed with floods. This indeed leads to vulnerability of our agriculture sector to vagaries of climate induced weather change. It is not that Odisha was vulnerable to natural disasters like flood, drought, cyclone etc prior to global warming perception came into picture. But in the recent past the frequency and intensity of these natural disasters have increased manifold, for example, between 1834 and 1926, floods occur in an average interval of 3.84 years. But between 1961 upto 2001 and onwards, floods have become an annual affair. Even in 2007, floods have occurred twice in a year.

During 2014, many parts of the state was engulfed by devastating flood. During the last two years due to Etnino effect, many parts of the state mostly in western and southern region have been grabbed by severe drought. During 1970s and 1980 only two severe cyclones hit the state. In the year 1999 two cyclones hit the state in quick succession. The second one being marked as super cyclone that ravaged 14 coastal districts which not only took heavy toll of 19660 people and thousands of livestock's but also badly affected more than 5 million people who lost their livelihood, in October, 2013 Odisha was hit by a very severe cyclonic storm 'Phailin', followed by flash flood which affected 18,374 villages in 18 districts of the state. About 11 lakh hectare of cropped area was being affected, with an estimated loss of about Rs.2,300 crore. This hazard resulted in negative growth of agricultural sector during 2013-14. One year after, during October 2014, another severe cyclonic storm 'Hudhud' just spared our state in its last lap and only inflicted severe damages to property and environment of Koraput and Malkangiri district.

Apart from more frequent extreme weather events stated above, long term impact of climate change will also cause an increase in sea level. Since, Odisha is placed across Bay of Bengal having 480 km of coastline, a slight change in the sea behaviour due to global warming will have an immediate impact on livelihood, food security of the people of two major communities like agrarian and fishing segment of population. Over the last three decades, the sea has engrossed over 3 kilometer into the land area, that were once hosting villages, providing people sustained traditional livelihood such as farmland, grazing land and fishing. Due to rapid disappearance of mangroves and other coastal vegetation, the ingress of sea into the land mass has become almost a regular phenomenon. The worst victims in all these cases are mostly the agrarian community either living in coastal, tropical or subtropical region. Due to scanty and erratic rainfall, livelihood options from agriculture is becoming unviable and so as livelihood losses from forest produces and fishing. Most of the eligible farmer community either prefer or rather forced to migrate as labourers. The vulnerability and socio economic risk favour encountered by Agriculture and food security sector due to global warming and climate change is depicted in Table-1.

Table-1

Sector	Vulnerability	Socio Economic Risks
Agroculture & Food Security	<ul style="list-style-type: none"> • Temperature stress • Erratic precipitation • Reduced soil moisture • Food drought condition • Sea level rise and inundation • Invasion of parasitic species or disease 	<ul style="list-style-type: none"> • Increased risk of desertification and land degradation (South and West Odisha) • Decline in crop yield and production (Northern Odisha) • Decline in availability of food and increased incidence of malnutrition (South-West Odisha)

Climate sensitive functions indicate that temperature alone governs the productivity compared to all other components. Studies conducted by the Indian Agriculture Research Institute (IARI), New Delhi pointed to a possible loss of 4 to 5 million tonnes in the overall wheat production of the country with every 1 degree centigrade increase in temperature. Dr. S.N. Pasupalak, presently vice Chancellor, OUAT, has pointed out in one of his articles that, if temperature during the season increased by 1 to 2° C, then the rice yield is projected to decrease by 7.5 quintal/ hectare. Impact of climate change is also likely to have adverse impact on livestock

and fisheries. Fish production will decrease as fishes are more sensitive to rise in temperature and coastal trade of fishermen community will suffer significantly. Similarly pest dynamics are also changing due to climate change. New pests are becoming more virulent. Incidence of bacterial leaf blight, blast and swarming caterpillar are likely to affect the rice crop more and more. Productivity of most cereals would decrease due to increase in temperature and simultaneous water scarcity.

In summing up, it may be said that in our state Odisha, with almost 60 percent of land under rainfed agriculture and with water-dependant rice, as its main crop, the agriculture sector is particularly vulnerable to the vagaries of climate change. Further paddy fields in the coastal areas are prone to frequent erosion, salinisation and inundation. Climate projections indicate that in coming years drier areas will become more drier and flood prone areas will be subject to more flooding. Other problems, such as pest and disease outbreak are also likely to increase due to climate variability. Over the years, implementation of various programmes in the realm of food and agricultural production sustainably improved the general food security and livelihood security situation in vulnerable pockets of our state. The extreme weather events due to global warming and climate change is likely to upset the delicate gains achieved so far.

Having admitted that agriculture sector in our state is highly vulnerable to natural vegahes arising out of global warming and climate change, various possible mitigation measures have been suggested in Odisha Climate Change Action Plan. Besides the measures like developing integrated water shed programme in rain fed areas, increasing the area under perennial fruit tree plantation etc, another measure could be promotion of Agro-forestry. The practice is not new to us. Because in south and western districts, one could invariably notice plantation of Babul (*Acacia arabica*) trees on the farm bunds, providing various benefits to farmers.

Agroforestry is a collective name for land use systems and technologies, where woody perennials (trees, shrubs, palms, bamboos etc) are deliberately used on the same land management units as agricultural crops. In the arid and semi arid regions of he state, scanty rainfall is a major constraint, specifically for upland farmers, who do not have access to irrigation. Successful and well managed integration of trees on agricultural farms often results in diversified and sustainable crop production. It also provides a wide range of environmental benefits such as

bringing about favourable changes in the micro-climatic conditions by influencing radiation, air temperature, wind speed, erosion control, watershed services etc. Optimizing the use of increasingly scarce rainwater through agro-forestry practices could be one way of effectively improving the capacity of farmers to adopt to drier and more variable conditions in low rainfall areas. Integration of trees and crops in farmlands can produce positive interaction that could contribute towards controlling pest and disease outbreak, besides suppression of weed. The agro-forestry practices has many other advantages such as carbon sequestration, soil moisture conservation, intervention in drought mitigation etc, which requires a separate article for elaborate discussion, but certainly this practice is one of the mitigation measures to save our farmers from natural disasters.

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The benefits of micro irrigation (drip irrigation) are revealing. It reduces irrigation cost; saves electricity & fertilizers; augments yields of crops (mostly high value crops like wheat, gram, soyabin etc) and improves farm income.

- Evaluation report of National Mission on Micro Irrigation, Ministry of Agriculture, GoI, conducted in 64 districts of 13 States including Odisha.

NRRI plays catalytic role in boosting rice production in India

Dr. P. Samal and Dr. A. K. Nayak

Abstract

Food grain production, rice in specific, form the basic component of crop sector in India. The dependency syndrome on farming in terms of rural livelihood support & employment generation is wide open. Technological change and suitable government policies play the clinical role in raising production and productivity of rice. The paper makes a trend analysis on area, production & yield rate of rice at national level. The discovery and development of about 115 varieties of rice including hybrids by NRRI since 1960s have direct bearing on increased production in rice crops. Application of a series of technology based crop management techniques by NRRI immensely help in rise in rice production, productivity, reduced cost of cultivation, irrigation efficiency use, better seed, fertilizer and pest management. NRRI builds up strong partnership with national and international institutional mechanisms. NRRI makes special efforts to bring green revolution in eastern India, in terms of production, marketing, irrigation, technology development.

Rice is the staple food crop of India and accounts for 35% of total area and 41% of total production under foodgrains. The crop provides employment to majority of farming population in India. Therefore, increasing production and productivity of rice is important from the point of food security. Technological change and favourable government policies has helped in increasing rice production in India during the last 65 years (1950-51 to 2014-15) and made India not only self sufficient in rice production but also the largest exporter of rice in the world. The decadal growth in production, productivity and area of rice over the last six decades and the recent past (2012-14) is presented in figures 1, 2 and 3. The average production per year has increased from 26.29 million tonnes during 1950s (1950-51 to 1959-60) to 89.19 million tonnes during 2000s (2000-01 to 2009-10). The production increase was faster during the recent past and reached 105.79 million tonnes. The production increase is due to growth in productivity and expansion in area. The productivity has increased from 0.83 tonnes per ha during 1950s to 2.05 tonnes per ha during 2000s and reached 2.42 tonnes per ha in the recent past. The area under rice has reached a plateau during the last 25 years and fluctuating around 43 million ha depending on the monsoon pattern in a particular year. With government's incentives to diversify upland rice area to other crops and diversion of land to other sectors of the economy, the area under rice will decline in future. Therefore, future expansion in production has to come

from productivity increase only through technological advancement. India will need 137 million tonnes of rice to feed its growing population by the year 2050 besides export demand. The problem before us is how to feed millions of new mouths and hungry people in the face of shrinking land frontiers, diminishing per capita irrigation water, deteriorating soil health, increasing biotic and abiotic stresses and changing climate.

National Rice Research Institute (NRRI), formerly known as CRRI, is in the forefront of technology development to increase productivity and profitability of rice cultivation and is in the 70th year of its existence. The institute was established in the year 1946, by the then British government as an aftermath of the great Bengal famine, where millions of people perished, to look into a holistic approach to rice research in India.

Fig 1. Trend in production increase of rice in India

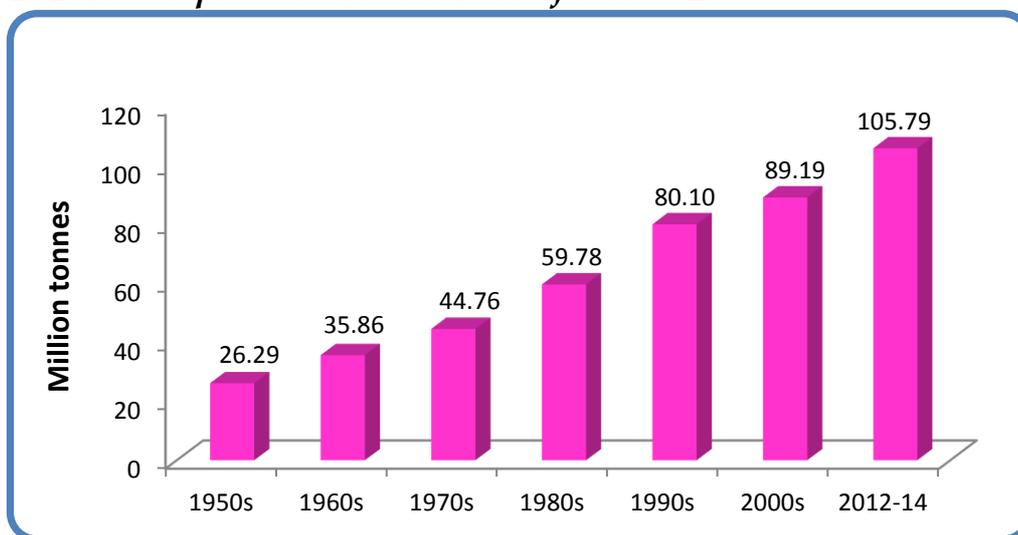


Fig 2. Trend in productivity increase of rice in India

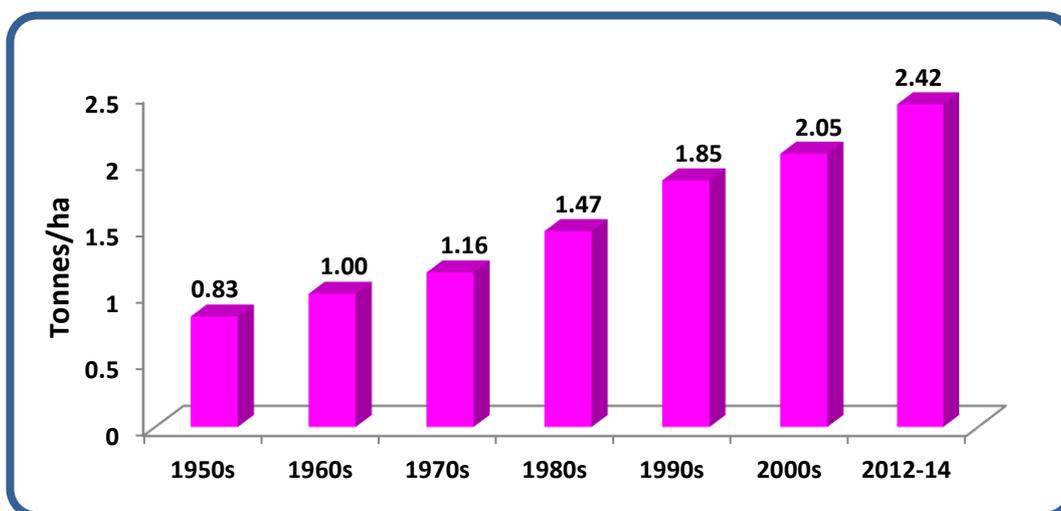
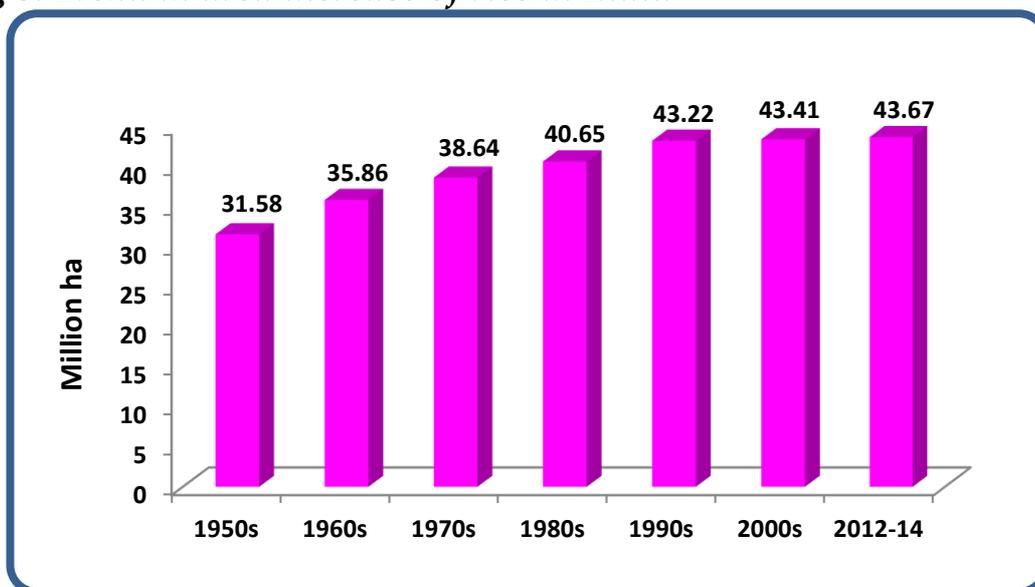


Fig 3. Trend in area increase of rice in India



The goal of the institute is to ensure food and nutritional security for the present and future generations of the rice consumers and producers. Therefore, the mission of the institute is to develop and disseminate eco-friendly technologies to enhance productivity, profitability and sustainability of rice cultivation. The institute has developed a number of technologies, which helped in increasing rice production in India. Some of the promising technologies are listed in the following section.

Varietal Development

NRRI has developed 115 varieties (including three hybrids) for different ecosystems till date. The names of the varieties are listed ecosystem wise in table 1.

The *indica-japonica* hybridization programme sponsored by Food and Agriculture Organisation, which was launched in 1952 at NRRI, yielded varieties like ADT-27 (released in Tamil Nadu), Malinja and Mahsuri (released in Malaysia) and Circna (released in Australia). Mahsuri was later released as Ponni in Tamil Nadu, Pajam in Bangladesh and Masuli in Nepal. Mahsuri is one of the parents of many popular rice varieties like Swarna and Samba Mahsuri. CRRI is pioneer in developing photosensitive non-lodging rice varieties by Indica x Japonica hybridization in early sixties. The program resulted in development of CR 1014, a superfine grain variety, in 1966 capable of yielding under stagnant water with intermediate depth. The variety is still popular in Odisha. CR 94-13, a line developed by CRRI, is one of the parents of varieties like IR 36, IR 32, IR 38, IR 40, IR 42 and IR 44 which are mega varieties in many countries. First semi dwarf high yielding

variety 'Padma', released in 1968 by CRRI, and later released varieties like Ratna, Bala, Krishna and Vijaya 1970 gave a new lead for the development of semi tall, profuse tillering and low input efficient varieties suitable for rainfed lowland system (water depth up to 30 cm). CR 1009 released in 1982 and other varieties of 'CR 1000' series became popular in various states of India (Tamil Nadu, Pondicherry, Andhra Pradesh, Kerala, Odisha and West Bengal) and other countries like Burundi and Srilanka. All these varieties developed in late fifties and sixties constitute core breeding materials for subsequent varietal development in National Agriculture Research System of our country and abroad.

NRRI was first to report the existence of cytoplasmic male sterility (during 1954), which has been used for development of hybrid rice worldwide. The institute identified *Oryzalongistaminata* as a source of bacterial blight resistance, which was subsequently used elsewhere to isolate *Xa21* gene. The institute perfected the anther culture technology and pioneered to develop and release two high yielding *indica* rice varieties namely *Satyakrishna* and *Phalguni* through this technique. Integrated marker assisted selection technique was used to transfer three bacterial blight resistance genes to the popular varieties *Lalat* and *Tapaswini* and released their improved versions as new varieties by the institute. Work on specialty rice at NRRI has resulted in identification of eight high protein rice cultures with 10% protein in milled rice. One such rice in *Naveen* background has been released as CR Dhan 310. Rice cultivars with high iron/zinc have also been identified. The rice variety Kalinga III with long slender grains grown in upland ecology was found to be high in protein and zinc content. The rice variety *Kalabhat* with high antioxidant content has also been identified.

Table 1. NRRI varieties suitable for different ecosystems

Sl. No	Ecosystem	Name of the varieties
1	Upland (20)	Bala, Sattari, Kalinga-III, Neela, Annada, Heera, Kalyani-II, Tara, Vanaprabha, Sneha, Vandana, DhalaHeera, Anjali, Sadabahar, Virender, CR Dhan 40, Sahbhagidhan, Phalguni, Satyabhama, CR Dhan 101
2	Irrigated (42)	Padma, Kiron, Krishna, Ratna, Vijaya, Saket-4, Jayanti, Kalinga-I, Kalinga-II, Shakti, Supriya, Vani, Naikichili, Indira, Pallavi, Narendra-1, Khitish, CR-138-928, Sarasa, Udaya, Kshira, Shaktiman, Radhi, Tapaswini, Shatabdi, Hazaridhan, Abhishek, Geetanjali, Naveen, Rajalaxmi (Hybrid), Ajay (Hybrid), Satya Krishna, Hue, Improved Lalat, Improved Tapaswini, , CR Dhan 300, CR Dhan 303, CR Dhan 305, CR Dhan 304, CR Dhan 306. CR Dhan 307, CR Dhan 310

Sl. No	Ecosystem	Name of the varieties
3	Aerobic (7)	CR Dhan 200, CR Dhan 201, CR Dhan 202, CR Dhan 203, CR Dhan 204, CR Dhan 205, CR Dhan 206
4	Boro/ Summer (3)	Chandrama, Chandan (CR Borodhan 2), CR Dhan 601
5	Shallow rainfed lowland (22)	Anamika, Ramakrishna, Samalei, Savitri, Dharitri, Moti, Padmini, CR 1002, Seema, Pooja, Ketekijoha, Nuakalajeera, NuaDhusara, Swarna Sub1, Reeta, NuaChinikamini, CR Dhan 701 (Hybrid), Sumit, PoornaBhog, CR SugandhDhan 907, CR Dhan 407, CR Dhan 408
6	Medium Deep Water (11)	Utkalprabha, CR 1014, Gayatri, Kalashree, Panidhan, Tulasi, Sarala, Durga, Varshadhan, Hanseswari, CR Dhan 501
7	Deep Water (4)	CR Dhan 500, Jalamani, JayantiDhan, CR Dhan 505
8	Coastal Saline (6)	Lunishree, Sonamani, Luna Suvarna, Luna Sampad, Luna Barial, Luna Sankhi

(Figures in parentheses indicate number of varieties)

Crop Management Technologies

- ❖ Integrated Nutrient Management (INM) - Combined use of various sources of nutrients *viz.*, chemical, organic and bio-fertilizers have been formulated to increase crop production and the productivity in different ecosystems.
- ❖ Resource Conservation Technology - Incorporation of *Dhaincha* at 25-30 days after sowing by cono-weeder if standing water is available. Alternatively, knock down *dhaincha* plants by 2,4-D at 25-30 days after sowing if standing water is not available.
- ❖ Leaf Colour Chart - It was customized and found useful (increase Nitrogen efficiency by 10%) for need based nitrogen management in rice and reducing nitrogen use and reduction in cost of production.
- ❖ Management of Acid Soils - Liming to increase pH, base saturation, CEC, inactivating Al, Fe, and Mn, reduce acidity and Phosphorus (P) fixation (needs regular application due to reserve acidity). Management of acid soils involves organic manuring (Farm Yard Manure, Compost, Green Manuring, etc.). Reducing P fixation by using less soluble P sources such as rock phosphate. Selection of crops, cropping systems and varieties helps in reducing acidity.

- ❖ Aerobic Rice -Growing rice with aeration or under non-flooded condition is termed as aerobic rice. With this technology reasonably good yields can be obtained with only 2-3 irrigations, thus saving 30-40 per cent of irrigation water.
- ❖ Direct seeding - Direct seeding, using a drum seeder, is one of the methods of crop establishment of rice which has potential to increase production with reduction in cost of cultivation.
- ❖ Azolla -The aquatic fern Azolla is promising nitrogen-fixing bio-fertilizer for rice. One crop of Azolla produces 10-20 tonnes of fresh biomass and supplies 20-40 kg of nitrogen per ha. NRRI has identified a strain of *Azollacaroliniana* with tolerance to major insect pests in comparison to *Azollapinnata*, which has been commonly used.
- ❖ Rice-fish-horticulture based farming system models for increasing farm productivity, income, employment, sustainability and household food and nutritional security were developed.
- ❖ Several implements / machineries / devices have been developed for small farmers as they constitute 85% of the total holdings available in India. They are: a) CRRRI drum seeder, b) CRRRI manual rice transplanter, c) CRRRI two row manual seed drill, d) CRRRI animal drawn seed drill, e) CRRRI tractor drawn seed drill, f) CRRRI animal drawn disc harrow, g) CRRRI rice husk stove, h) CRRRI power operated paddy winnower cum cleaner, i) CRRRI mini parboiling unit, j) RCC ring bin, k) Variable capacity paddy dryer.
- ❖ Management of biotic stresses depends on proper pest surveillance/monitoring and fixing of economic threshold level. The surveillance is generally done by fixing light/ pheromone traps and regular sweeping by net in the field for insect pests and also visual observation for both insect pests and diseases. Eco-friendly pest management forms a major option and need based with emphasis on bio-intensive Integrated Pest Management technologies (IPM) in rice. IPM technologies for management of pests in different ecosystems has been developed.
- ❖ ITK-based botanicals such as Neem (*Azadirachtaindica*), Karanja (*Pongamiapinnata*), Kochila (*Strychnosnux-vomica*), Water Pepper (*Polygonumhydropiper*), Parasi (*Cleistanthuscollinus*) and Wild Sugarcane (*Saccharumspontaneum*) etc. were validated in tribal areas and refined for higher efficacy and user-friendly applications. These are mainly recommended for tribal areas, where rice farming is subsistence in nature.

Linkages and Partnership

The NRRI has linkages with several national and international organizations such as the Council for Scientific and Industrial Research (CSIR), Indian Space Research Organization (ISRO), Indian Institute of Rice Research (IIRR), State Agricultural Universities, State Departments of Agriculture, and the institutes of the Consultative Group for International Agricultural Research (CGIAR), such as the International Rice Research Institute (IRRI), Philippines and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad. NRRI also has strong linkages/collaboration with several institutes/universities in India for technical cooperation and development of technologies for the farmers. The institute has partnered with more than ten private companies for commercialization of its products and technologies. Partnership with farmer organizations and a rice milling firm has been established for participatory seed production and commercial production of high-quality milled rice for providing remunerative price to the farmers and also to have a win-win situation to all the stakeholders.

Outreach Programmes

The institute has been conducting frontline demonstrations and on-farm trials through KVK's, and various other collaborative projects with institutes like National Centre for Integrated Pest Management, New Delhi, International Rice Research Institute, Philippines, and Government of India projects like National Initiative on Climate Resilient Agriculture and Tribal Development project and other institute projects etc.

The State-of-the-art Facilities

The institute obtained the ISO-9001:2008 certification for quality management system. The facilities available in the institute are:

- *Oryza* museum
- Gene bank
- Transgenic laboratory
- Biotechnology laboratory
- High temperature wind tunnels
- Salinity screening facility
- Open top chambers for CO₂ enrichment study

- Maintains more than 30,000 accessions of rice germ plasm including nearly 6,000 accessions of Assam Rice Collection (ARC) and 5,000 accessions from Odisha.
- Data base on various aspects of rice

BGREI program

The eastern region of India accounts for 67.0% of total rice area of India and 59.5% of total rice production (Table 2). Though rice area is concentrated in the eastern region, the productivity of the region is far less than the northern and southern regions. The availability of water in eastern part India is much more than other regions of India, for which the region has comparative advantage over other regions for growing rice. Therefore, government of India has launched a scheme called Bringing Green Revolution to Eastern India (BGREI) in 2010-11 to incentivize farmers in seven major states of eastern India to produce more rice in this part of the country. The scheme involves block demonstrations, mechanization of farm operations, knowledge based demonstrations, post harvest management and marketing support *etc.* NRRI has been identified as the nodal agency to guide, supervise, monitor and suggest technical interventions for BGREI program in coordination with state agricultural universities / ICAR institutes and concerned state department of agriculture.

Table 2. Region wise share of area, production, yield of rice in India (2012-14)

Region	Area in percent	Production in percent	Yield (t/ha)
Eastern	67.0	59.5	2.15
Southern	15.3	18.5	2.94
Northern	10.8	15.7	3.53
Western	5.8	4.9	2.03
India	100.0 (43.7)	100.0 (105.8)	2.42

(Figures in parentheses indicate actual values (Area in million ha and production in million tonnes)

Data source: Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

The BGREI scheme has completed six years of its existence and therefore it is time now to assess its impact. A comparative analysis has been made for production and productivity between pre-BGREI period (2007-08 to 2009-10) and BGREI period (2012-13 to

2014-15) and the results are presented in tables 3 and 4. The average production and productivity in BGREI states has increased by 16.6% and 18.8% respectively in comparison to 11.4% increase in production and 11.7% increase in productivity at all India level. The production has increased by more than 40% in two states *viz.* Bihar and Chhattisgarh, and more than 30% in Assam. The major increase in productivity has taken place in states like Bihar (51.4%), Chhattisgarh (38.2%), Assam (29.0%), Jharkhand (20.0%) and Odisha (17.0%) due to the operation of the scheme and has benefitted a large section of farmers.

Table 3. Average increase in rice production in BGREI states

Figure in million tonnes

BGREI state	2007-09	2012-14	% increase
Assam	3.89	5.09	30.8
Bihar	4.54	6.46	42.5
Odisha	7.09	7.74	9.1
Chhattisgarh	4.64	6.55	41.1
Jharkhand	2.76	3.11	12.6
UP	11.89	13.74	15.5
WB	14.70	15.02	2.2
Total BGREI States	49.52	57.72	16.6
India	94.99	105.79	11.4

Data source: Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

Table 4. Average Increase in rice productivity in BGREI states

Figures in tonnes/ha

BGREI state	2007-09	2012-14	Percent increase
Assam	1.59	2.06	29.0
Bihar	1.32	2.00	51.4
Odisha	1.60	1.88	17.0
Chhattisgarh	1.25	1.72	38.2
Jharkhand	1.87	2.24	20.0
UP	2.11	2.33	10.5
WB	2.55	2.76	8.1
BGREI States	1.84	2.19	18.8
India	2.17	2.42	11.7

Data source: Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

Challenges and Future Thrusts

The major challenges to future increase in rice production are declining profitability from rice cultivation, shortage of irrigation water due to diversion to other sectors of the economy and declining ground water table in some areas, changing climate, plateauing yields in irrigated areas, constraints in input delivery, drudgery reduction in rice farming and other infrastructural bottlenecks in storage and marketing.

Therefore, the future research thrust areas are, a) Development of super rice including super hybrids, b) Development of climate resilient varieties tolerant to multiple abiotic stresses, c) Changing crop management practices, which reduce Green House Gas emission and support environmentally sustainable rice production, d) Enhancing input use efficiency, e) Breeding high quality rice for enhancing the nutritional value, f) Development of more efficient machineries and implements for small farm mechanization, g) Addressing socio-economic constraints and infrastructural bottlenecks. NRRI is working on the above thematic areas to develop technologies, which will benefit the farmers in the years to come.

India truly remains agrarian as the nation ranks (as % share to world agriculture)

- ✓ *1st in production of pulses, jute, buffalos and milk.*
- ✓ *2nd in arable land area; agriculture dependent population & workforce; production of wheat, paddy, groundnut, fruit & vegetables, potato, dry onion, sugarcane, cotton, cattle, goat, agriculture tractor in use.*
- ✓ *3rd in production of total cereals, rapeseed, tea, tobacco leaves, sheep, egg.*

Agriculture Statistics at a Glance, 2014, Ministry of Agriculture & Farmer's welfare, Government of India

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Promote Agro-based Industries to boost Agricultural Productivity

Prof. Jagannath Lenka

Abstract

Since over crowded agriculture does not hold any promise for rapid economic development, prosperity of the state lies in a balanced development of small scale industries which need to be linked with agriculture on the one hand and large scale industries on the other. Agro-based industries not only make use of local resources but also help generating employment and output catering to local demand as well as demand from outside. These industries have high degree of complementarities with agriculture sector. By withdrawing surplus labour on the one hand and creating market for agricultural products on the other, it helps increase in agricultural productivity.

Key Words:

Agro-based industries, Agricultural Productivity, Employment Elasticity

Introduction

The importance of agriculture in Odisha can hardly be undermined in spite of the fact that the sector contributes only a fifth to the Gross State Domestic Product. The agriculture sector provides employment to more than three-fifths of total work force of the state. This sector so to say is the mainstay of the poverty population of the state. The dream of improving the economic status of the rural masses will be a myth unless and until the growth of agriculture is accelerated from the present dismal rate of less than 2 per cent.

Increasing agricultural labour force, lower capital formation, very small per capita availability of cultivable land (0.15 ha), predominant presence of marginal and small farmers, inadequate infrastructural facilities, marketing and credit problems, lack of extension services are main impediments of agricultural growth. Corrective measures are highly necessary for achieving 4 per cent growth rate as targeted in current plan to support the increasing population of the state.

Economic progress no doubt depends highly on industrialisation and deployment of surplus rural labour in industrial and services sector. However, the capital intensity of industrialization possesses a great challenge to a poor agrarian state like Odisha. Moreover,

rapid rural urban migration leads to growth of an informal sector and creates difficulties in provision of basic amenities of life in that sector as it requires a higher amount of investment.

The solution therefore, lies in reducing unemployment, man-land ratio and thereby increasing agricultural productivity through establishment of small-scale industries in general and agro based industries in particular. The capacity of this sector in generating employment with a short gestation period coupled with less capital intensity has made it an ideal instrument for reducing unemployment. With its high employment elasticity with respect to investment i.e. 0.27, it will definitely succeed in reducing the population pressure on land and raise the agricultural productivity.

Moreover, the agro-based industries facilitate the use of agricultural products as raw materials providing outlet to surplus produce in the sector. By widening the market, it induces the farmers to raise production and productivity. In addition to this the high export potential of the processed agri-products also ensures widened market and alluring remunerations for the farmers engaged in the production of exportable goods. The establishment of agro industries inculcates industrial culture, develops entrepreneurship in rural areas. It also generates a sense of participation in the development process.

The present paper that attempts to study the importance of agro-based industries in promotion of agricultural productivity is organized in following way. The Section-II contains the objectives of the study. The materials and methods are presented in Section-III. Results of the study are discussed in Section- IV followed by the concluding Section.

Objectives

The broad objectives of the present study are as follows:

1. To find out the growth trend of agro based and non-agro based industries in the state.
2. To find out the elasticity of employment with respect to investment in both agro based and non-agro based industries.
3. To suggest measures for balanced growth of agro-based industries in the state.

Materials and Methods

The present study makes use of secondary data collected from the annual issues of District Statistical Handbook published by the Directorate of Industries, Orissa, Cuttack. These data relate to the number of SSI units, investment and employment. The study covers the period from 1991-92 to 2009-10 for which comparable data are available. It could not be extended further because of non-availability of data and it is assumed that the trend remains the same.

In order to find out the growth trend of SSI units, investment and employment an exponential trend line is estimated by using the following formula.

$$Y = Ae^{bt}$$

$$\Rightarrow (dY/dt)/Y = b$$

Where b = exponential growth rate

The employment elasticity of investment is obtained by estimating a log linear function.

$$\ln E = \alpha + \beta \ln I$$

Where E = employment

I = investment

α, β = parameters

Therefore, $d(\ln E)/dI = d/dI (\alpha + \beta \ln I)$

$$\Rightarrow (I/E) \times (dE/dI) = \beta/I$$

$$\Rightarrow \beta = dE/dI \times I/E$$

β = investment elasticity of employment

Results and Discussion

Number of SSI Units

The number of SSI units took a gigantic leap forward during the period under reference. It is evident from the Table-1 that the total number of SSI units, which stood at 15,292 in the year 1991-92, increased to 39,340 in the year 2009-10. The number of Agro-based industries is found to have increased from 3838 to 8953 while that of other industries increased from 11,454 to 30,387 during the same period.

Table 1 : Number of SSI Units

Years	Agro-based	Non-agro based	Total
1991-92	3838	11454	15292
1992-93	3924	12118	16042
1993-94	4070	12719	16789
1994-95	4219	13338	17557
1995-96	4408	13879	18287
1996-97	4600	14724	19324
1997-98	4832	15619	20451
1998-99	5120	16548	21668
1999-00	5513	17587	23100
2000-01	5881	18743	24624
2001-02	6237	20048	26285
2002-03	6624	21320	27944
2003-04	7031	22627	29658
2004-05	7375	23981	31356
2005-06	7755	25271	33026
2006-07	8052	26427	34479
2007-08	8353	27641	35994
2008-09	8648	28934	37582
2009-10	8953	30387	39340

Source: Statistical Hand Book

**Table1.1: Exponential Growth Rate of Number of Industries
(Regression Results)**

Parameters	Agro based	Non-Agro based
Constant	3.490E4	1.070E4
Growth Rate	0.051	0.056
R ²	0.993	0.998

The exponential growth rate of the number of Agro-based industries is calculated to be 5.1 per cent, which is lower than 5.6 per cent for that of other industries as shown in the Table -1.1.

Investment

Investment plays a vital role in determining the level of employment and output. More the level of investment more will be the output and employment of resources both physical and human. The speed and pattern of growth of industries are also closely related to the volume of investment.

Table 2 :Level of Investment in SSIs (Rs in Lakhs)

Years	Agro-based	Others	Total
1991-92	9241.65	46578.48	55820.13
1992-93	9465.64	48447.21	57912.85
1993-94	9752.37	50451.36	60203.73
1994-95	10257.71	51968.58	62226.29
1995-96	11154.94	53343.87	64498.81
1996-97	11773.54	57516.65	69290.19
1997-98	12842.25	60537.95	73380.2
1998-99	14656.91	65484.51	80141.42
1999-00	16305.98	69576.15	85882.13
2000-01	17528.35	71953.85	89482.2
2001-02	19205.7	76855.84	96061.54
2002-03	20541.38	86412.86	106954.2
2003-04	22514.29	90514.2	113028.5
2004-05	24371.43	94237.05	118608.5
2005-06	26947.13	98235.67	125182.8
2006-07	29232.97	108144.6	137377.6
2007-08	31619.32	130019.7	161639.1
2008-09	33659.44	138535.9	172195.3
2009-10	35921.32	149473.4	185394.7

Source: Statistical Hand Book

Table-2 reveals that there has been a phenomenal growth in investment in small scale industries that has increased from Rs55,820.13 lakh to Rs. 1,85,394.7 lakh during the study period. It may be noted here that the investment in agro-based industries has increased from Rs.9,241.65 lakh to Rs. 35,921.32 lakh registering an exponential growth of 8.2 per cent. On the other hand, the investment in other industries has increased from Rs. 46,578.48 lakh to Rs. 1,49,473.4 lakh registering an exponential growth of 6.5 per cent.

Table 2.1: Exponential Growth of Investment (Regression Result)

Parameters	Agro based	Non-Agro based
Constant	7.698E3	3.999E4
Growth Rate	0.082	0.065
R ²	0.993	0.977

Employment

Employment in the SSI sector, as shown in the Table- 3, has increased from 1,40,009 in the year 1991-92 to 3,33,465 in the year 2009-10. The corresponding figures in Agro-based vs. other industries stand in the order 21,519 & 1,18,490 and 68,945 & 2,64,520. The exponential growth of employment in the Agro-based industries is calculated to be 6.8 per

cent as compared to less than one per cent for other industries for the period under reference.

Table -3 : Level of Employment in SSIs

Years	Agro-based	Others	Total
1991-92	21519	118490	140009
1992-93	22444	126246	148690
1993-94	23529	132271	155800
1994-95	24981	138375	163356
1995-96	26729	142805	169534
1996-97	28387	148923	177310
1997-98	30469	155816	186285
1998-99	32711	163194	195905
1999-00	36299	170459	206758
2000-01	39127	178025	217152
2001-02	41173	185655	226828
2002-03	43451	192311	235762
2003-04	47995	199570	247565
2004-05	51103	208064	259167
2005-06	54559	216865	271424
2006-07	58102	225774	283876
2007-08	61403	239193	300596
2008-09	65479	251364	316843
2009-10	68945	264520	333465

Source: Statistical Hand book

Table 3.1 : Exponential Growth of Employment (Regression Results)

Parameters	Agro based	Non-Agro based
Constant	1.937E4	1.048E5
Growth Rate	0.068	0.007
R ²	0.998	0.985

Investment Elasticity of Employment

In view of the ever-increasing magnitude of unemployment and underemployment, it is imperative that the situation be controlled by undertaking employment- cum -

production-oriented activities. Since the pressure on land is already high, it is now emphasized by all that the solution to this problem lies in rapid growth of small-scale industries in general and agro-based industries in particular. It is found that the investment elasticity of employment (0.828) is higher in agro based industries compared to that (0.649) of other small-scale industries taken together. Thus, the employment generating capacity per unit of investment is more in Food and Allied industries compared to that of other industries as a whole.

Table 4 : Investment Elasticity of Employment (Regression Results)

	Constants	Se	t	R ²
Agro based Industries	$\alpha = 2.468$	0.097	25.33	0.998
	$\beta = 0.828$	0.010	83.06	
Non-Agro industries	$\alpha = 4.787$	0.257	18.65	0.979
	$\beta = 0.649$	0.023	28.45	

Findings

The major findings that emerged from the study are as follows:

- So far as the number of SSIs is concerned, agro-based and other industries as well are increasing with an exponential growth of 5.1 and 5.6 per cent respectively.
- In terms of investment, the agro-based industries are ahead of non-agro industries with an exponential growth of 8.2 per cent.
- The employment in agro-based industries is also registering a higher growth rate of 6.8 per cent as compared to the other small-scale industries.
- With a higher investment elasticity of employment i. e.0.828, the agro-based industries emerge to be a potential sector of employment generation that can reduce man land ratio thereby increasing agricultural productivity.
- In the context of present scenario in Orissa agriculture and the importance of agro-based industries there in, the study makes the following suggestions for the development of these industries.
- With strong feedback in terms of higher demand for raw materials, the agro-based industries will induce generation of surplus agri- products. Necessary steps should

be taken to see that there is sufficient surplus of agricultural output in the state. This can be achieved through encouraging diversification of agriculture.

- A coordinated establishment of related groups of agro-based industries will ensure fruitful use of byproducts.
- Investment should be encouraged in all the districts with special emphasis on the less developed ones to ensure balanced and homogeneous growth of the agro based industries in the state.
- The labour intensive agro based industries should be encouraged in the districts with low density of population so that migration to high-density regions can be prevented.
- Extension services and dissemination of information along with research activities and training programmes are necessary. Steps should be taken in promotion of all these activities.

Conclusion

Since large scale industries do not automatically lead to an improvement in the level of living and over crowded agriculture does not hold any promise for rapid economic development, prosperity of the state lies in a balanced development of small scale industries which need to be linked with agriculture on the one hand and large scale industries on the other. The particular emphasis that we want to put here is that Agro-based industries that not only make use of local resources but also help generating employment and output catering to local demand and demand from outside. These industries have high degree of complementarities with agricultural sector. By withdrawing surplus labour on the one hand and creating market for agricultural products on the other, it helps increase in agricultural productivity and paves way for development of agriculture and development of the state.

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The share of India's Agricultural Exports & Imports in World trade in 2014 were 2.46% & 1.46% respectively. The exports & imports experience rising trend since 2009-10. The share of India's exports & imports of agricultural products to agricultural GDP increased to 12.08% & 5.89% in 2014-15 respectively.

WTO's Trade Statistics

Augmenting Productivity – Balasore Experience

CMA K S S Prasad,

Abstract

Technology, extension, capacity building, information dissemination and infrastructure development can improve the crop productivity & farm income sizably. NABARDs pilot project covering more than 10 % farmers of 12 blocks on 5 major crops in Balasore district for 3 years between 2012 & 2015 along with more than 1000 trainings programmes to farmers target groups with the support of NGOs & SHGs Showed the way to improved crop productivity & farm income.

Strategy for Improving Crop Productivity

- i. promoting use of appropriate crop varieties,
- ii. improving the health of soil and thereby its productivity potential,
- iii. planning for timely delivery of required production inputs, specifically quality seeds, and
- iv. putting in place an effective technology transfer system from the technology store houses to the last mile farmer.

Strategy for Increasing Net Income

- i. reducing labour cost by promoting mechanization of various farm operations,
- ii. reducing cost of cultivation through promoting integrated nutrient management, integrated pest management and effective weed management through use of herbicides
- iii. strengthening post production infrastructure to arrest distress sale, and
- v. encouraging freshwater fishery as a source of supportive income

NABARD had taken up a “Pilot Project for Augmenting Farm Productivity” in Balasore District of Odisha, to promote an integrated approach for increasing the crop productivity and farmers’ income. The project which started in Kharif 2012, spread over 6 crop seasons for the three years came to a close with Rabi season in June 2015. The pilot project was implemented in all the 12 blocks of the district for the lead crops grown there, viz. Paddy, Green Gram / Black gram, Ground Nut and Mustard.

The strategy adopted was

Strategy for increasing the crop productivity

The productivity of a crop is a complex phenomenon, which comprises of interplay of biotic and abiotic factors. While the abiotic factors like climatic condition and cultural practice and timeliness of intervention plays a dominant role, the biotic factor like genetic potential, acclimatization of a crop variety and resilience of a crop to adverse conditions cannot be ignored. Therefore the strategic measures adopted for enhancing the crop productivity were:

Promotion of scientifically proven suitable crop varieties through crop demonstration. The demonstrations were carried out in clusters of about 10 acres comprising of about 20 master farmers. The crop demonstrations were organised in 1880 villages in about 270 panchayats. Improvement of Soil health conditions through green manuring, azolla application and usage of vermin compost and bio-fertilizers

Adoption of recommended cultural practices viz., Summer ploughing, Line sowing / transplanting, Seed treatment, etc.

Strategy for Reduction of Cost of Cultivation

- ✓ Replacement of labour intensive activities like transplanting, harvesting and threshing by promotion of farm mechanization
- ✓ Use of Integrated Nutrition Management (INM) on the basis of soil test results
- ✓ Use of Integrated Pest Management methods including Pheromone traps and Tricho cards

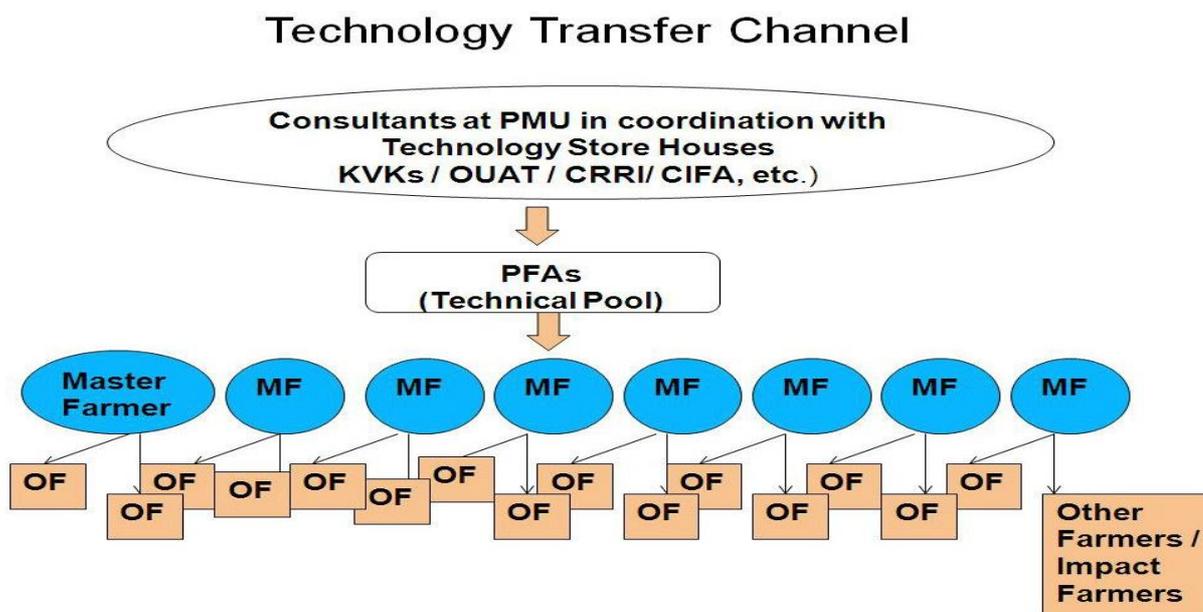
The strategies for reduction in cost of cultivation and increase in productivity have resulted in enhancing the farmer level income. In addition, the promotion of Fishery activity through technical training by the professionals ensured supplementary source of income for the households.

Strategy for Knowledge and information dissemination

With the crop specific and intervention specific Information, Education & Communication and audio-visual material in place, a cadre of trainers in the form of Technical Specialists and Programme Organisers was created to facilitate the last mile

linkage in knowledge dissemination. The project involved about 21000 farmers and involved crop demonstration in about 10500 acres in Kharif and 8000 acres in Rabi @ 0.5 acre per farmer.

The mode of Technology Transfer adopted under the project is given as below:



Strategy Adopted for timeliness of completion of field level operations

- ✓ Timely assessment of the input requirement and planning in advance for procurement
- ✓ Bulk purchase of quality inputs at low price through the Project Facilitating Agencies
- ✓ Widening and strengthening the existing input supply system of PACS
- ✓ Promoting Seed production activities & Seed processing units

Outcome of the Project

- ✓ Cumulative demonstration area of around 47500 acres in 6 consecutive crop seasons from Kharif 2012 to Rabi 2014-15.
- ✓ Covered about 10% of the farmers (21000) in the district under the project for undertaking crop demonstration

- ✓ Seed production in about 3915 acres with seed production at about 3500 quintals assuring SRR of 25% for the entire district
- ✓ Soil testing of about 6183 project farmers was done, covering demo fields of about 15000 farmers.
- ✓ During the project period 370 no of trainings were conducted for the capacity building of the project staff on standard farm practices.
- ✓ At the Project Facilitating Agencies level 756 trainings were organized mostly to train the farmers at village level. The trainings were organized at different stages as per the need. The Project Facilitating Agencies also successfully coordinated with the line department officials and KVKs to train the farmers.
- ✓ Promotion of more than 2000 JLGs, nearly 4000 SHGs, 600 Farmers Clubs and 7 FC federations as an effort towards financial inclusion
- ✓ Increased sale of farm implements

Impact of the Project

Increase in crop productivity

The average increase in crop productivity was in the range of 20-30% in all lead crops (despite cyclone “Phailine” and flash floods during October 2013) over the base yield rate in respect of the project farmers. In the case of paddy production, the average yield increased to 20.61 q/ per acre which indicated a growth of 29% over and above the base productivity level (16q / acre as reported by XIMB in pre-project survey) under the project.

Productivity per acre -Paddy(Q/ACRE)



- ✓ The near dominance of one high yielding variety (Swarna in paddy) has been broken and the farmers are now having access to a variety of improved seeds viz., Swarna Sub-1, Parikshya, Ranidhan, etc. which have shown resilience against the adverse climatic conditions
- ✓ The project farmers extended their technology adoption beyond the demo plots and covered their entire cultivation under advanced practices. In addition, there has been a substantial increase in the number of impact farmers adopting the improved package of practices. Besides, activities like seed production, farm mechanisation and fishery added to the credit demand in the district. This has resulted in cumulative average growth in credit offtake @ 25% for the agri sector over the project period, the details of which is given below

Credit	2011-12	2012-13	2013-14	2014-15	CAGR in %
Crop Loan	492.05	648.91	664.18	856.31	21.05
Term Loan	106.18	123.22	406.5	301.03	73.33
Total loan to Ag. Sector	598.23	772.13	1070.68	1157.34	25.28
Total Ground Level Credit	1147.4	1155.23	1499.173	1986.29	20.98

As against the above, during the project period, the total loan to agriculture sector in the State was increased @ 20.83% and that of total GLC increased @ 14.17%.

- ✓ The seed village programme under the project led to setting up of three new Seed Processing Plants in Balasore.
- ✓ Creation of impact farmers in the ratio of 1:4. Therefore, the impact of the project spread to cover about 50% of the farming population in the district.
- ✓ There has been a marked shift in the demand for farm mechanisation owing to the demand for timely completion of field activities. Due to concentration of a particular field operation in the crop season, the problems were compounded with shortage of farm labour in the short term. This has propelled the sale of farm equipments viz., transplanters, rotavators, harvester combine, threshers and power tillers, etc. At present more than 1141 FM hubs are in operation in the district.
- ✓ The project envisaged information dissemination in respect of inland fishery activity without any direct intervention for promotion of the activity. During the

project period, more than 50 fishery trainings were organised involving about 1500 fish farmers. About 250 new Fishery Projects sanctioned by banks.

Learnings

- *It is possible to improve productivity and income by application of available technology. But extension system needs total revamp.*
- *Farmers are more concerned about timely delivery of quality inputs than prices. They are willing to switch to improved varieties, if made available.*
- *The JLGs are a viable option for large scale coverage of small and marginal farmers*

Indian agriculture has an 'input intensive' cereal centric regime. There is need to switch forward to a 'input saving' pulses & oilseed centric regime with better water productivity (more crop per drop), favourable MSP, strengthened procurement system and remedial measure on market segmentation (national market) etc to boost farmer' income and security.

-India Economic Survey, 2015-16

Coastal Ecosystems of Odisha- Health and Nutritional Challenges Consequent to Climate Change

Dr. Jaya Krushna Panigrahi

Abstract

Odisha's coastal region is endowed with rich eco system, biodiversity, including agro biodiversity, perennial rivers, marine resources etc. The land, water & air of the region has been inflicted with environmental stress by recurring natural hazards, industrial activities, climate change impacts etc in recent years. These lead to casualties in crop growth & production with increased survival of plant pests, disease, weeds etc thus resulting in low crop yield. Odisha Climate Change Action Plan with conducive policy measures and farmers sensitization to protect plants methodologies are few of the potential mitigation & adaption measures to combat such ecological stress.

Introduction

The climatic variations occurring rapidly at the present juncture are considered one of the most threatening meteorological events emanating from diverse human activities, but not from process internal to the Earth. Burning of fossil fuels such as coal, petroleum and natural gas for electricity production, industries and other purposes has generated billions of tons of greenhouse gases (GHG) that has devastating consequences on the ecosystems and the living communities of the world. Naturally occurring greenhouse gases include carbon dioxide, methane, nitrous oxide (N₂O) and water vapour, while synthetic GHGs comprise chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆) and nitrogen trifluoride (NF₃). Enhanced emission of these GHGs has been the root cause of the recent spell of climatic disruptions as a consequence of global warming. The visible current changes in our climate have manifested mostly due to the consequence of diverse anthropogenic impacts in the form of various unsustainable developmental activities undertaken, more specifically in the post-industrial revolution period. Population explosion, energy-intensive lifestyles and overuse of resources in the recent times have culminated in several environmental perturbations, including climate change. Carbon dioxide, the most significant greenhouse gas in the atmosphere, has gone from a mere 285 ppm in late 18th century to 400 ppm in its concentration at this juncture of the 21st century. Consequently, the average global land and sea temperatures are on the rising. The impacts of climate change and climatic extreme events have a corollary of detrimental manifestations in diverse fields. The

Intergovernmental Panel on Climate Change (IPCC) in its assessment reports, the latest being the fifth report, has examined the potential climatic threats concentrating on the regions or ecosystems which are threatened, such as forests, agriculture and coastal regions.

Coastal Ecosystems

Coastal ecosystems constitute a transition zone between the land and the sea, and are among the most productive natural systems of the world. Coastal, marine and estuarine ecosystems are intimately linked to climatic and geological processes. However, these ecosystems are more fragile and vulnerable systems that would be severely affected by changes in climatic conditions. These sensitive ecosystems are particularly susceptible to many projected impacts, including erosion from intrusion of sea water, severity in frequency and intensity of storms/cyclones, and variation in precipitation patterns. Coastlines have been highly populated for availability of resources from both terrestrial and marine sources. Thus, climate change will exacerbate the problems already occurring in these vulnerable ecosystems due to increasing coastal populations, detrimental developmental activities, habitat modifications, nutrient pollutions and invasive species. Disruption to livelihood would cause food insecurity, especially to people living in rural agrarian society. Stress on livelihood as a consequence of this environmental change would enhance social and economic vulnerability.

In view of these happenings, there is a critical need to understand the processes by which climate change is stimulated, the implications of these processes for present day vulnerability to the changes and the adaptations desired for developing resilience and countering such environmental changes. Enhanced understanding in the fields would inform both the scientific community and policy makers of the underlying causes of vulnerability, and the potential policy for ameliorating such vulnerability.

Odisha's Coast

The state of Odisha, situated on the Bay of Bengal, is blessed with a long coastline of 482 km that bears great significance concerning the economic prosperity of the state. Through the coastal districts of Baleswar, Bhadrak, Kendrapada, Jagatsinghpur, Puri and Ganjam, all the principal rivers of the state viz. Surbarnarekha, Budhabalanga, Brahmani and Baitarani combining to form Dhamra, Mahanadi, Devi and Rushikulya flow to debouch into the bay. The three major ports of the state - Paradip, Gopalpur and Dhamra contribute considerably to the trade and commerce activities of the eastern India. Though the coastal

expanse of the state is not enriched with mining resources, unlike the central and western belts, intensive agriculture in the plains along with fishery and cattle farming remain the key source of the economy supplemented by industrial units in some pockets. The coastal region is rich in biodiversity, more importantly in the ecosystems of Bhitarkanika mangrove forests and Chilika Lagoon. This scenario has been very conducive for sustaining a dense population in the coastal region of Odisha.

However, the coastal Odisha has been witnessing extreme weather events in the recent decades that can be attributed to certain degree to the onset of human-induced climate change. This has a significant bearing on the growth and development of the state. The intensity of floods, cyclones, droughts, heat waves, low temperatures, etc has magnified greatly to take the shape of disasters. The super cyclone of 1999, the cyclones Phailin of 2013 and Hudhud of 2014, and the heat waves of 1998 are good evidences of such disasters that have led to heavy loss of life and property. Accelerated coastal erosion, as exemplified in Satavaya and Pentha in Kendrapada, Ersama in Jagatsinghpur, Puri and Chilika in Puri and Gopalpur in Ganjam districts, consequence to sea level rise and storm surges has put a grave challenge for the coastal communities, besides the changes in natural landscapes. The assessment made by the World Bank funded Integrated Coastal Zone Management Project (ICZMP) has identified 39.3 km (about 8.2 %) of the coastline as high erosion zone and 51.96 km (about 10.82 %) as medium erosion zone. Increased inundation sequel to seawater intrusion in some areas has been increasing the salinity of soil, groundwater and river systems that badly hits agriculture and biodiversity.

The coastal cities and human habitations supporting a large proportion of the population of the state will be affected more severely facing displacement and loss of property and livelihood if the scenario aggravates further in the future. In addition to heat-related illness and health problems associated with disasters, climate change may increase the spread of infectious diseases, mainly because warmer temperatures allow disease-carrying insects, animals and microbes to survive in areas where they were once thwarted by cold weather. Manifestations of the detrimental impacts of climate change in diverse spheres may not be stern at the present juncture, but the impacts will progressively intensify. Social and ecological vulnerability to disasters as outcomes of climate change can only be impeded to a larger extent if early mitigation and adaptation measures are undertaken in right earnest.

Impacts of Climate Change

The following is an account of the probable impacts of climate induced environmental changes on coastal/ oceanic ecosystems of the world basing on the happenings occurring across the globe. The impacts also hold good in the context of the coastal waters and ecosystems of Odisha state taking the physical, social, economic and environmental vulnerabilities into consideration.

- ❖ Oceans have been absorbing carbon dioxide from the atmosphere having increased concentrations of carbon from diverse man-made sources, significantly from burning of fossil fuels. As a result, the pH of the oceans' surface waters has decreased, a process called acidification. This has important implication for marine life, as the increased acidity interferes with shell formation for marine animals such as coral, plankton, and shellfish.
- ❖ Since warmer water (formed as a consequence of global warming) can hold less oxygen, the concentration of oxygen has been decreasing in many parts of the oceans. This has been most apparent along coastlines, where nutrient runoff into the ocean also contributes to lower oxygen levels. In the light of the vast amounts of new data published by the IPCC, it is very likely that the oceans are warming, the sea levels are rising; on the other hand, the salinity is increasing and the concentration of carbon dioxide is enhancing, causing acidification
- ❖ Between 1901 and 2010, the global mean sea level has risen by 19 cm (7.5 in). The rate of increase has accelerated in the past couple of decades. Many continental land masses have been experiencing some rebound (an upward vertical motion), but not enough to explain this sea level rise. Most of the observed rise is due to the warming, and therefore expansion of water.
- ❖ Models based on thermal expansion and ice melt estimate that global sea levels will rise approximately 20 to 39 inches by the end of the 21st century.
- ❖ Developmental activities undertaken in coastal regions reduce the ability of natural ecosystems to respond to climate changes.
- ❖ Extreme high sea events produce coastal flooding and are usually the result of the coinciding effects of a large storm and high tide. During these rare events, water levels have been recorded higher than during extreme events in the past, and this increase is mostly due to the rising mean sea levels.
- ❖ Temperature changes alter ecological processes and species interactions. Warming may lead to big changes in coastal ecosystems, affecting species that inhabit these

areas. Thus, biodiversity will experience increased stress leading to extinction of more species.

- ❖ Invasive species that had not been able to establish populations in colder environments may now be able to survive and start competing with native species.
- ❖ Increase in frequency of extreme ocean warming events resulting in acidification has implications for coral reef bleaching.
- ❖ Rising sea levels could also increase the salinity of ground water and push salt water further upstream. Increased salinity may make water undrinkable without desalination, and harm aquatic as well as terrestrial plants and animals that cannot tolerate higher salinity level
- ❖ Climate change would likely bring heavier rainfall and more precipitation to some coastal areas, which could lead to increased run-off and flooding. This would alter freshwater run-off of nutrients, sediments and contaminants to coastal waters.
- ❖ Sea level rise could erode and inundate coastal ecosystems and eliminate many tidal wetlands, which function as natural buffers to flooding. More rapid coastal erosion and loss of protective natural barriers, such as mangrove forests, also result.
- ❖ Storm surges, as an outcome of climate change, flood low-lying areas, damage property, disrupt transportation systems, destroy habitat, and threaten human health and safety.
- ❖ Drought risk as a consequence of irregular rainfall patterns may bring serious production shocks to agricultural farms in the absence of efficient irrigation systems. Lower yields and enhanced commodity prices would put further stress on people living in the lower strata of the society.
- ❖ Droughts and floods in general have impacts on agriculture, including loss of yield and employment resulting from inundation, salinization, and land loss. The coastal aquaculture also suffers resulting in loss of revenue and livelihood.
- ❖ Droughts reduce freshwater input into tidal rivers and bays, which raises salinity in estuaries, and enables salt water to mix farther upstream. Reduced dry-season freshwater supply from upstream sources may further exacerbate water scarcity in the coastal areas in addition to salinity problems.
- ❖ The occurrence of El Nino has increased in frequency and intensity in the scenario of climate change. This has enhanced the incidence of natural disasters such as droughts, floods, storms, cyclones, etc that adds to the misery of the coastal inhabitants.

- ❖ Alteration of oceanic wind and water circulation patterns occur.
- ❖ Continued loss of sea ice over large areas of the Arctic basin take place augmenting sea level rise.
- ❖ Occurrence of infectious diseases would increase due to increase in populations of disease-carrying vectors in warmer climates.
- ❖ There would be landward shifting of mangrove forests, but it would be inhibited by human development. Change in forest composition, shift in geographic range of forests and variation in forest health and productivity would also occur.
- ❖ Shift in ecological zones and loss of habitats and species would happen that would bring about changes in food chains.
- ❖ There is damaging impacts on coastal tourism and recreation, particularly due to the erosion of sandy beaches in some parts.

Farmers' Plight

Global warming and climatic variability are posing serious threats to the agriculture sector, disrupting the prospects of producing adequate food to meet the requirement of the mounting human population. It has been estimated that there may be about a 10% decline in yields of the major grain crops of the world- corn, soybean, rice and wheat, for every 1.8°F increase in global average surface temperature. Crop growth and food production will be casualties as higher temperature decreases rates of photosynthesis, reduce soil moisture, increase water demand and leads to increased survival of plant pests, diseases and weeds. All of these combine to reduce the final agricultural yields that on the other hand put food security in quandary and enhance farmers' predicament.

There are several ways how the threat to agricultural practices and food production may be adversely affected as a consequence of climate change. Among others, these include:

- ✓ Heavy rains and storms may flood fields, erode soils and wash away crops.
- ✓ More droughts may occur, causing large-scale crop loss.
- ✓ Frequent, severe and longer-lasting heat waves will increase killing crops.
- ✓ Plant pests and diseases will thrive destroying crops.
- ✓ Melting glaciers and changing river flows will reduce water availability for irrigation.

- ✓ Rising sea levels and storm surges will flood crops and salt soils.
- ✓ Higher ozone levels will damage plants and reduce crop yields.
- ✓ Animal production will be affected for the increasing price of feed grains.
- ✓ Animal diseases will rise in the scenario of temperature extremes, thus influencing production.
- ✓ Fisheries production will decline in the face of adverse climatic conditions.

Mitigation and Adaptation Measures

With more than half of the world population living near the coast, proper management of our coastal resources and ecosystems is a matter of great concern. For predicting the impacts of climatic variability and devising the mitigating and adaptation measures, the managers are required to be provided with the scientific knowledge and tools, including ecological models, with more certainty in scale, timing and local details. Research in main focus areas - agriculture, vegetation, fisheries, protected resources and sea level rise - with regard to ecological as well as economic implications needs to be strengthened. The Climate Change Action Plan 2010-15 formulated by the Government of Odisha is certainly a step forward in chalking out strategies, for both mitigation and adaptation, would certainly promote capacity building to reduce our vulnerability. But it needs effective early implementation and monitoring with the involvement of community-based and non-governmental organizations. Regenerating the mangrove forests along the whole coast of the state to lessen the severity of the sea-related disasters is just one of the most appropriate initiatives to be undertaken. Educating and engaging the stakeholders and their capacity building and translating the strategies into reality hold the key for success of the government initiatives. In the field of agriculture, the ability of the farmers for adapting to the adverse effects of climate change needs to be reinforced. Farmers are required to adopt the flood and drought resistant crop varieties developed through research to escape from crop loss.

Conclusion

Confronting the existing environmental challenges is already a concern for the mankind; addressing the additional stress of climate change may require new approaches and strategies for managing land, water, waste, and ecosystems more effectively for continuance of life on earth. Odisha has to reorient its policies and planning, more importantly in energy sector, so as to reduce its greenhouse gas emission and its

contribution to global warming. We need to develop resilient social and ecological systems incorporating diverse mechanisms on the basis of past experiences and future projections. Keeping in view that global sea level rise will accelerate in the 21st century, appropriate climate models fitting the local conditions need to be developed. Disaster management in climate change scenario requires scientific strategies and multilevel governance systems that can enhance our capacity to cope with uncertain conditions that may occur during disasters by mobilizing diverse sources of resilience. Coastal ecosystems, acting as repositories of biological diversity and providing a wide range of goods and services to the humanity, must be protected neutralizing the detrimental impacts of climate change for the benefit of the posterity. In addition to our obligation to the stipulations of the UN Framework Convention on Climate Change, the Government of Odisha needs to set the example for other states by addressing effectively the challenges of climate change, as it has displayed the path to others in devising the Climate Change Action Plan at the earliest in the whole nation.

Prime Minister Krishi Sanchai Yojana (PMKSY), with its precision irrigation like sprinkler, drips etc, aims to improve on farm water use efficiency, reduce labour cost & power consumption. Such micro irrigation have led to 35 to 40 percent savings of irrigation water in cultivation of groundnut & cotton in Gujurat, Karnatak & Andhra Pradesh.

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An Overview on Agriculture Budget of Odisha

*Sri Satyapriya Rath,
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Abstract

Agriculture predominates Odisha's economy even after its depleted share to GSDP. The high dependency and inclusiveness on agriculture by rural mass guided Odisha State government to place exclusive agriculture budget since 2013-14. The budget addresses the challenges of remunerative output, poverty & malnutrition reduction and inclusiveness more effectively. With Rs 13181.89 crore budgetary outlay for agriculture and allied sectors during 2016-17 (134. 23% rise over 2012-13), the budget include implementation of about 47 schemes on management of production , inputs, subsidies, marketing, credit, infrastructure, technology development etc in crop horticulture, fisheries, animal husbandry, irrigation, co-operative credit sectors.

Introduction

Agriculture is the back-bone of rural economy and livelihood of Odisha. It provides employment both directly and indirectly to about 64% of the total workforce. It is the largest private enterprise of the State as almost 2/3rd of the population of the State are dependent upon agriculture. So the development of the State is mainly dependent upon the growth in Agriculture Sector.

The farm sector in Odisha faces several challenges like low investment, low productivity, fluctuating growth, recurrence of natural calamities like drought, flood, cyclone, lack of adequate inputs like quality seeds, fertilizer, irrigation, availability of credit at affordable rates, effective insurance cover against crop loss and access to new technology for productivity gain, post-harvest needs like warehousing, storage and marketing facilities.

Odisha's economy has been dominated by agriculture and allied sub-sectors that contributed to more than 70 percent of the Gross State Domestic Product (GSDP) in the 1950s. The contribution of Agriculture & allied sector to the GSDP has declined to about 18% in 2015-16 due to relatively higher growth in non-agriculture sector. With decrease in contribution of agriculture to the GSDP, the relative income of farmers is going down vis-à-vis other Sectors. Per-capita Agricultural GSDP stands at about one-third of per-capita GSDP. Besides, the average size of holdings is declining gradually. This has adversely affected the financial condition of the farmers. Application of agricultural technology

through the use of high yielding varieties, economy in input use, the availability of quality seeds and modern farming techniques with an effective marketing link would go a long way in improving farm productivity.

Apart from this, the challenge is to meet the strong demand for food-grains as well as fruits, vegetables, milk, eggs, meat and fish which also form a substantial part of the food consumption basket and above all ensure long term food security. To achieve the goal, there is need for increasing farm productivity and investment in infrastructure through superior water management, soil nutrient management, quality seeds, pesticides management, development of dairy farming, livestock rearing and fisheries.

Agriculture is a State subject, and the role of State Government in the development of agriculture sector is very important. It is, therefore, necessary to focus attention on development of agriculture and welfare of farmers by making agriculture more remunerative.

Recognizing the challenges facing the Agricultural Sector and the fact that higher priority to agriculture will help achieve the goals of faster reduction of poverty as well as malnutrition and make the growth process more inclusive, separate Agriculture Budget for the growth of agriculture and its allied activities like Horticulture, Fisheries, Animal Husbandry, Irrigation, Co-operative Credit etc. is in force since 2013-14. Odisha is among the few States in the country to present a separate Agriculture Budget. The budgetary allocation was also enhanced from Rs.5627.87 Crore in 2012-13 to Rs.7161.84 Crore in 2013-14, the increase being 27.25% over 2012-13.

Budgetary outlay for Agriculture Sector

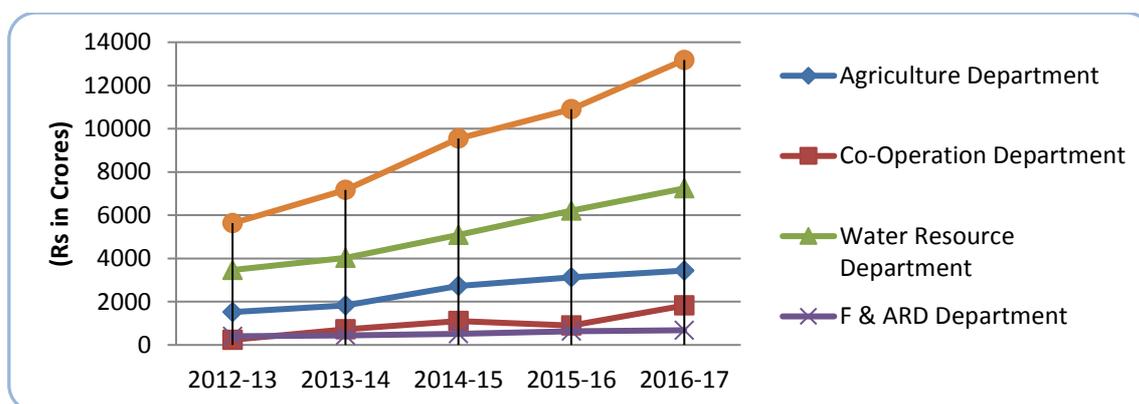
The budgetary outlay for Agriculture & its allied activities for the period from 2012-13 to 2016-17 is depicted in the following table:

Agriculture Sector	Budgetary outlay (in crore)				
	2012-13	2013-14	2014-15	2015-16	2016-17
Agriculture Department	1519.31	1823.77	2727.99	3124.38	3438.91
Co-Operation Department	239.88	716.44	1106.46	892.27	1821.73
Water Resource Department	3466.43	4024.54	5087.68	6212.15	7241.65
F & ARD Department	402.25	447.09	520.09	624.80	679.60
Energy Department (Agriculture Purpose)		150.00	100.00	50.00	
Total Agriculture Sector	5627.87	7161.84	9542.22	10903.60	13181.89

The above figure clearly shows that the Government have given due importance to the Agriculture Sector by enhancing the budgetary outlay from Rs.5627.87 crores in 2012-13 to Rs.13181.89 crores in 2016-17, the substantial increase being 134.23% in these 4 years. Emphasis given in different Agriculture Budgets is for redesigning the strategy for agriculture to reduce drought vulnerability and increase farm income through higher investment in irrigation, access to institutional credit, provision of quality inputs like seeds, fertilisers and pesticides.

The following graph shows the yearly growth trend of the constituents of Agriculture Sector. It is seen that more emphasis has been attributed to the allocation of Water Resource Department for restoration & creation of irrigated land.

Figure 1 : Annual growth of Agriculture Sector



Implementation of Schemes

The budgetary allocation for some of the important schemes provided during 2013-14 to 2015-16 for implementation under Agriculture Sector are as follows:

Sl	Item	Amount
1.	Intensive extension campaign on Agriculture:	₹7.00 Cr.
2.	Organic Farming :	₹5.50 Cr.
3.	Establishment of Agro Polytechnics :	₹9.27 Cr.
4.	Rashtriya Krishi Vikas Yojana :	₹1624.54Cr.
5.	Jalanidhi and Sustainable harnessing of ground water in water deficit areas:	₹1130.00 Cr.
6.	Input Subsidy :	₹102.91 Cr.
7.	Popularisation of Agriculture Implements :	₹490.00 Cr.
8.	Micro Irrigation :	₹49.71 Cr.
9.	National Horticulture Mission :	₹171.77 Cr.

10.	Subsidy under Agriculture Policy :	₹50.00 Cr.
11.	Interest Subvention on Short Term Crop Loan :	₹ 732.38 Cr.
12.	Infrastructure Development under RIDF :	₹342.44 Cr
13.	Development of Infrastructure in Regulated Market Committee Market Yards :	₹298.00 Cr.
14.	Computerisation of Odisha State Co-op. Bank, District Central Co-op. Banks and Urban Co-op. Banks and Primary Agricultural Co-op. Societies :	₹97.92 Cr.
15.	Establishment of Agro Service Centres and Soil Testing Laboratories in primary Agricultural Co-op. Societies :	₹24.78 Cr.
16.	Assistance to Co-operative Sugar Mills	₹ 15.00 Cr.
17.	Establishment of Market Yards at Block Level :₹	₹ 30.00 Cr.
18.	Interest Subsidy/Subvention :₹	₹ 215.90 Cr.
19.	Indemnity for Crop Insurance :	₹350.00 Cr.
20.	Interest subsidy on Short term credit to Fish Farmers:	₹15.00 Cr.
21.	Interest subsidy on Long term credit to Fish Farmers:	₹12.49Cr.
22.	Promotion of intensive aqua culture and fresh water fish seed hatchery :	₹25.00 Cr.
23.	Interest Subvention on short term/ long term loan to Dairy Farmers:	₹ 27.61 Cr.
24.	Major and Medium Irrigation Projects:	₹5926.27 Cr.
25.	Flood Control and Drainage :	₹929.65 Cr.
26.	Minor Irrigation Works:	₹3051.23 Cr.
27.	Command Area Development:	₹627.12 Cr.
28.	Dedicated Agriculture Feeder	150.00 Cr.
29.	Health Insurance for Farmers under Biju Krushak Kalyan Yojana:	₹100.00 Cr.
30.	Development of Potato and Spices :	₹ 60.00 crore
31.	Biju Krushak Kalyan Yojana (BKKY) :	₹180.00 crore
32.	Corpus Fund for Fertilizers :₹	₹ 100.00 crore
33.	Corpus Fund for Seeds :₹	₹ 125.00 crore
34.	Matshyajibi BasagruhaYojana :	₹8.00 crore
35.	Revival of Defunct Lift Irrigation Projects	₹ 55.00 crore
36.	Irrigation Road Construction and Improvement Scheme :	₹119.00 crore
37.	Water Sector Infrastructure Development Programme :	₹40.39 crore
38.	Assured Power Supply for Mega Lift Projects :	₹84.00 crore
39.	Odisha Dedicated Agriculture and Fishery Feeder (ODAFFP) :	₹100.00 Cr.
40.	Deep Bore Well - <i>Secha Karyakram</i> :	₹520.00 Cr.
41.	Soil and water conservation works :	₹258.17 cr.
42.	Infrastructure Development for Livestock Services and Infrastructure Development under RIDF :	₹145.36 cr.
43.	Corpus fund for procurement operation by MARKFED :	₹100.00 cr
44.	Water Sector Infrastructure Development Programme :	₹100.00 cr
45.	Mega lift irrigation projects :	₹673.00 cr
46.	Rooftop Rainwater harvesting & Ground water recharge in urban areas :	₹7.00 cr
47.	Canal lining & System Rehabilitation programme (CLSRP) :	₹100.00 cr

Conclusion

This Agriculture Budget is prepared separately since 2013-14 for the Departments dealing with irrigation, agriculture, co-operation, fisheries and animal resources development. The Government have planned for providing irrigation to additional 10 lakh hectares of cultivable land over a period of five years during 2014-2019. So far, additional two lakh hectares have come under irrigation. Due to the hard labour of farmers, the state has bagged the „*Krishi Karman Award*“for the fourth time in last five years. The Government has taken a number of measures to mitigate the difficulties of the farming community through compensation and relief, provision of inputs, protective irrigation and a number of other supportive policy and programme interventions. The redesigned strategy of agriculture is basically meant to reduce drought vulnerability and increase farm income through higher investment in irrigation, access to institutional credit, provision of quality inputs like seeds, fertilisers and pesticides. Simultaneously, steps are being taken for crop diversification from cereals to pulses and millets, revitalising the extension system for transfer of advanced technology, strengthening of market linkages through financing, storage and transportation, risk mitigation and value addition.

Food inflation was moderately contained during 2014-15 inspite of the vulnerability of national crop sector growth rate. The WPI, CPI(combined) and CPI(IW) for food items declined significantly to 6.1,6.5 and 6.5 respectively during 2014-15 as compared to 12.8,11.2 and 12.14 in 2013-14.

-India Economic Survey, 2015-16

Agriculture & Farmer's Welfare

Sri Sarat Ch. Dash

Abstract

Agriculture no more remains predominantly agrarian in Odisha. Recurring natural shocks; increasing marginalization of cultivators, agriculture labourers; distorted trend of inputs; operational holdings sizes; institutional credit; cropping intensity; lagged behind irrigation etc keep the crop sector almost in stagnancy. Intensive skilling of farmers, cold storage facilities, incentives, water & land efficiency use, improved soil testing facilities, promotion of cash crops and horticulture etc need to be addressed with priority to improve crop production & productivity in the State.

Scenario

Agriculture in the State is yet dependent on monsoon as irrigation to the crops is still lagging behind. The rainfall widely varies from the normal rainfall of 1451.2 mm in different years. The recurrent natural calamities like cyclone, flood and drought in different parts of the State every year have become common phenomena. This affects the life of the people due to substantial crop loss and also loss of lives (both human and animals), plants etc. Further many people are rendered homeless.

In recent years human activities all over the world have adverse impact on the climatic change in different countries and India is no exception to this.

There has been pronounced, shift from agricultural activities to non-agricultural activities over years in the State. Moreover the agricultural activities being very arduous in nature round the crop seasons, the rural youth are gradually getting distracted. Hence contribution of crops as an economic activity in the state share has come down to 9.56 percent in the year 2015-16 from about 50 percent in the early seventies.

In this back drop we propose to discuss some of the characteristics vital to agricultural development.

Present Status

Cultivators and agricultural labourers in Odisha:

Cultivators and agricultural labourers are the key persons in growing the food and non-food crops in the field. Thus they may be termed as 'Anna datta'. The agricultural development is highly correlated with their efficiency, skill and zeal.

The following table presents the number of cultivators and agricultural labourers in Odisha in the four census years, i.e. from 1981 to 2011

Table 1 : Cultivators and agricultural labours in Odisha

(Fig in '000')

Category of Workers	1981 census		1991 census		2001 census		2011 census	
	No	%	No	%	No	%	No	%
1. Cultivators	4053	40.4	4599	38.7	3435	24.1	4104 3375 (m) 729(f)	23.4
2. Agricultural Labourers	2397	23.9	2977	25.1	2098	14.7	6740 3482 (m) 3258 (f)	38.4
A. Total main workers	8635	86.1	10378	87.3	9589	67.2	10708	61
B. Total marginal workers	1387	13.9	1505	12.7	4687	32.8	6834	39
Total workers (A+B)	10022	100	11883	100	14276	100	17542	100

Source :Odisha Economic Survey, Annex 2.13A 2015-16))

We may observe from the table that there were 41.04 lakh cultivators (male-33.75 lakh + female 7.2 lakh) in the state during the year 2011. The 2001 census registered abnormal fall of both cultivators and agricultural labourers with respect to 1991 by around 12 lakh and 9 lakh respectively. Surprisingly the number of Agricultural labourers has sprang up from 20.98 lakh in 2001 to 67.40 lakh in the year 2011. Agriculture and rural household industry are the two activities in which there is significant female participation in rural areas. It appears because of the compelling circumstances the female participation has gone up in the year. Agriculture is highly labour intensive and we may see that more than one crore persons (62 percent of the total workers) comprising cultivators and agricultural labourers are working in the field of agriculture.

Number of operational holdings by size-class

Operational holding may be considered as “all land wholly or partly put to agricultural production without regard to the title, legal form, size or location. It is a technical unit of cultivation.” we propose to present the size-classwise number of operational holdings in the years from 1980-81 to 2010-11 at decennial intervals in the table 2 below.

Table 2 : Number of Holdings by Size Class in different agricultural census years in Odisha.

(No. in '000')

Agricultural Census year	Marginal (below 1.0 ha)	Small (1.0-2.0 ha)	Semi-medium (2.0 - 4.0 ha)	Medium (4.0 - 10.0 ha)	Large (10.0 ha) and above	Total All sizes
1980-81	1560	891	610	239	28	3328
1990-91	2118	1035	594	186	15	3948
2000-01	2295	1114	501	145	13	4068
2010-11	3368	919	311	64	6	4668

Source :State Agricultural Census Reports, DES

The table no. 2 gives us an impression about the size of the different cultivating units growing crops in the State. We may observe that the marginal holdings (below 1.0 ha) are multiplying over the years from 1980-91 to 2010-11. Marginal holding in 2010-11 constitute 72.17% of the total holdings. This is due to fragmentation of land for partition, sale etc. small holdings (1.0-2.0 ha) are some-what stable at around 27 percent of the total but showing a decline to about 20 percent in 2010-11. Other holdings of greater size are conspicuously declining over years.

Cropping Intensity

We propose to present here in table No.3 the net area sown (NAS) and gross cropped area (GCA) under irrigated and unirrigated conditions in the State during the year, 2013-14.

Table 3 : State level estimates of cropping intensity during the agricultural year,2013-14

(Ares in '000'ha)

Type Area	Irrigated and unirrigated area (total)	Irrigated area	Unirrigated area
Gross cropped area	5168(100.0)	1505(29.1)	3663(70.9)
Net Ares sown	4495(100)	1245(27.7)	3250(72.3)
Cropping Intensity	115.0	120.9	112.7

(Figures in the parentheses indicate percentages to respective totals)

Source : Technical Report on EARAS, 2012-13 and 2013-14, DES

The table reveals that 27.7 percent of the net area sown was irrigated during 2013-14. Similarly 29.1 percent of the gross cropped area (GCA) was irrigated during the same year. The cropping intensity under irrigated condition thus works out to 120.88. In the year net unirrigated area and gross unirrigated area have been estimated at 72.3 percent and 70.9 percent to respective totals. The cropping intensity works out to 112.70 under unirrigated conditions.

Further Odisha Economic survey, 2015-16 (annex 3.14)reveals that percentage share of irrigated area under principal crops (provisional) in the State during the year , 2011-12 is 29 percentage as against 47 percent for All India. Further a cursory glance at the state wise picture for the year presents that Punjab (93%) tops the list followed by Haryana (87.5%) Uttar Pradesh (76.7%), Bihar (67.4%) and other. Odisha and chhatisgarh have the same status of about 29% . Assam ranks the lowest (3.9%). Maharashtra (18.7%), Himachal Pradesh (19.7%)and Kerala (20.5%) and others are above Assam in order.

Institutional finance

The following table gives the estimated number of holdings taken institutional credit for agricultural purposes during the year 2006-07.

Table 4: Estimated number of operational holdings taken institutional credit for agricultural purpose

(No. in'000)			
Size Class	Total no. of Operational Holdings (O.H)	No. of OHs availing institutional credit	Percentage of OHs availing institutional credit
(1)	(2)	(3)	(4)
Marginal (Below 1.0 ha)	3368	2207	65.5
Small (1.0-2.0 ha)	919	533	58.0
Semi- medium (2.0 - 4.0 ha)	311	192	61.7
Medium (4.0 - 10 ha)	63	42	66.7
Large (10.0 ha and above)	5	3	60.0
All Sizes (Total)	4666	2977	63.8

(Institutional holdings were not covered during the Input Survey, 2011-12 only individual and joint holding were covered)

Source : Input Survey, 2011-12, DE&S

The figures in the above table sheds light on the trend of availing loans by the size class wise holdings. It appears that percentage of operational holdings availing institutional credit is almost equal for all size classes. We may see that above 66 percent of marginal holdings availed loan during the year. At the State level the holdings availing agricultural loans have been estimated at 63.8%.

Land use :

A time series of certain characteristic of land use for the years from 2004-05 to 2013-14 are presented in the table No.5 below.

Table 5 : State level Estimates of certain characteristics of land use

(Area in '000ha)

Years	Total area under survey	Certain categories of land use				
		Net area sown	Current fallow	Old fallow	Culturable waste	
1	2004-05	11508	4847	864	536	471
2	2005-06	11526	4852	881	536	492
3	2006-07	11573	4823	856	567	475
4	2007-08	11568	4796	845	566	479
5	2008-09	11567	4725	827	587	511
6	2009-10	11566	4761	859	573	487
7	2010-11	11569	4682	877	567	520
8	2011-12	11579	4394	997	622	536
9	2012-13	11578	4386	949	659	551
10	2013-14	11569	4495	877	634	575

Source : Technical Report on EARAS, 2012-13 & 2013-14 DES

We may observe that the Net Area sown in the state shows a declining trend over the above years except for the years 2005-06, 2009-10 & 2013-14 where it shows a marginal increase. Current fallow land fluctuated between 8.3 lakh to 10.0 lakh hectares. Interestingly it showed an increasing trend from 2009-10 to 2011-12 and then it has started falling. However there has been fall of 72 thousand hectares from 2012-13 to 2013-14. Old fallow land shows almost an increasing trend over the years from 5.36 lakh to 6.59 lakh hectares and only declined about 25 thousand hectares from 2012-13 to 2013-The culturable waste land show a slow increasing trend over the above years from 4.71 lakh to 5.75 lakh ha with marginal fluctuations.

Consumption of Fertilizer

The following table depicts that time series of total consumption and per hectare consumption of fertilizer in the State from the years 2004-05 to 2014-15.

Table 6 : Fertilizer consumption in Odisha

	Years	Total consumption in TMT	Consumption in Kg/ha
1	2004-05	355.30	43.00
2	2005-06	394.89	46.00
3	2006-07	402.88	47.00
4	2007-08	451.90	52.00
5	2008-09	534.87	62.00
6	2009-10	519.34	59.78
7	2010-11	537.85	62.85
8	2011-12	514.68	62.25
9	2012-13	490.20	58.74
10	2013-14	487.14	57.11
15	2014-15	499.53	58.91

Source : Odisha Economic Survey, 2015-16 Annexure-3.15 and 3.16

We may discern from the above table that both the total and per hectare consumption of fertilizer over the years in the state show an increasing trend with marginal fluctuations. The total consumption of fertilizer during 2014-15 is about 500.0 Tmts whereas the per hectare consumption is 58.91 Kg.

We present below the fertilizer consumption (Kg/ha) in major states of India along with Odisha during the year 2013-14 for a general impression about the performance of different states in this aspect.

Table 7 : Fertilizer consumption(kg/ha) in major states of India in 2013-14

	State	Fertilizer consumption (Kg/ha)		State	Fertilizer consumption (Kg/ha)
1	Andhra Pradesh	226.72	9	Maharashtra	127.07
2	Assam	65.41	10	Odisha	57.11
3	Bihar	164.87	11	Punjab	216.73
4	Gujarat	119.52	12	Tamilnadu	153.76
5	Haryana	179.48	13	Uttar Pradesh	148.86
6	Karnataka	136.06	14	West Bengal	131.17
7	Kerala	121.03	15	Rajasthan	49.69
8	Madhya Pradesh	84.43	16	All India	125.39

Source : Odisha Economic Survey, 2015-16 (Annexure 3.15, 3.16 and 3.17)

We may notice that the level of consumption of fertilizer in our State in relation to most of the major states is very low (57.11 kg/ha). Only one state, i.e. Rajasthan is the lowest (49.69 kg/ha) and below Odisha. All other major states are above our State so far as per hectare consumption of fertilizer is concerned. Andhra Pradesh (226.72 Kg/ha) tops the list followed by Punjab, Haryana, Bihar and others. We are also far behind the per hectare consumption of fertilizer (125.39 Kg/ha) for All-India.

Even though the state level performance is bleak, some of the districts have performed very well in per ha consumption of fertilizer in the year 2014-15. Balasore (140.20 kg/ha) tops the list followed by Nabrangpur (137.83) ,Bargarh, Bhadrak and others. Perperformance of Kandhamal is the lowest (8.42 kg/ ha) in this regards. Angul (27.67 kg/ha) and Malkangiri (29.52) are above Kandhamal in order during the said year.

Suggestions

- ✓ We have seen that large number of rural people are working in the field of agriculture either as cultivators or as agricultural labourers. Most of the cultivators are marginal (below 1.0ha land) and may not be getting good returns from the field to sustain themselves. Marginal and small holdings (1.0 - 2.0 ha) are vulnerable groups and need attention. Whether big or small, farmers are key to the agricultural development. All of them need to be properly trained in the different activities of agriculture and use of improved agricultural implements by the technical personnel of Agricultural Department. The field operations are in the process of mechanization and this may go a long way in attracting the rural youth to the field of agriculture.
- ✓ The farmers may be advised for testing of soil, wherever necessary, for higher productivity of crops they raise. They should be trained to use quality seeds according to the soil. The primary agricultural worker may be readily available to advise the farmers at the time of need by visiting the site. The Primary agricultural worker may have demonstration plots on different crops in each village or a couple of villages together at government cost to disseminate the knowledge to the farmers. The farmers may have easy access to the timely availability of quality seeds, fertilizers, pesticides and institutional finance in the village itself or in the vicinity.
- ✓ Above all, availability of irrigation facility to the field is vital. We have mentioned earlier that Odisha is lagging behind in respect of irrigation to the crops and application of fertilizer. Every year volumes of rain water are flowing through the rivers to the sea. This is being discussed at different levels. However positive steps have to be taken to harness such large quantity of water to meet the growing needs

of agriculture and industry. It is being discussed that in about 10-20 years there may be scarcity of water. As such conservation of water has become most essential for mankind, animals and plant kingdom. Moreover it is reported that ground water level is receding for which adequate care has to be taken. Tree plantations may be taken up on a priority basis on fallow and other lands.

- ✓ However all attempts have to be made to increase the level of irrigation to the crops to get higher yield for feeding the growing millions. Similarly per hectare consumption of fertilizer has to be stepped up for higher productivity.
- ✓ Current fallow and culturable waste lands are of significant size in the State, which may be put to crops.
- ✓ All this narrated above may help welfare of the farmers and for ameliorating rural poverty to a great extent. Even today both rural and urban poor (mostly rural) are not fully fed and clad. Hence higher level production of food grains is a must for us.
- ✓ Another most important item is the marketing of the produce of the farmers. Odisha, essentially being a paddy growing area, Government fixes support price for paddy every year and procure their requirement from the farmers.
- ✓ There are certain perishable agricultural commodities such as potato and onion and certain fruits which need to be stored in cold storages. Lack of cold storage facility affects the cultivation of potato and onion. These two items are required for consumption round the year in each household and very essential for the poor. As the production of the above two items in the State is much below the requirement, these are brought from other states and we face problems at times for this. In order that the State may be self-sufficient, adequate care has to be taken by extension measures for growing crops in larger area and simultaneously making available the cold storage godowns for preservation and sale over the year.
- ✓ In the absence of the storage facilities and absence of government agencies the farmers are faced to sell their products at low price to the traders, who always exploit them. This is distressed sale and major profit goes to the traders.
- ✓ We cite a small example of lichi fruit, a cash crop, grown in certain blocks, i.e. Kuchinda, Jujumura, Rengali and Maneswar of Sambalpur district, certain pockets of Deogarh and Angul districts as came out in a newspaper. This is a perishable commodity and the sale value is quite high. As there is no proper control of government, the growers, usually poor, are being exploited by the traders, who are always present. Further as reported no training and promotional measures have been taken for the farmers. As such they are not able to control the pest attack to the

crop. As per the report about 1700 MTS of lichi are produced in a year but there is no storage facility available. So they are forced for distressed sale to the traders.

- ✓ Agriculture and horticulture in its present status need a big push upwards through (say) another green revolution starting from the village level with both government and people's participation to become at par with advanced major states like Haryana, Punjab, Andhra Pradesh and others. If the farmers of our State get good returns and in the absence of distressed sale, there is no reason why they will not be able to repay the loans and attempt to commit suicide.
- ✓ We wish for a booming future in the offing in so far as agricultural and horticultural production is concerned when no one may die for starvation in our State.

India succeeded in combating transient food insecurity caused by droughts or floods, But it failed to make much dent in chronic food insecurity as reflected in the low energy intake and high incidences of malnutrition

R. Radhakrishna & K.Venkatreddy on "Food security & nutrition: Vision 2020"

Agriculture & Farmers' Welfare : An Analysis

Sri Ramesh Chandra Panda

Abstract

The paper makes a subjective evaluation of traditional verses modern approach to agriculture sector. The challenges of land use, traditional production process, input costs, natural vulnerability, irrigation, marketing ,remunerative occupation, etc that grip agriculture in term of farmer suicides, issues of crop insurances, promotion of cash crops in the State have been elaborately discussed in the paper.

“Go to villages, there in lives the soul of India“said Mahatma Gandhi during the freedom struggle. Agriculture is the main occupation in India. Two-third of population is dependent on agriculture directly or indirectly. It is not only merely a source of livelihood but a way of life also the main source of food, fodder and fuel and is the basic foundation of economic development. Agriculture is the culture and way of life of rural India. Literally speaking agriculture means the production of crops and live stock on a farm. Generally speaking, agriculture is cultivation of crops. In Economics, agriculture means cultivation of crops along with animal husbandry, poultry, dairy farming, fishing and even forestry.

Agriculture is the back bone of our economy. Agriculture is important not only from economic point of view but also has deep rooted influence on our social, political and cultural life. Agriculture in India is not only a source of livelihood but has become a way life. Our fairs, festivals and customs are influenced by agriculture. In the words of Jawaharlal Nehru, “Agriculture needed top most priority because the Government and the Nation would both fail to succeed if agriculture could not be successful”. The agriculture sector whose contribution to the National GDP was 56.10 % during 1950-51 has been reduced to 17.4 % in 2013-14. But sadly it employs about half of the labour force available in the country. In rich countries the agriculture is quite developed but contribution to GDP is very little as such USA agriculture contributes only 2%.

Since independence a number of changes have been taken place in the field of agriculture. The first phase of development includes abolition of intermediaries, land reformations, additional investment in agriculture, irrigation and co-operation. These development activities have changed the rural scene and diverted the people living in villages to other occupations and reduced the pressure of population on agriculture. Introduction of micro level planning takes care of all aspects of agriculture. Agriculture provides food for Nation. Before 1947, we had acute food shortage but after 1969 Green Revolution in agriculture has made us self sufficient in food production.

M S Swaminathan the father of second green revolution recommended for welfare of farmers which to be implemented for the greater interest of the Nation. One tenth of food grain lost before and post harvest period as such sufficient number of godowns to be constructed for right preservation of food grains. And procurement policy should be farmer friendly and PDS system of the country should be on the equitable distribution for the needy. Minimum Support Price (MSP) to the farmers to be hiked as per the recommendation of National Commission on farmers headed by MS Swamynathan. Dr. Kuriyan of Anand started white revolution in India and Amul became a worldwide icon by which milk growers of rural India got employment and cater the needs of public on milk and milk product. In spite of major reforms to agriculture, it still lags behind. For instance US has 174.45 million hectares of agricultural land while India has 159.65 million hectares but food production of US is only 6624.4 kg per hectare but it is only 2647.2 kg per hectare in India, which is one third of the former. Lack of latest technology and loss in traditional method of farming makes agriculture an unattractive sector. Sufficient production of food grains will bring stability in prices of food grains. This brings stability in cost of living and wages also. Agriculture influences the price level. So increased production of agriculture keeps the price stable.

The youth are reluctant to adopt agriculture as a profession due to low status of farmer in society and have no role in decision making or planning for agriculture. Truly speaking agriculture is backed by most of persons those who could not opt other profession they are adult persons, illiterate persons, unskilled women and poor persons as this profession needs manual labour under the open sky and is strenuous and hard working so this sector is unattractive to the youth because of less output in terms of money. According to an NSS study 40 % of farmers in India want to give up agriculture if other opportunities are offered. Incentives to be provided to educated youths to attract to this sector and orientation programme to be organised in rural areas or say in each panchayat level to meet the local need of the farmers.

In most cases ownership of land lays with Zamindars of village and they let the land to the poor persons those actually cultivate the land and they have to pay rent to the Zamindars and their profit is very marginal; and in case of crop loss due to natural calamity compensation made by Government or other agencies goes to the account of land owner but not to the tenant as such necessary law to be implemented so as to compensate these marginal agricultural tenant' is the major issue that the country needs.

Some time Government and public faces unpleasant situation at the time of land acquisition .Compensation of land acquired for metro project highest ever in country. At a time when farmers across the country are struggling to save their lands against acquisition

at low rates. Delhi Government has shown the way by ensuring the highest ever compensation of Rs3.07 crore per acre to farmers whose land was acquired by the Delhi metro. This is the highest ever compensation for farmers losing crop due to inclement weather. Similarly agricultural land are acquired for setting of industries in these case employment should be guaranteed to the family members of farmers those who lost their land.

Irrigation is the life of agriculture. Crop production is heavily affected by change in climate and rainfall. Agriculture accounts for 80 % of all water consumption. Free canal water and electricity for pump sets can solve the problem. The flood water can be channelized through inter-connecting of big rivers. As India stand at a second consecutive drought, the prices of essential commodities sky rockets. Due to crop loss the rate of farmer suicide has increased. Maharastra continues to be the dark spot. Two droughts in a row have caused immense distress in area like Marthwada. The rise in the price of the arhar and urad dal is the consequence of continuous drought at Marthwada, the centre of dal production. A documentary film named 'Marthwada' has been released showing the distressed condition of the farmers. Chhattisgarh government prepared a long term strategy to deal with the drought situation in which Rs.502 crore has been sent to tackle the drought situation from the NDRF. In world scenario, Thailand is the worst sufferer of drought with the lowest level of rainfall more than two decades yet it celebrates annual weeklong traditional new year festival to know that biggest water fight in the world is still on for the sake of tourism but not for agricultural input.

Table 1: Number of farmers and farm labourers' suicide in different state

State/ year	2014	2015
Maharastra	1207	1841
Telengana	503	342
Karnataka	156	107
Madhya pradesh	120	-
Andhra pradesh	78	-
Punjab	3	495
Total no of suicides in India	2115	2997

Source- Union Ministry of Agriculture and Farmers Welfare.

Genetically Modified (GM) crops have to be popularised. This will raise yield by 20-30% and improve farm income and ultimately reduce India's dependence on imported edible oil and pulses and also will expand export of cotton. Adoption of GM cotton revolutionised cotton cultivation and doubled our output thus converting India from importer to a major exporter of cotton. Like all crops GM cotton needs consistent improvement. The economic conditions of sugarcane and cotton farmers are well in comparison to other farmers in India.

Agriculture in Odisha

Even though agriculture continues to be the prime occupation of over 60 % people of the state, the share of agriculture sector to the GSDP is declining fast. The report submitted by the state government to the NITI Aayog said per capita availability of land, water and other resources in the State continue to decline. The State has cultivable area of 61.80 lakh hectares.

The sharp decline in agriculture production was despite launching of a number of social security schemes and provided for a separate agriculture budget by the state government since 2013-14. Despite the importance on farm mechanization for quality agricultural operations and reduction in cost of production, it is yet to be implemented properly. Paddy remains the highest cultivated crop while cultivation of cash crops like oilseed, pulses, sugarcane, vegetable and fibre is not encouraging.

Even though the agro-climatic conditions are immensely suitable for cultivation of fruits like mango, lichee, guava and orange, the present gross cropped area under horticulture is 13.61 lakh hectares which is about 20% of net shown area. The state government aims to increase it to 20 lakh hectares. Although the irrigation potential has been increased by 13.25 lakh hectares from 36.06 lakh hectares in 2000-01 to 49.31 lakh hectares in 2013-14, it still lags behind the National average of 44.9%.

Pradhan Mantry Fasal Bima Yojana(PMFBY)

The state government announced Pradhan Mantry Fasal Bima Yojana (PMFBY) in the state for kharif 2016. It would replace the National Agricultural Insurance Scheme. Under the plan launched by the Hon'ble Prime Minister Sri Narendra Modi on January 13 the premium rate for kharif crop will be 2% of the actual sum assured amount. For

commercial and horticulture crops, farmers would have to pay a premium of 5% of the actual sum assured rate amount.

Initially the state government aims to bring crops like paddy and cotton under the preview of PMFBY. Beside post harvest loss, the insurance policy would cover other multiple localised risks at different times.

Agriculture Insurance Company of India Limited (AIC) is the apex body of India which deals with insurance coverage to the selected crops and registered farmers through commercial banks and local cooperative banks. Mainly it receives premium from the farmers and it covers insurance to scheduled crops in case of loss due to drought, flood, pest and animal.

Table 2 : Audited annual accounts for the year ended 31st March 2016 of AIC

(Rs. in Crore)			
Sl no.	Particulars	2015-16 In croreRs.	2014-15 In croreRs.
1	Premium earned (Net)	1862.23	1598.37
2	Operating Profit/loss	3001.6	69.11
3	Gross Premium	3521.22	2739.70
4	Claim Paid	2929.58	2433.51
5	Net Worth	2449.49	2136.56

Source – AIC

The population of India is growing day by day. So food production and population growth should go together so that India to be self-sufficient and should not depend on other countries of the world. So how can it be possible? It is through innovations of science and technology, research and implementation of new method of agriculture in the practical field. In this field, 'Start-up India' mission can help to achieve the goal. The Indian Council of Agricultural Research (ICAR) and other agricultural universities will start the ball into motion for more productivity and which will be beneficial to the farmers. In Indonesia a startup named 'Eight Villages' has shaped the agricultural field of farmers by giving information on climate and demand for food well in advance to the farmers. Similarly 'Fargin' of Vietnam startup shows the way of mushroom cultivation by taking waste

materials and the farmers adopted this with pleasure and became economically sound. 'Project Alba' of Cambodia taught and successfully implemented the cultivation of crops which require less water than paddy in the wastelands. A German- based research institute has claimed to have developed a "novel prediction method" to forecast early forecast of climatic conditions to the farmers. US based pioneer meteorological centre National Oceanic and Atmospheric Administration (NOAA) processes and provides long ranged weather forecast to its clients. These are the glaring examples of worldwide scenario which changed the face of agriculture and welfare of farmers in various countries. With the change of time we should give up our traditional method of agriculture and should adopt new methodology for the welfare of both agriculture and farmers.

References

The Times of India newspaper from March to May 2016

The Sambad, Odiya news paper

Out of 21 reported major countries that produce rice, India has the 2nd highest global share of 21.4 % after China. But India's average yield rate of rice in 2012 was at a lower ebb of 3721 kg per hectare as against the world yield rate of 4548 kg per hectare.

Agriculture Statistics at a Glance, 2014, Ministry of Agriculture & Farmer's welfare, Government of India

Indebted Agricultural Households in Odisha: A Crucial Study

Sri Rashmi Ranjan Kanungo,

Abstract

This paper is based on the raw data of central and state sample of 70th round National Sample Survey (NSS). The indebtedness of agricultural households being the main focus of the study, various indicators like Social group wise indebted agricultural households, economic class wise average loan outstanding, indebtedness within the social categories and various source of finance to indebted agricultural households are discussed in this paper.

Introduction

Agriculture plays a pivotal role in the Odisha economy. Although its contribution to gross domestic product (GDP) is now about 15.06* percentage, it provides employment to more than 60 percent of the workforce. Also, the forward and backward linkage effects of agriculture growth increase the incomes in the non-agriculture sector. The growth of some commercial crops has significant potential for promoting exports of agricultural commodities and bringing about faster development of agro-based industries. Thus agriculture not only contributes to overall growth of the economy but also reduces poverty by providing employment and food security to the majority of the population in the country and thus it is the most inclusive growth sectors of the economy.

Agriculture in Odisha still depends on the small and marginal farmers, which constitute 83% of the total holdings. It continues to be characterized by low productivity due to traditional agricultural practices, inadequate capital formation and low investment, inadequate irrigation facilities, low water use efficiency, uneconomic size of holding. As a result, the agricultural households forced to lay their lives in miserable condition.

Objective

To focalize the indebtedness of farmers family of rural Odisha through a sample study.

Source of Data & Description

The raw data of central and state sample of 70th round NSS has been used in this paper. The two sets of data have been collected by Directorate of Economics & Statistics

(DE&S) and National Sample Survey Office (NSSO) during the period January 2013 to December 2013 using scientific method of multistage stratified sampling.

Table: 1

Odisha	Number of Villages surveyed	Number of Households surveyed for	
		Visit-I	Visit-II
	421	3353	3346*

*(*7 households were casualty for visit-II)*

Entire Survey period divided into two visits. The detail data collected from same household in two visits. The reference period for visit-I was July 2012 to December 2012, & for visit-II reference period was January 2013 to June 2013

*(*State domestic product of Odisha, report published by, DE&S, at current price, only crop production for the year 2012-13),*

Total 421 Villages were surveyed in Odisha, and detail data on situation assessment have been collected from 3553 number of farming households in two visits.

Terminology

Agricultural households-An agricultural household is defined as a household having some production from agriculture activities. Further, households with at least one member self-employed in agriculture either in the principal status or in subsidiary status and having total value of agricultural produce more than or equal to Rs.3000/- during the last 365 days will only be considered for being covered as 'agricultural households'.

Cash loan

All loans taken in cash will be considered as cash loans payable, irrespective of whether those loans are repaid or proposed to be repaid in cash or in kind. Cash loans, generally, cover borrowings at specific rate of interest for a specific period of time. However, if a loan is taken even at 'nil' rate of interest from relatives and friends, it will be considered as cash loan. The loans may be taken against a security or without any security. Dues payable by the household owing to the purchase of goods under hire-purchase scheme will be treated as cash loans.

Kind loan

All loans taken in kind (except the case of hire-purchase) irrespective of whether those are already repaid or yet to be repaid in cash or in kind will be considered as kind loans payable.

Indebted Households

The information pertaining to the household indebtedness as on the date of survey will be collected. Loans will include borrowing in cash and/or kind (including hire purchases/ credit purchase). Borrowings in kind should be evaluated at current retail price prevalent in the local market. An advance payment received for forward delivery of goods should also be regarded as loan. Cash loans taken for short period without any security will be excluded. If the original amount of an unsecured loan is less than Rs.500/- and the said loan is fully repaid within a period of one month, then, it will not be considered as a loan for the purpose.

Economic Classes

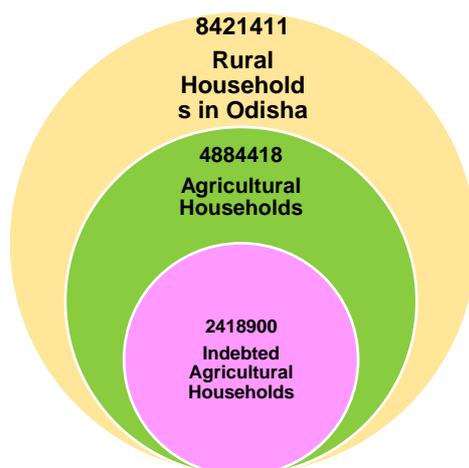
Based on Monthly Per capita Consumer Expenditure (MPCE) the entire domain of agricultural households were divided into ten economic classes.

Loan Outstanding

Average amount of loan outstanding is estimated, as the total amount due (outstanding principal plus the interest due) on the date of survey.

Findings

Figure 1 :



*(*projected figures of census 2011 for 2013)*

There were 84 lakhs* households in Odisha. Out of which 58% were agricultural households, and within agricultural households 49% were Indebted .The social group wise composition of Indebted Agricultural Households were shown below

The figure 2 indicates that 41% Indebted Agricultural households belongs to 'Other Backward Class', of the total indebted households, followed by 'Schedule Tribe' (21%), 'Others' (20%) and 'Schedule Caste' (18%) in Odisha. It is evident that less than 40% Indebted Agricultural households belongs to the social Category 'ST' & 'SC' ..

Figure 2 :Social Group wise Percentage Distribution of Indebted Agricultural Households

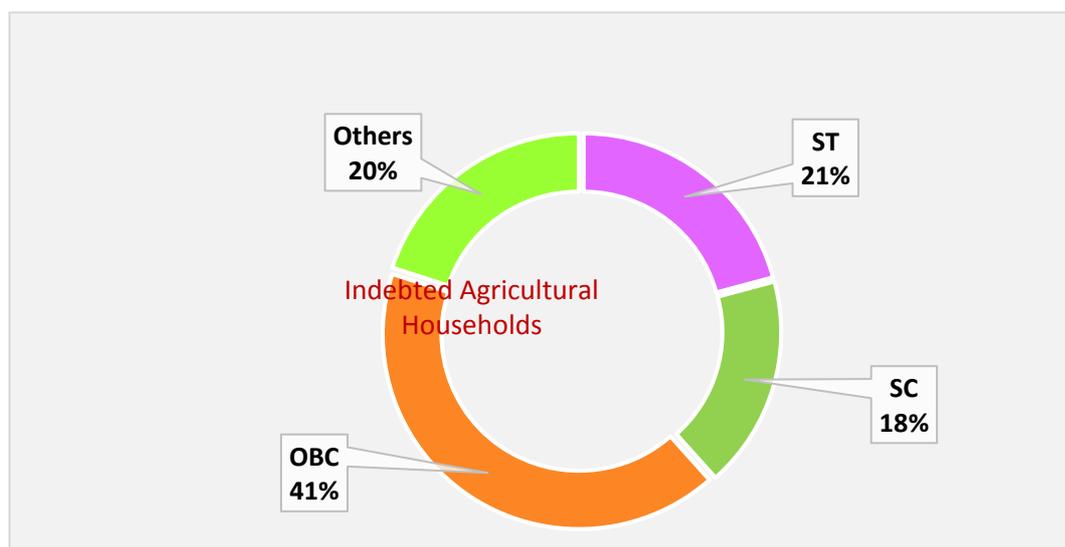


Table 2: Proportion of Indebted Households within social category

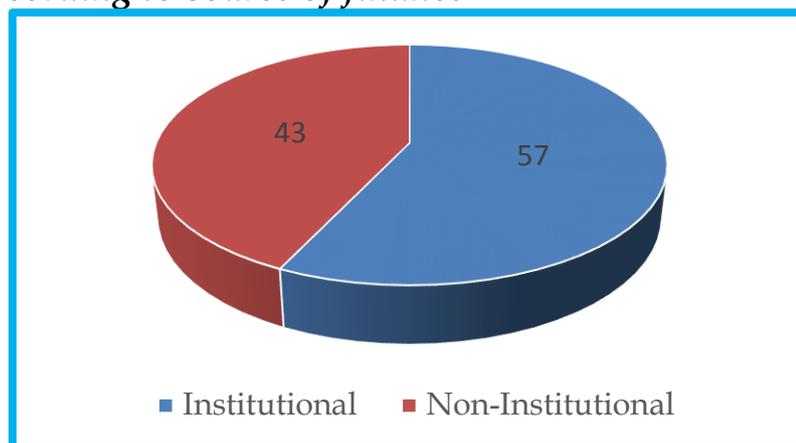
Social Group	Proportion Indebted Agricultural hhs
ST	34.1
SC	55.7
OBC	58.7
Others	52.1
ALL	49.5

Table 2 shows that, taking domain as agricultural households, Proportion Indebted Agricultural households were maximum in case of ' Other Backward Class' (58.7) and minimum in case of 'Schedule Tribe' (34.1).

Sources of finance

This is regarding the source from which loan taken by the agricultural households.

Figure 3 : *Percentage distribution of Agricultural Households according to source of finance*



Here institutional source includes (government, cooperative society & Bank), similarly non-institutional source includes (employer/landlord, agricultural/ professional money lender, shopkeeper/ trader, relative & friends and others). Above graph shows that the non-institutional source of finance (57%) remain as major source of finance for agricultural households in rural area, which indicated that, people were unable to approach Government source to fulfill their financial needs. Table 3 shows different source wise percentage loan taken by the indebted agricultural households

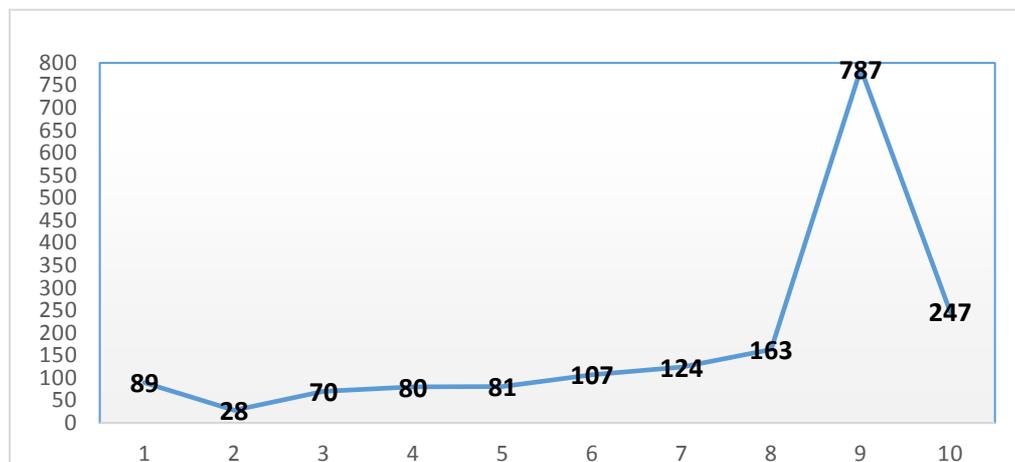
Table: 3 :*Percentage loan taken by the indebted agricultural households*

Source	Percentage
Government	1.3
Co-operative society	15.5
Bank	26.5
Employer/Landlord	1
Agricultural/professional money lender	12.4
Shopkeeper/trader	33.2
Relatives & friends	7.6
Others	2.5

It is clearly indicated that, in rural area 'shop keeper/trader' (33.20 %) was the major source of finance for agricultural households, followed by 'commercial bank' (26.50%) and 'co-operative society' (15.50%). Finance from government was merely 1.30%.

Average Loan Outstanding:

Figure: 4 : Average loan outstanding on agricultural households



It is observed from the figure 4 that, for the economic class two to ninth, the average amount of loan outstanding was in increasing order. The 9th economic class has the highest average amount of loan outstanding *which may be due to presence of outlier*. If we divided the total economic class into two parts, the lower part, i.e from economic class 1 to 5 shows that the average amount of loan outstanding was highest in the poorest class.

The upper half of the economic classes, i.e from 6th to 10th classes show that, comparatively richest class, at the 10th position has average amount of loan outstanding was less than its preceding class (*i.e 9th class*). It is inferred that those people who are at the lower rung of economic ladder are unable to clear outstanding loan, due to their low purchasing power. On the other side, those people at the 10th economic class are comparatively high income group & their purchasing power is high, for which average amount of loan outstanding was less.

Government Initiatives for welfare of Agricultural Households:

Government of Odisha has implemented 'State Agricultural Policy' from the year 2008, with a focus more on the economic well-being of the farmers, rather than just on production and growth. It has helped the State to achieve a consistent growth in agriculture. In this regard Government has provided food security to the majority of the population by enrolling them through ration cards. In this regard Government has provided food security to the majority of the population by enrolling through ration card.

Figure 5 : Possession of Antyodaya / BPL Card

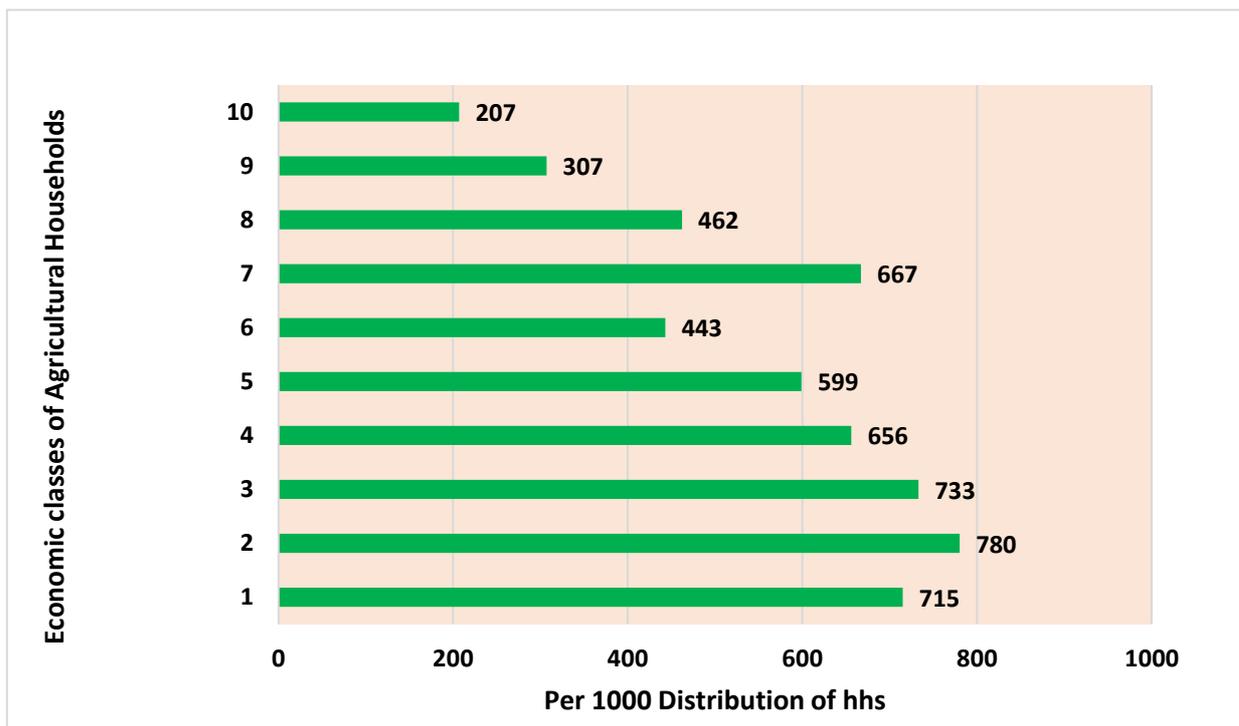


Figure 5 shows that nearly 71% of agricultural households belong to poorest class having Antyo-daya/BPL Cards. On the other hand 21% of agricultural households belong to richest class having Antyo-daya /BPL Cards. Which indicate that, more comprehensive grass route planning required to capture those left out households belonging to poorest class.

Conclusion

In the recent past India has been witnessed a series of suicidal case of farming households in different parts of the country. This situation happens due to combination of factors like, indebtedness, crop loss and low yield rate of production. Considering the debated topic, this study has attempted to draw some statistical conclusion regarding indebted farmers of rural Odisha.

According to this study there are 58% agricultural households in Odisha and out of which 49% are indebted .Indebtedness among 'SC' & 'ST' categories are significantly less than that of 'OBC and 'Others' categories. This paper concluded that the major source of loans for agricultural households are bank, co-operative society, shopkeepers & money lenders. The proportion of finance from other source are very negligible . Similarly for

average loan outstanding in poorest class is comparatively more than middle classes. The amount of loan outstanding is in inclining trend from lower middle class to upper class.

Coming to the steps taken by the Government regarding distribution of different cards like Antoday, BPL etc, the poorest class has been benefited with a big share, i.e 71% ,but 21% of top most economic class are also getting this benefits. Some comprehensive planning is required to capture the left out poors to get actual benefits.

Rationalize fertilizer subsidy by Direct Benefit Transfer(DBT); Implementation of Nutrient based subsidy(NBS) Scheme; Linking fertilizer use with soil health card profile; promotion of organic fertilizer to overcome micro nutrient deficiency in soil (67% of Indian soil has low organic carbon); use of IT & soil fertility map(for soil testing of 12 crore farm holdings in India) and reduction of regional disparities in fertilizer consumption are potential solutions to improve marginal productivity of fertilizers as an crucial input.

India Economic Survey, 2015-16, Page 107-109.

Agricultural Census in Odisha : Some Issues

Sri Nrusingh Ch. Jena

Sri Pradyumna Kumar Swain

Census of Operational Holdings

Operational holding is the fundamental unit of decision making in agriculture. It is defined as “all land which is used wholly or partly for agricultural production and is operated as one technical unit by one person alone or with others without regard to title, legal form, size or location”. Agricultural census or otherwise called census of operational holdings is being undertaken at decennial intervals in large number of participating countries with a view to collecting internationally comparable information on structure and characteristics of operational holdings under uniform concepts and definitions. The first census was organised in 1930 and the second census was undertaken for the year 1950 and then it was conducted at decennial intervals.

India participated in the world Agricultural Census, 1950 and 1960 by way of collecting required information through different rounds of National Sample Survey. However considering the importance of the basis data on structure and characteristics of the operational holdings for agricultural development, the first comprehensive Agricultural Census with reference year 1970-71 was undertaken in our country as part of the world Agricultural Census and since then it is being organised at quinquennial intervals with regard to undergoing rapid change in the agricultural front.

The Census brings out basic information on Number and Area of operational holdings, their tenancy, irrigation status, size, type (of holding) and farming practices. Thus the census also provides data on Area under different land use and irrigated and unirrigated area under different crops. These data are crucial for decision making in agriculture, viz

- (i) Formulation development programmes for different size class of holdings, planning for agricultural production programmes both at micro and macro level etc.

Issues

It is proposed to discuss here on the issues involved in use of the results of the census (survey) in subsequent surveys with reference to Odisha.

It is envisaged for collection of information from the operational holdings for the reference year in the subsequent year. But it is observed that it has been difficult to complete the field work for the census within the prescribed time schedule. It may be mentioned that there is no exclusive primary data collection as well as supervising agency for conducting the field work.

The data collected mostly by oral enquiry method are based on memory of the respondents. Hence more the delay in field work, more the data get vitiated due to memory lapse of the respondents. It may be stated that in a number of sample cases significant divergence has been observed in the figures collected by oral enquiry versus field verification. Further holdings have a tendency not to reveal the correct information about the operated area and tenancy particulars. What they report is mostly about ownership holdings and information about leased out area, leased in area, otherwise operated area etc. are not properly reported. Information on utilisation of operated area round the year also not correctly reported. Thereby the information on area under different irrigated and unirrigated crops and net and gross cropped area get affected. It is not out of place to mention that collection of agricultural statistics from the land holdings is very intricate and the Investigators have to take adequate care and caution in collecting reliable information. However the response bias coupled with Investigators bias affect the estimates relating to the characteristics of the holdings.

Any census brings out information in quantitative terms about some related characteristics. Detailed analysis of different aspects about characteristics are required to be made through different specific Sample Surveys. The results of the census serve as benchmark data for further studies.

Agricultural Census, as indicated earlier, provides information on Number and Area of operational holdings, their tenure and tenancy status, terms of leasing, land use, irrigation status, operational holdings receiving irrigation from different sources, irrigated and unirrigated area under different crops. These may be used as benchmark data and agricultural statistics may be further enriched by detailed enquiry on different aspects.

Suggestions

At the State level concerned departments for their own consumption, make efforts and produce data which are also brought out by the Agricultural Census. The Departments of Agriculture, Planning & Convergence, Panchayati Raj, Water Resources, Revenue &

Disaster Management are very much concerned with the data released by the Agricultural Census. Odisha essentially being an agricultural economy, the results of the census of operational holdings may play a key role in policy formulation in the field of agriculture and irrigation both at micro and macro level. In the meantime some amendments to the constitution of India have been made for peoples participation in the development programmes from the grass root level upwards and Panchayat has become the unit of development. In view of above, the results of the census are required to be brought out at the Gram Panchayat level for its effective use for planning for development of agriculture from the grass root.

It is not out of place to mention that Odisha is one of the States having the largest population below poverty line and poverty lies mostly in rural areas. Development of agriculture and ancillary agricultural activities may go a long way in eradicating rural poverty. Agriculture in Odisha is still underdeveloped and lagging behind as compared to other States of the country. This being a private enterprise and the decision making is at the hands of the operational holders, State intervention in a massive scale and with missionary zeal is warranted by way of educating and motivating them and providing inputs and advanced technology for boosting agricultural production.

In view of above, it is considered that due weightage may be given to the Agricultural Census and under joint responsibility of Departments of Agriculture, Water Resources, Panchayati Raj, Planning & Convergence and Revenue & Disaster Management the census may be conducted and the results may be made available from the Gram Panchayat level upwards for effective formulation of programmes for agriculture and irrigation from the grass root level. Like the population census, the data released by the Agricultural Census may be adopted by all concerned.

The Census provides valuable information about number of holdings by size class growing different crops with area (irrigated and unirrigated separately). If these benchmark data are made available at the Block and Gram Panchayat level, then separate surveys may be undertaken for purposeful area specific crop planning for different areas of the State. Special welfare programmes for benefit of the small and marginal holdings may be undertaken taking into consideration their concentration in different areas.

The Census also provides figures on different types of fallow land for different categories of holdings within the operated area at various administrative levels. Survey

may be conducted to ascertain the reason for the land lying fallow in order to take measures to bring the fallow land under crop.

Culturable land being inelastic and the number of holdings increasing due to fragmentation of holdings for obvious reasons, the size of operational holdings for different size classes is on the decrease. Further culturable land is being converted for non-agricultural use due to the impact of growing population, trade and commerce and industrialisation. This may warrant separate survey for taking necessary possible measures to discourage the people from converting crop fields for non-agricultural use. Moreover with the declining size of operated area per holding, cropping intensity has to go up for feeding the teeming millions. In view of above, location specific crop production plan and irrigation plan may go together for raising the cropping intensity.

Thus, the results of the census of operational holdings coupled with follow up surveys and studies may help in a big way for agricultural growth in the State as well as in the country.

Indian agriculture is inflicted with low level mechanization. 60-70 percent of harvesting & threshing for wheat & rice are mechanized followed by soil working & seed bed preparation (40%), irrigation (37%), plant protection(34%) and seeding & planting (29%).

Department of Agriculture &Farmer's Welfare, Government of India.

Agricultural Households in Rural Odisha: A NSS Study

*Mrs. Pārbati Barla,
Mrs. Sanghamitra Mohanty,*

Abstract

This study is based on the raw data of latest National Sample Survey on Agricultural households during 2013. It provides an overall idea of the socio-economic conditions of the agricultural households of Odisha. Here some powerful demographic indicators like MPCE, family size, sex composition of agricultural households and literacy have been discussed using the combined data of central and state samples of NSS 70th round surveyed during Jan-Dec'2013.

Introduction

Agriculture is underperforming in many developing societies including Odisha for a number of reasons. Among these is the fact that farmer households lack the resources and basic opportunities they need for their wellbeing to make the most productive use of their efforts. After all, agriculture plays a pivotal role in the Odisha economy. Although its contribution to gross domestic product (GDP) is now around one sixth, it provides employment directly or indirectly to more than 60 percent of the population (Odisha Economic Survey, 2014-15). But the agriculture households are facing problems of poverty, unemployment, inequalities in access to health and education resulting in poor performance of agriculture sector. One of the excluded sector during the reform period was agriculture which showed low growth. There are serious concerns on the performance of agriculture sector in our society. A clear idea of the social and economic conditions of the farmer households seems very contextual. Some powerful indicators addressed in this paper are economic classes based on minimum consumer expenditure, family size, sex composition of farmer households and literacy which affect the economic conditions and in turn social conditions. To have a comprehensive profile of the farmer households, a demographic base becomes more relevant.

Source of data

This paper is based on the combined unit level data of central and state samples of NSS 70th round on Situation Assessment Survey (SAS) of Agricultural households collected

by two separate government agencies i.e NSSO, Government of India and DES, Odisha, during Jan'2013 to Dec'2013.

Description of data

The required data have been collected through stratified multi stage sampling design. First stage stratum is the district and first stage unit (FSU) is census village. The survey, conducted in the rural areas of Odisha within its two visits, was spread over 421 villages covering 3353 households in visit-1 and 3346 households in visit- 2. Seven households were found as casualty in visit-2. Some of the key demographic estimates related to household size, sex ratio, conditions of dwelling units, educational level and consumption expenditure have been analyzed in this paper.

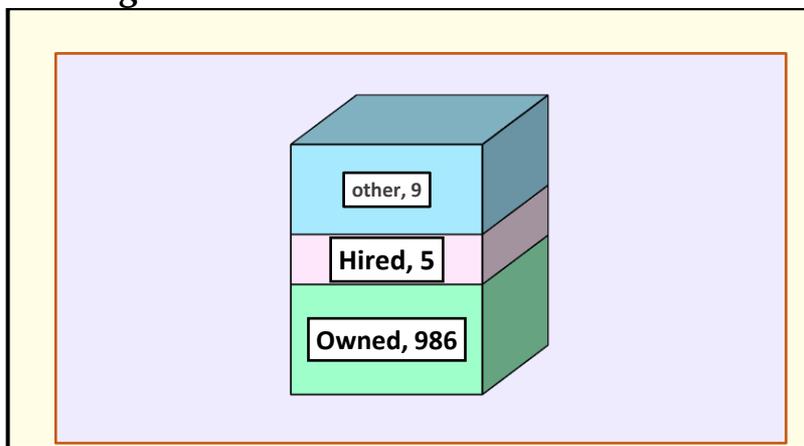
Results and analysis

According to the estimated result of 70th round NSS, there are 4.35 million agricultural households in rural Odisha. These agricultural households were about 58 percent of the total rural households of Odisha during the same period. Well-being of agricultural households is a broad and dynamic concept that encompasses economic indicators such as monthly per capita expenditure along with non-economic indicators like household size, quality of housing, education and formal training in agriculture. In the context of measuring the well-being of agricultural households, data in those areas should be presented which will provide a comprehensive picture of their levels of living. Using these information important indicators of living facilities are developed and is presented in the following sections.

Type of Dwelling Possessed

A safe comfortable dwelling unit to live is fundamental to our sense of well-being. A difference in this indicator may reflect genuine differences between the levels of living of the farmer households. Fig:-1 shows that 98.6 percent agricultural households in rural Odisha were house owners whereas 0.5 percent and 0.9 percent of the households were living in hired and other types of houses respectively during 2012-13.

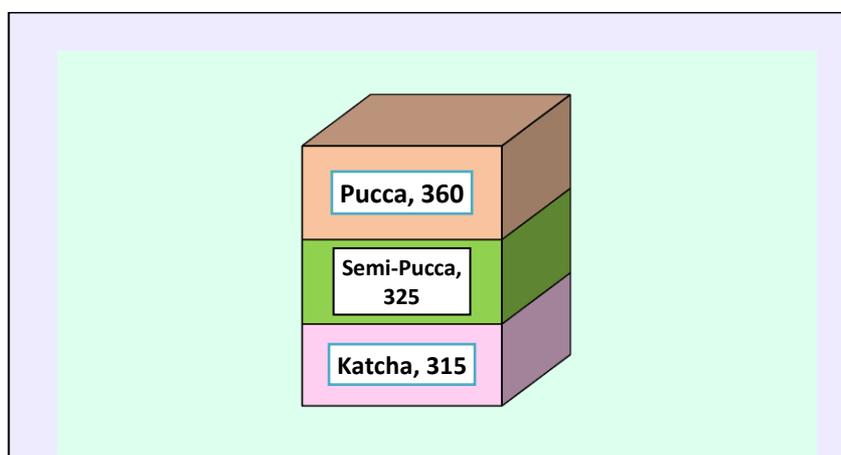
Figure 1 : Per 1000 distribution of Agricultural households by type of dwelling unit.



Structure of dwelling unit

The quality of shelter has direct effects on the socio-economic wellbeing of the residents. The type of material used for the construction of roof and wall of a dwelling unit is taken as an indicator of quality of shelter. Based on the material used for construction, the structure of dwelling is classified into pucca, semipucca and katcha. Fig:-2 reflects per 1000 distribution of agricultural households by type of structure of dwelling unit. It gives the real picture of the living condition of the agricultural households of rural Odisha. Out of total rural such households, 36% households were residing in pucca, 32.5% were residing in semi-pucca houses and 31.5% were residing in katcha houses.

Figure 2 : Per 1000 distribution of Agricultural households by structure of dwelling unit.



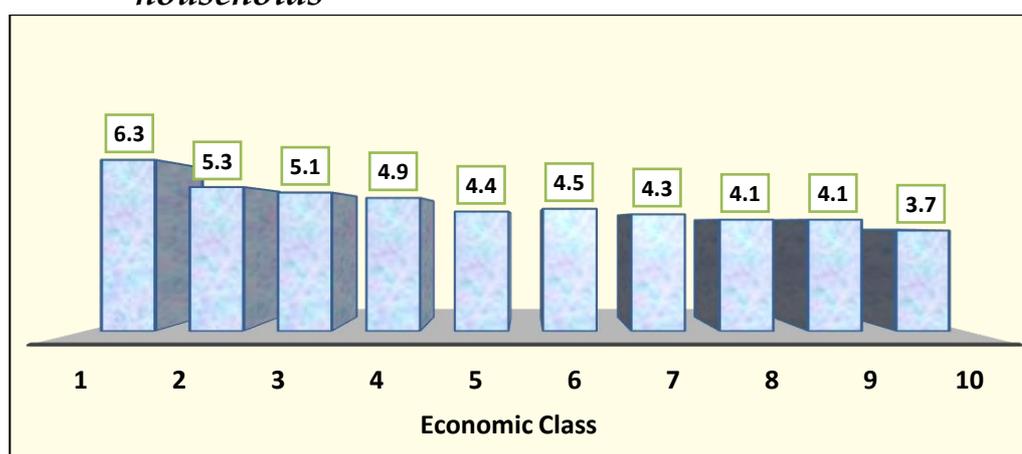
Family size and Sex ratio

Table1 : *Economic class wise sex ratio, child sex ratio and average household size of agricultural households in Odisha.*

Economic Class	Sex ratio	Child Sex ratio	Average Household Size
1	989	933	6.3
2	982	801	5.3
3	1098	1140	5.1
4	1059	1134	4.9
5	1015	908	4.4
6	875	716	4.5
7	909	917	4.3
8	930	731	4.1
9	970	566	4.1
10	929	738	3.7
All	974	872	4.6

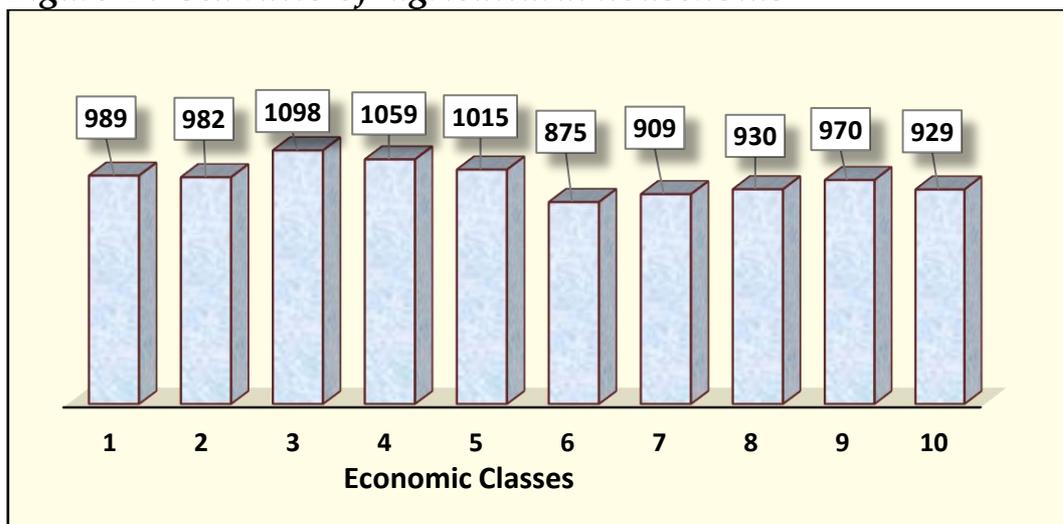
The demographic factors like family size and sex ratio may influence the economic activity and consequently the wellbeing of agricultural households. The entire domain of agricultural households were divided into ten economic classes basing upon monthly per capita consumer expenditure. Sex ratio, child sex ratio and average household size are given for each economic class.

Figure 3 : *Economic class wise average household size of agricultural households*



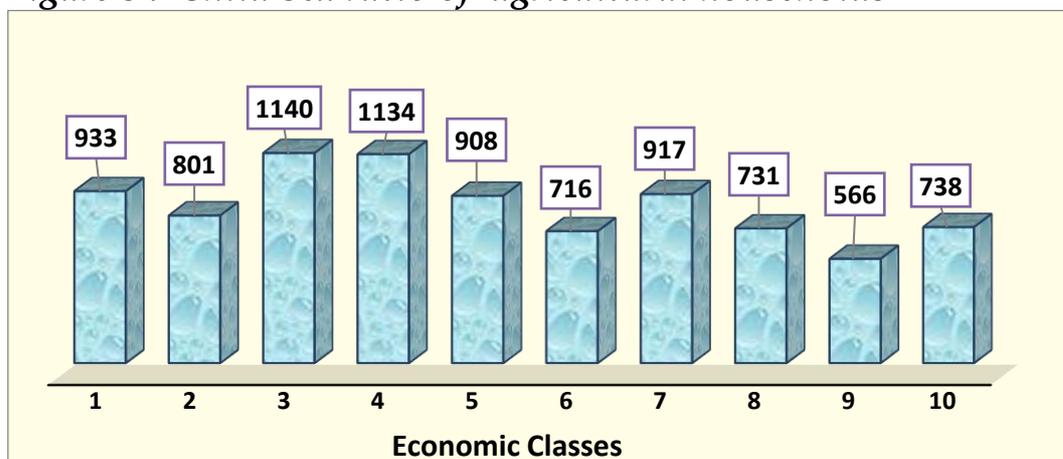
The average household size of agricultural households in the state was estimated as 4.6. It was highest (6.3) in the lowest economic class and lowest (3.7) in the upper most economic class. Also average household size declined steadily over successive classes of economic class. Details are in table-1. Considering the distribution of households by different economic classes.

Figure 4 : Sex ratio of agricultural households



The average sex ratio (number of females to 1000 males) of agricultural household was 974 during the period. The highest sex ratio was reported in the economic class-3(1098) followed by economic class 4(1059). There exists a negative relationship in Male- Female ratio as we move from lower economic class level to higher, lowest being for economic class 6 (875).

Figure 5 : Child Sex ratio of agricultural households

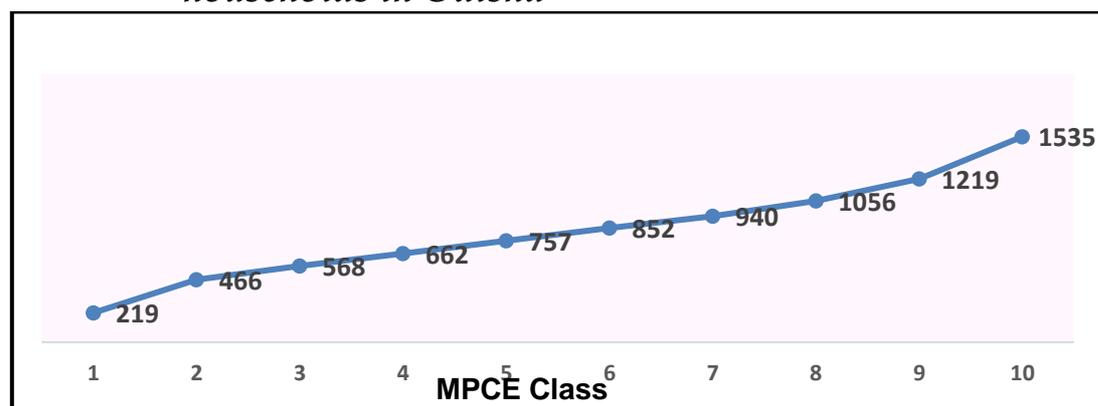


Being a vulnerable issue it is significant to say that child sex ratio is found to be higher in lower economic classes. More specifically, economic classes 3 and 4 had witnessed the maximum child sex ratio i.e. 1140 and 1134 respectively. Figures 4 & 5 show the general sex ratio and child sex ratio in different economic classes at state level.

Minimum monthly per capita consumer expenditure.

Mostly, well-being has been measured through economic indicators such as expenditure. The higher the level of expenditure, the better is the living standard of the farmer households. Economic class wise distribution of minimum consumer expenditure is presented in Fig:-6 to provide a comprehensive picture of the well-being of farmer population.

Figure 6 : Economic Class wise minimum MPCE (In Rs.) of agricultural households in Odisha



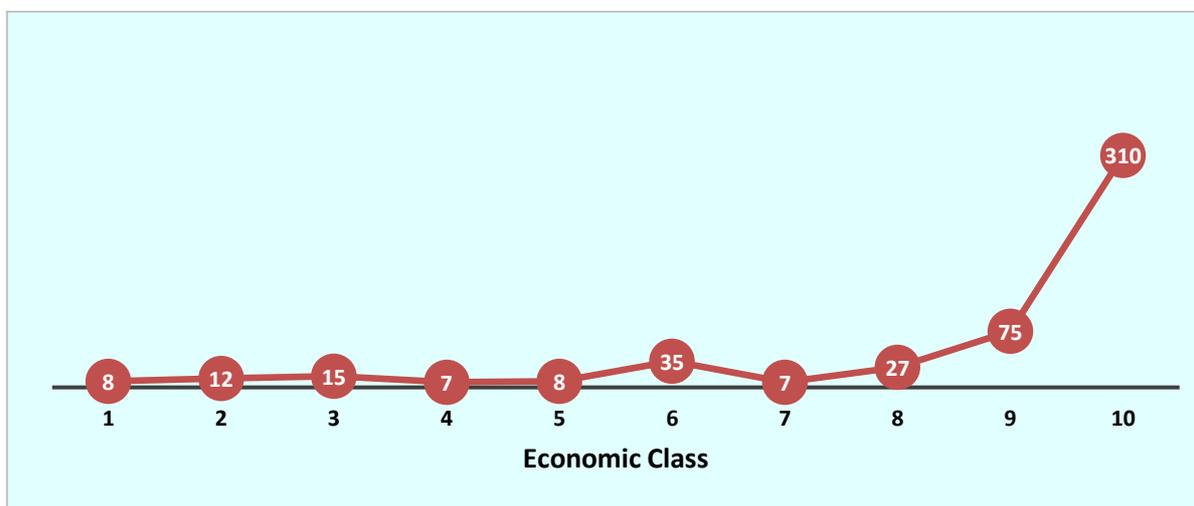
Formal Training in Agriculture

Table2: Economic Class wise average no. of persons per 1000 households attended formal training in agriculture in Rural Odisha.

Economic Class	Average no. of persons per 1000 households attended formal training in agriculture		
	Male	female	Person
1	9	0	8
2	12	9	12
3	16	0	15
4	8	0	7
5	9	0	8
6	38	5	35
7	8	0	7
8	30	1	27
9	81	9	75
10	337	29	310
All	63	6	58

Formal training in agriculture is essential for employing modern technology for high yield rate. The average number of male and female who reported to have attended some kind of formal training in agriculture was as low as 63 and 6 for male and female respectively of the agricultural households of the state. This lower participation restricts the use of technical knowhow in agriculture and consequently wellbeing of the farmers in Odisha to some extent. The share of persons attended formal training in agriculture was higher for higher economic group than lower economic group in all the economic classes. Details are in table-2 and depicted in figure7.

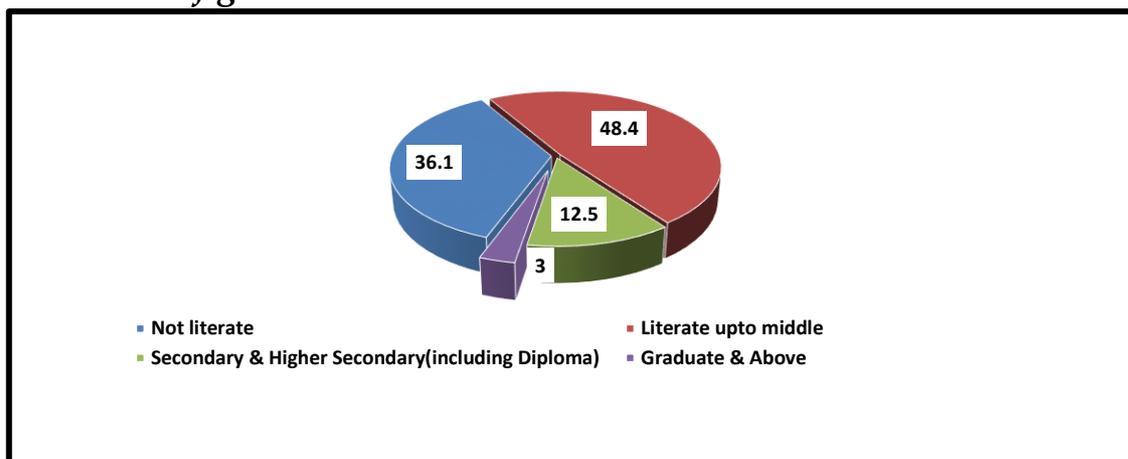
Figure 7: Economic Class wise average number of persons per 1000 households attended formal training in agriculture in rural Odisha.



Level of general education.

Education provides knowledge and opens the door to new opportunities that can improve one’s living standard. Better educated farmer population can improve community’s capacity into higher-valued employment. Therefore, an uneven distribution of skills may reinforce an uneven pattern of well-being. The share of illiterate persons of the agricultural households was estimated as 36.1 percent. While considering the educational details at more disaggregate level, the percentage of persons with educational level literate up to middle contributes the maximum share of 48.4% followed by Secondary & Higher Secondary (including Diploma) with share of 12.5% and Graduate & Above 3%.

Figure 8 : Distribution of members of agricultural house holds by level of general education.



Conclusion

The idea behind this topic is to examine inter-relationship between demographic and socio-economic wellbeing of farm households. From the anatomy of socio-economic features of farmer households of the study area, it is observed that the average household size of agricultural households of Odisha was lower than the National average of 5.1. Considering sex ratio, agricultural households of Odisha registered higher value i.e. 974 against 948 of National sex ratio. It can be noted that according to both the above indicators, the farmers’ households of Odisha enjoyed a better social condition than that of all India. From the analysis of structure of dwelling units, it has been observed that living condition of the agricultural households of rural Odisha was quite worse than its all India counterpart as the percentage of households having pucca structure is nearly half of that of all India. The comparative study of educational status of farmer households’ reveals that on an average, 36.1% were illiterate in state level whereas it was 40.8% in all India level. It is visualized that more number of agricultural households of Odisha state had educational level up to middle in comparison to all India level which reveals their higher participation in the policy “Free and compulsory education for all”. Considering average no. of persons per 1000 households attended formal training in agriculture, agricultural households of Odisha (58) were also privileged with higher participation than that of all India level (34).

Fertilizers are meant to improve crop productivity. In India, fertilizer subsidy to farmers was around 10 % of total agricultural GDP in 2013-14. But ironically, the response ratio of fertilizers decline since 1970s due to inefficient use of fertilizers. The yield of grain per kg use of NPK fertilizer has declined from 13.4 kg grain per ha. in 1970 to 3.7 kg grain per ha. in irrigated areas by 2005.

Department of Fertilizers, Government of India

Trend analysis of agricultural establishments in Odisha

Shri Kashinath Baskey,

Abstract

This paper is based on the result of 6th Economic Census 2013 over 5th Economic Census of 2005. A trend analysis has been made for number of agricultural establishments and employments in agricultural establishment through Compound Annual Growth Rate from 2005 to 2013.

Economic Census (EC) is the complete count of all establishments (i.e. units engaged in production and/or distribution of goods and services not for the purpose of sole consumption) located within the geographical boundaries of the Odisha state. Last two Economic Census (EC) have been conducted during 2005 and 2013 in Odisha under the guidance of Central Statistics Office (CSO), Ministry of Statistics and Programme Implementation (MOS&PI), Government of India.

The Economic Census proposes to provide up to date information on number of establishments and number of persons employed therein, activity wise, of all the sectors (excluding crop production, plantation) of the State. In this paper, discussion on trend of agricultural establishments has been made based on the result of 5th EC 2005 and 6th EC 2013.

Establishment

The establishment is a unit situated in a single location in which predominantly one kind of economic activity is carried out such as that at least a part of the goods and/or services produced by the unit goes sale (i.e entire produce is not for sole consumption).

Agricultural establishments

The Establishments for the purpose of Economic Census is one, engaged in production of agriculture goods (other than crop production & plantation by the farmers or a group of farmers or any agency), agricultural services, hunting, trapping & game propagation, where at least some part of the production or services is sold out. **Establishments engaged in activities pertaining to crop production and plantations**

though in the agriculture sector are excluded from the coverage. Thus primary cultivators themselves excluded from the coverage of Economic Census. However, services incidental to crop production or plantation provided/ undertaken by any one individual or a firm or a company by charging fee or rent/compensation e.g. machinery & equipment for tilling/cultivation, preparation of field or sowing harvesting/chaffing, transportation of agriculture goods/produce charging for irrigation facilities etc.as their principal activity had been included and the establishments engaged in such activities had been covered.

Worker (Person employed)

All persons (including children under 15 years of age) working on the last working day prior to the date of fieldwork in the establishment, either as owners, members of the household, co-owner or partner or family members helping the owner in running the establishment including other persons engaged by the establishment, whether hired or not, besides regular and salaried employees, casual/daily wage labourers are considered as workers for the establishment.

Objective:

- ✓ To find out the annual compound growth rate of Agricultural establishments and employment from 2005 to 2013.

Tools used to obtain growth rate;

$$E_1 = E_0 (1 + r/100)^t$$

Where E_1 = figures of 6th EC 2013

E_0 = figures of 5th EC 2005

r = CAGR (Compound Annual Growth Rate)

t = time

Result and Analysis:

i. Establishment:

According to the latest result of Economic Census 2013, there are about 3.75 lakh agricultural establishments in Odisha, out of which 3.55 lakh (94.67%) were operating in rural sector and 0.20 lakh (5.33%) were operating in urban sector. Fig 1 shows the percentage distribution of agricultural establishments in rural and urban sector. Among the agricultural establishments, 3.49 lakhs (93.09%) were without hired worker and 0.26 lakhs (6.91%) were establishment with at least one hired workers.

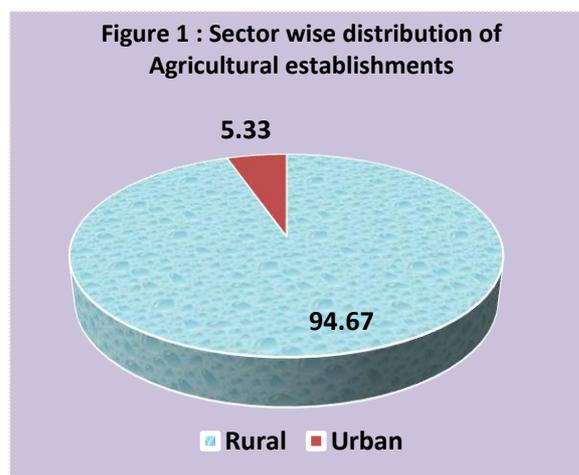
The following table 1.1 shows the number of Agricultural establishments by major activity group.

Table 1.1 :Agricultural establishments by major activity group

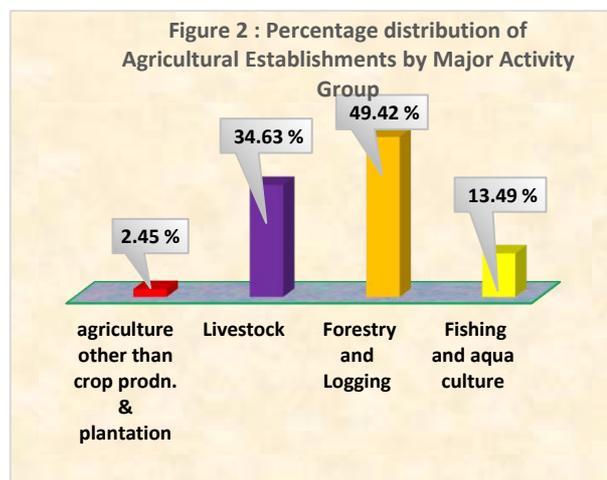
Major Activity Group	Rural	Urban	Total
Agriculture other than crop production & plantation	8738	478	9216
Livestock	121760	8351	130111
Forestry and Logging	182089	3588	185677
Fishing and aqua culture	43075	7607	50682
Total	355662	20024	375686

Among the four major group, Forestry and logging occupied the top position reporting 49.42% (1.85 lakh) of the total agricultural establishments of Odisha. The other attributes in agriculture establishment were livestock 34.63% (1.30 lakh), fishing etc 13.49% (0.50 lakh) and Activities relating to agriculture other than crop production & plantation 2.45% (0.09 lakh). The percentage distribution given in fig-2 shows, sector wise broad details of establishments by different agricultural activities. In more details 3.49 lakh (93.09%) of the total agricultural establishments were own account (Without Hired Worker) establishments and the remaining 0.26 lakh (6.91%) establishments were with hired workers. The share of own account agricultural establishments was 88.45% in the rural sector and 4.64% in urban sector.

Fig_1



Fig_2

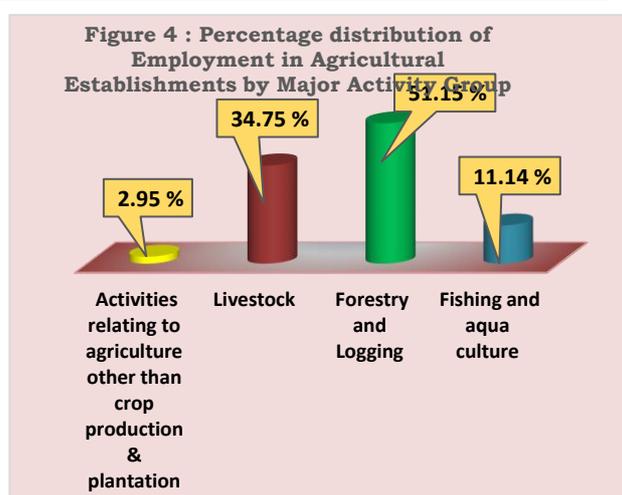
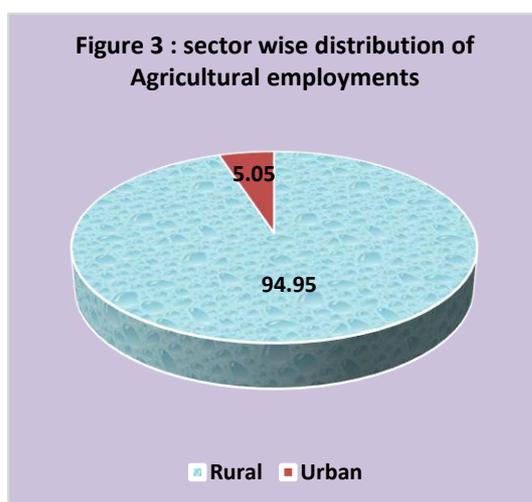


ii. Employment:

The share of workers in the agriculture establishments was 16.38% (7.07 lakh) of the total employment of Odisha. The distribution of employment in agricultural establishments with major groups & type of establishments with major activity groups & type of establishment are given in table 1.2.

Table 1.2: No. of Employment in Agricultural Establishments by Major Activity Groups.

Major Activity Group	Rural	Urban	Total
Agriculture other than crop production & plantation	19677	1220	20897
Livestock	231017	14813	245830
Forestry and Logging	354870	6962	361832
Fishing and aqua culture	66027	12741	78768
Total	671591	35736	707327



It reveals from fig_3 that within the agricultural establishments 94.95% (6.71 lakh) of the employment was found in the rural and 5.05% (0.35 lakh) was found in the urban sectors.

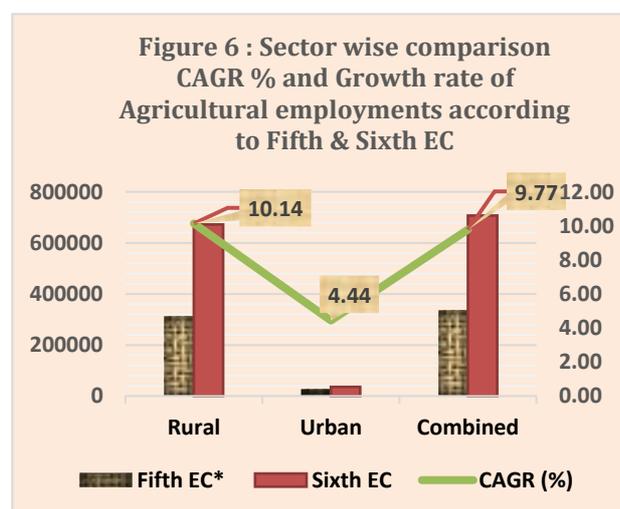
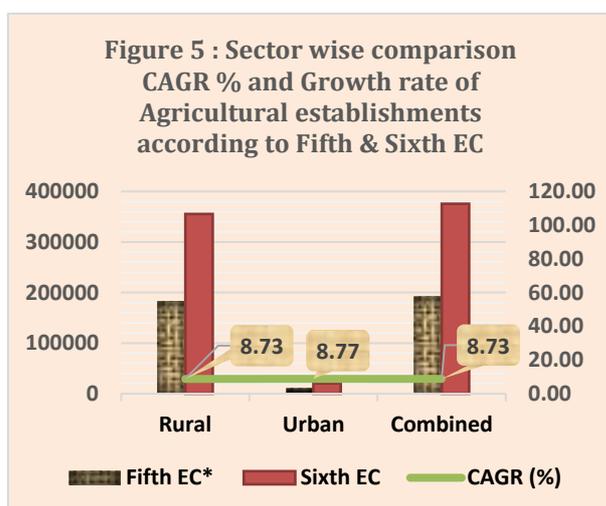
If the type of establishment is concerned, the own account establishment in agriculture clinched its position sharing 87.69% (6.20 lakh) of employment within the agricultural establishments, which consists with 95.76% (5.93 lakh) in rural sector and 4.24% (0.26 lakh) in urban sector. Among the major activity groups the Forestry and logging services in the rural sector of the own account (Without Hired Worker) establishments shared 57.00% and Livestock in the urban sector shared 41.31% employment in the agricultural establishments. At the state level 51.15% (3.62 lakh) of the total employment in Forestry and Logging establishments was provided by the agricultural services.

Growth from 2005 to 2013 of Agricultural Establishments

Table-1.3 gives sector wise details of the agricultural establishments. It is observed that share of agricultural establishments is 10.51% in 2005 and 17.98% in 2013. The overall CAGR (Compound Annual Growth Rate) of agricultural establishments has increased to 8.73% during 2005-13. The increasing trend has been noticed in rural areas of the state. Similar pattern of CAGR can be seen in employment in the agricultural establishments with a surge to 9.77% during 2005-2013.

Table 1.3 Growth rate of Agricultural Establishments and employment therein by sector

Sector	Item	Fifth EC	Sixth EC	CAGR (%)	TotalGrowth (%)
Rural	Estt	182073	355662	8.73	95.34
	Emp	310202	671591	10.14	116.50
Urban	Estt	10223	20024	8.77	95.87
	Emp	25247	35736	4.44	41.55
Combined	Estt	192296	375686	8.73	95.37
	Emp	335449	707327	9.77	110.86



From Fig_5 it is clearly observed that annual growth rate of agricultural establishments nearly equal in both rural and urban sector, but the difference is more in case of employments. The employments in rural agricultural establishments is in increasing trend with annual growth rate 10.14% where it is 4.44% in urban sector.

Conclusion

According to the result of last two Economic Census i.e. 5th EC of 2005 and 6th EC of 2013, the number of Agricultural establishments are significantly increasing. The trend indicates that each 100 agricultural establishment is rising to 109 annually whereas the employments in agricultural establishments is growing to 110 from 100 in a year. But if we point out the growth in rural sector it is more remarkable in case of employments. The annual growth rate of employment in agricultural in rural sector is 10.14 % while it is 4.44 % in urban sector.

Sectoral share of agriculture to GSDP of Odisha depletes over years. But the sector still remains a high priority sector in the State because of its imposing rural livelihood support & employment generation in unorganized sector.

Odisha Economic Survey,2015-16.

Agricultural Statistics in Odisha - Issues & Prospects

Dr Kailash Chandra Pani

Abstract

The centrally sponsored survey scheme of EARAS under DE&S, Odisha provide the single most important official estimates on production & productivity of paddy at block level and 13 minor crops at district level. RKBY survey is the added dimension to the EARAS survey at GP level estimates. There is need to revamp the operational process of the crop survey relating to the efficiency & sufficiency conditions of surveyors; methodological issues on sample size techniques; impact of mechanisation in crop cutting; monitoring issues; administrative issues on skilled manpower etc.

In spite of rapid developments in industrial as well as service sectors during last two decades as good as 17.70% of state income of Odisha still comes from agriculture sector & roughly 64% of its population now also depend upon agriculture for their livelihood. Hence considering the dependency of this large percentage of the population of state on agriculture, the reliability of the area & yield statistics of crops bears crucial importance. Though Forest, Horticulture & Animal Husbandry and fishery come under the broad category of agriculture, the crop statistics is focussed in the present paper. It may not be illogical to present a glimpse on the formulation of estimates on Dairy & Animal Husbandry, Forestry, Fishery & Horticulture. Broadly production estimates here are dependent on their departmental accounting without any sophisticated scientific and Statistical techniques which needs independent discussion. As per the present practice, the Directorate of Agriculture, Government of Odisha formulates estimates in respect of all the crops grown in the state except 14 no. of major crops covered under the centrally sponsored scheme "Establishment of Agency for Reporting Agricultural Statistics" popularly known as EARAS. At the behest of Ministry of Agriculture, Government. of India, this scheme is implemented in Odisha through Directorate of Economics & Statistics since 1981 with 20% sampling fraction with a view to formulate reliable estimates of 14 nos. of major crops like Paddy, Patato, Groundnut, Mustard, Mung, Biri, Kulthi, Rasi, Sugarcane, Maize, Til, Niger, Jute & Wheat grown in the state.

It is a common phenomenon that if the Department / Organization responsible for integral development of the sector is allowed to estimate its own performance, the estimate will be biased one having an upward trend. On the other hand if time & cost permits an independent organization not having any relation with production Department and skilled with technical know to estimate things in a scientific manner be given the job of estimating

sensitive statistics like crop statistics. It is sensitive simply owing to fact that either under estimation or over estimation of basically food crops, pulses and oil seeds can create uncontrollable problems for Government & people. Historical evidences are many which has engineered fall of popular Governments. Moreover, this is highly essential in states / countries where a large percentage of the population rely on agriculture to earn their livelihood. Case of Odisha needs no. elaboration.

On the other hand, if the independent & scientific organization lacks logistics, monitoring & supervision & simply boasts of being the scientific body, they may also produce biased & bogus results far from truth & reality.

So to come over the problems encountered in case of both the systems aforesaid, there should be a apex body having requisite members from Production Department & Experts from other fields & requisite members from implementing agency which should sit in regular intervals preferably quarterly to take stock of the situation & discuss the field issues & recommend appropriate action to ensure qualitative field work. Once the field work is qualitative & sampling design as well as sample size is appreciable, estimates will certainly lie in close proximity of truth. The biased estimation of agricultural produce sizeably influences procurement policy, price policy & market policy as well. In a welfare country like ours, Government of India has launched many farmer benefit schemes like R.K.V.Y & R.K.B.Y etc. & our State Govt, in particular, has also taken many important steps for helping the farmers in case of causality or distress. In recent times Remote Sensing Agency, Odisha is also taking steps for formulating crop estimates with use of remote sensing technique. They normally estimate the crop area by following statistical sampling technique and classifying crop area by reflectance of crop cover. To reach out other non paddy crops they need high resolution data & a thorough change in their sampling techniques to formulate district level estimates. Continuous cloud cover some times possess serious bottlenecks for acquisition of this data. There is also every possibility of misclassification of crops if reflectance of two or more different crops or even a non-crop adjoining to crop area becomes equal. They are also applying a regression modelling for deriving yield statistics.

It may be clearly noted here that regression modelling is not a substitute to estimate based on actual fields data. It is a forecast which helps planners when time & resources are much limited. But for sensitive estimates like crop estimates we can not solely depend upon regression modelling. Further if production estimates are mechanical over years, regression estimate will utterly fail. Hence yield modelling of Remote Sensing is confined to domain of research at present. Of course, the regression modelling for yield estimate taking factors like rain fall, irrigation, manure, application of fertilizer & pesticides, occurrence of natural

calamity, the no. of dry spells, density of crop coverage, use of variety of seeds & the like may go hand in hand & these estimates may be helpful to know the exact areas where conventional crop estimates are under estimated or over estimated. In this checking, the areas found inconsistent needs to be rechecked to derive at a conclusion. If such operations are made the primary reporting agencies will be very careful & particular in their field work.

In view of the foregoing discussions, in this paper we have attempted to highlight some of the crucial ground issues & problems encountered in the EARAS Vis-à-vis estimation of crop statistics in our state along with certain suggestions for improvement.

Issues and problems in Agricultural Statistics with special reference to EARAS & RKBY

Shortage of Field Staff

Originally it was programmed that one SFS will be given the responsibility of survey of 8 to 10 villages covering 8000 to 10000 survey numbers to make plot-wise survey during the 3 crop seasons as per approval of Ministry of Agriculture, Government of India. At present the No. of villages per SFS varies for 30 to 50 & total survey no per SFS increases from 30000 to 50000. In view of this abnormal increase in work load the quality in data is a remote possibility. Apart from EARAS & RKBY works the SFS also works as primary worker for Agriculture Census, Minor Irrigation Census, Economic Census, VICS and other adhoc surveys .

He is also the chief instrument in collecting official statistics and also works as an important member in crop loss assessment team with Agriculture & Revenue department when crop is damaged in flood or cyclone. To cite an example in Jagatsinghpur district during 2015-16 as against 28 sanctioned SFS posts we manage with only one permanent SFS, three contractual SFS & 3 no of SFIs. Total no of plots per primary workers comes to 47, 136. Immediate steps may be taken to fill-up the vacancies of the SFS without further delay.

Adoption of systematic sampling for RKBY

As per procedure during kharif season 40% villages of sample are crop cutting villages for paddy & 50% villages of sample are c.c. villages for other crops. Since in kharif season each & every plot has a crop, work load of SFS is comparatively high during this

season. Taking this into consideration, SFS conducts detail plot-wise survey work in crop cutting villages first since advance estimates & crop cuttings are confined to crop cutting villages only. Towards last part of the crop season he covers LUS villages comfortably without any haste & commits less error. After introduction of RKBY the SFS is forced to complete the LUS in non crop cutting villages as well to supply the list of four selected plots to the RIs for crop cutting of RKBY by them. So, in doing this in a quick time frame, he commits errors which tells upon quality of data & reliability of estimates of EARAS. Hence, at least for winter paddy, which is grown in more than 80% of our field, we can take a systematic sampling approach & select 4 nos. of plots. On field verification if any plot is found not growing paddy we can take next higher plot growing the desired crop as substitute. This will not pressurize SFS & also add to quality of data. Adoption of systematic sample will provide a better result since it will draw sample from mutually exclusive segments spreading over total area.

Further a good no. of GPs beyond the coverage of EARAS are given to RIs for LUS & crop cutting as well. It is a fact that the LUS done by the RIs is much from satisfactory & rather if systematic sampling is followed this will provide scope for collection of representative data which will add to reliability of estimate.

Representativeness of Sample in RKBY

Under the scope of EARAS, normally one village either a CC village or a LUS village is coming in a GP. For RKBY we are taking 4 nos. of CC experiments in that particular village to develop an estimate for that GP. In case the selected village has a very good crop condition or seriously affected due to certain reasons, the estimate is terribly biased which becomes the cause of many court cases. So for RKBY at least 2 villages at GP level should be taken & rate of CC should be two. If 3 villages can be considered in a GP for RKBY, the estimates will be still better. This can be done by selecting one or two villages of G.P in addition to EARAS sample village & plots selected in systematic sampling technique.

The dimension of C.C field & labour charges for CC experiment

At present the Government provides ₹ 20.00 per CC towards labour charges. The dimension of a CC field is 5 Mtr. X 5 Mtr. It is very difficult to find a labour in the crop cutting village at the point of our need. Further now-a-days, a labour usually works 5-6 hours & takes a sum of ₹ 300.00 to ₹ 350.00 towards his wages. Starting from crop cutting, threshing & harvesting from a crop field of 5 Mtr. X 5 Mtr. dimension requires a minimum 3 hours labour time. Hence, in all genuineness, labour charges per CC should not be less than ₹ 150.00. Alternatively reduction in dimension of CC field area may also be considered with due enhancement in labour charge.

The problems for crop cutting of paddy after machine cutting

Machine crop cutting of paddy crop is growing significantly in Odisha. Farmers are very reluctant to accommodate CC experiments of Government As a result of this problem, large number of substitutions is taking place. As per sampling technique more than 10% substitution is not desirable. The programme of mini kits distribution of Agriculture Department can be tagged to such farmers in whose field crop cutting is made to come over the problem & encourage farmers. The matter may be taken up with Agriculture Department like the NSS, we can also take help of TV & Radio to motivate the farmers to extend cooperation in crop cutting since this exercise helps in nation building. Co-operation Department can also impress upon the cultivators through their PACS since they are extending loans & other inputs to farmers at primary society level. So, Agriculture Department & Co-operation Department need to sensitize their field staffs for this work.

Strengthening of monitoring at District level

The merger of erst while statistics & planning office at district level is a welcome step of Government since the strength of combined office as well as recognition has been suitably increased providing a better scope for collection of data and conduct of surveys. Quality of data is the primary need for any policy design or any level planning. Further the quality of sample data depends largely on method of selection of sample, identification of sample unit, proper collection, supervision & monitoring. At present, in 15 districts there is one post of Asst. Director, Statistics of OSES Cadre who looks after Statistical work exclusively. In other 15 districts the OSES officers work as Deputy Director (P&S). Since MPLADS / MLALADS & other works of Planning Wing are more public related, much of the time of Deputy Director (P&S) goes on attending to such works & such officers are constrained to give more time for Statistical data quality supervision. So, it is highly essential that in this 15 districts post of A.D (Statistics) need to be put in place & A.D (Statistics) should make 15-20 days field supervision of Statistical data & this should be checked by DES on monthly basis & apply corrective measures as and when required. Field supervision of statistical data to ensure desired quality needs no emphasis.

Consistency check at District level & State level

Basically, the estimates prepared by DES is based on ratio method of estimation. Before furnishing final figure in Form-4, 4(a) it should be cross checked at district level by comparing the area ratio of each crop with last 3 years. In case ratio of a crop is varying more than 20%, the block wise analysis need to be made and blocks having much divergence need to be checked and remedial measures taken. If divergence is genuine, the

reasons of divergence may be collected and reported to DE&S. Similarly, DE&S before taking the data for estimation should make such cross checks and intimate the district for necessary clarification. Similarly yield statistics at district level should also be cross checked in similar way. For RKBY in particular, average yield of every G.P should be cross checked with average yield of last 3 years & in case of inconsistency field enquiry be made & reported accordingly to DE&S.

Non-availability of up to date Maps

The accuracy of the crop data depends upon the use of up to date Maps which is much emphasized by Ministry of Agriculture. In the present system of purchasing maps from Tahasildars, we are facing serious problems since maps are available neither for purchase nor for tracing for years together. Direct purchase from office of the Director Settlement & Map Publications is very costly. Hence it may be taken up with Government and maps may be available to all districts through Joint Director, Central Range, Cuttack. This aspect may be looked into on much priority.

Responsibility of Revenue Authority

In beginning of the implementation of RKBY, only once, the Collectors were sensitised about RKBY crop cutting and its importance. Though a half volume of work of RKBY crop cutting is done by R.Is, no district level functionary like Sub-Collector & ADM monitor the matter. It is the poor D.D(P&S) who run from pillar to post & post to pillar to collect the schedules and therefore unable to enforce any quality. If at least ADM or Sub-Collector becomes responsible to collect such schedules and emphasise to ensure quality at level of R.Is, a lot of improvement can be made in increasing the reliability of RKBY estimates. They should also be asked to submit R.I wise crop cutting programme for web hoisting as a matter of transparency which is usually not happening. It is highly essential that towards end of July at least Chief Secretary or Development Commissioner should sensitize collectors, A.D.Ms & Sub- Collectors and Dy. Director Agriculture on this issue of RKBY insurance in a video conference every year & tell the likely consequences if work is not done properly. This arrangement will go a long way.

Role of unscrupulous people in conduct of crop cutting

Now the pressure is mounting up in field to show much less yield to grab the benefit of insurance. Gangsters/Unscrupulous people are utilised to threaten field workers to show less yield. This grave aspects need to be considered very

carefully. S.Ps of every district should be instructed to sensitize their I.I.Cs to extend pro-active assistance when they are requested for this. Annually a letter to this effect should be issued to all S.Ps/Collectors in signature of Chief Secretary.

Web hoisting of CC programme

The crop cutting programme should be web hoisted at least 15 days before the date of crop cutting & it should be scrupulously followed. Insurance people should be impressed to participate in crop cutting programme as far as possible. Their presence will go along way in improving quality in yield data and come over public pressure in view of RKBY. They were attending the Crop Cutting during the first 2 years of insurance operation i.e. 2011-12 & 2012-13.

Remuneration to field workers for additional crop cutting of RKBY

In EARAS usually 2 no. of Crop Cuttings are taken up in a village & by and large there is one CC village of EARAS in one GP. Hence, in paddy CC, SFS is handling the work load of 2 excess cuts beyond his normal work for R.K.B.Y. Hence, for the additional work load some nominal remuneration should be given to SFS which will boost his morale for work & improve the quality in field data.

Enhancement of FTA

Long long back the FTA of SFS per month was fixed to be ₹ 150.00 and for SFI/SSFI it is fixed to be ₹ 300.00. This amount is quite meagre & does not commensurate with the actual expenditure made by such people. The practice of cycling a long distance is no more prevalent like earlier days. Every field worker spends at least ₹ 2000.00 on petrol for making his field work. This tells upon purse of a low paid employee & hence in all genuineness & taking into consideration present scenario FTA of SFS should be fixed at ₹ 1200.00 & that of SFI / SSFI at ₹ 1500.00 per month.

Problem of Map & Equipment with R.Is & VAWs:

For Paddy crop Gram Panchayat is the unit of yield estimation where as for other crops like groundnut & Jute etc. block is the unit of estimation. Four random cuts are taken for paddy crop per Gram Panchayat & in case of other crops sixteen cuts are taken for block level estimation. For paddy insurance the work load is almost shared on 50:50 basis between RIs of Revenue Department & SFS of Directorate of Economics & Statistics.

Similarly, in case of other crops the responsibilities is shared between VAWs of Agricultural Department & SFS of Directorate, Economics & Statistics. Though it is instructed to make the crop cutting on a scientific basis following EARAS methodology still the actual practice is far from satisfactory because neither the VAWs nor the RIs are provided with maps or other equipments required for crop cuttings.

Re Examining justification of no of crop cuttings

For deriving a reliable estimate at certain level may be at block or at district level, Sample size needed for the purpose is determined basing on observed variance & level of significance .

Symbolically $n = 46^2 \times F \times (1.1) / d^2$

Where n = sample size

6 = the variance observed

d = the level of significance which is normally taken as 5% level

F = design effect

& (I.I) is the factor necessary to raise sample size to compensate for non response.

In case of EARAS estimation the yield rate is formulated at block level for paddy and for other 13 crops the estimate is prepared at district level. Hence in case of paddy the size of sample i.e no of crop cutting experiments required at block level may be once again recalculated and distributed over the crop cutting sample villages. Since majority of area in Odisha is now grown with high yielding paddy and heterogeneity due to variety has significantly been reduced, it is expected that no of cuts for paddy will be less compared to present norm of 2/3/4 crop cuttings per crop cutting village.

Similarly the variability in case of other 13 crops which are estimated at district level should be studied and no of cuts i.e, sample size required at level of individual districts for developing a reliable estimate may be re-fixed. This may reduce our work load and provide scope for developing quality in field work. At least from statistical point of view we can confirm whether we are taking a technically justified sample size.

No need of local paddy crop cutting

In EARAS procedure it is instructed to ensure at least one crop cutting on local paddy in a crop cutting village which is no more a need. It may be stated here that in the all the districts of Odisha more than 90% area under paddy is covered under high yielding variety / improved variety and aggressive farm mechanism has already taken place in our state. In most of the crop cutting villages, 2 no of paddy crop cuttings are made per village. If we stress on one local cut there is scope that the yield rate is pulled back. Hence in case

of paddy the cuts should be totally random without any reference to variety either high yielding or local. The random selection of plots without any restriction will automatically give due representation to local variety where ever grown. One cut of local paddy at crop cutting village level gives more weightage to local variety in changing scenario.

Consumption approach to study reliability of crop statistics

To examine the reliability of crop statistics we can also follow a consumption approach. We have our production statistics, we have our inward & outward flow data through road transport, Railways & waterways. Roughly, in case of Agricultural commodities, 10% is taken towards seed & wastage. Hence net availability of a crop for consumption & storage in a year can be found out. We can take per head consumption statistics of NSS & found out total consumption taking projected population for the year. In this exercise we can see what is net availability and what is the level of consumption which will provide a better idea regarding the reliability of production estimate prepared for agricultural crop either by Directorate of Economics & Statistics or Directorate of Agriculture.

Strengthening of EARAS

In view of foregoing discussions & for a non land record state like Odisha & also in consideration of State's massive peasantry population, the problems and short comings of EARAS should be taken care of & this programme should be suitably strengthened to cover all the crops grown in the State. There is no problem since it is a cent percent central assisted programme & Ministry of Agriculture, Government of India is prepared to supplement additional funding.

An apex committee taking high level officers & experts of Directorate of Agriculture, Experts of Directorate of Economics & Statistics, One / Two professors of Statistics of Utkal University, some Agriculture experts from Odisha University of Agriculture & Technology & representative of Ministry of Agriculture should be constituted which should sit quarterly to see that EARAS collects qualitative data and estimates are in proximity of truth.

Odisha joins National Agricultural Marketing through e-platform. 10 numbers of wholesale mandies in the State are being set up through e-platform to provide better marketing alternatives to producers of Maize, Cotton, Onion, and Coconut & turmeric products.

Registrar, Co-operatives, Govt. of Odisha.

Income Inequality among agricultural households of odisha: A situational study

Smt. Indira Garnaik.

Abstract

This paper is based on raw data of National Sample Survey (NSS) 70th round .All the results have been derived from the combined data of state and central sample over the topic 'Situation Assessment Survey (SAS) Collected during January 2013 to December 2013 .This study focused on income, expenditure and saving propensity of agricultural households of rural Odisha. Ten economic classes have been formed based on Monthly Per Capita Consumption Expenditure of the agricultural households .Analysis on income and saving propensity have been made over these economic classes and social groups.

Introduction

Most of the people of Odisha depend on agriculture .The history of **agriculture in Odisha** dates back to the Rigveda. Agriculture and allied sectors like forestry and fisheries play an important role in contribution to GDP (gross domestic product) of Odisha, with a big share in the workforce. The economic contribution of agriculture to Odisha's GDP is declining with the state's broad-based economic growth. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of Odisha. Thus, development in agriculture holds the key to socioeconomic development of the state.

This paper is based on the raw data of NSS 70th round. The 70th round survey (NSS) collected information on the receipts and expenditure relating to cultivation, farming of animals and non-farm business. Income from wage/salary employment was also recorded for the same period. Based on this information, average monthly income per agricultural household has been worked out by adding up income from wages/salary, net receipt from cultivation, farming of animals and non-farm business. Net receipt was worked out by deducting total expenses from total receipts for each source of income. Expenses included only the actual expenses incurred (out of the pocket expenses) for farm and non-farm business. Imputed expenses in respect of inputs out of home stock or out of free collection as well as receipt in exchange or borrowed were not considered for reporting expenses for the purpose of the survey. Income of the agricultural households from various other non-economic activities such as pension, remittances, etc. were not collected in the survey and not included in the average monthly income presented here.

Source and Description of data

This discussion is based on the combined unit level data of central and state samples of NSS 70th round on Situation Assessment Survey (SAS) of Agricultural households collected by two separate government agencies i.e. National Sample Survey Office(NSSO), Government of India and Directorate of Economics & Statistics(DES), Odisha.

The required data have been collected through stratified multi stage sampling design. First stage stratum is the district and first stage unit (FSU) is census village. The survey, conducted in the rural areas of Odisha with its two visits, was spread over 421 villages covering 3353 households in visit 1 and 3346 households in visit 2. Seven number of sample households is found less in visit 2, due to casualty . Some of the key estimates related to the income, consumption expenditure, and saving as obtained from this survey are presented in this paper. The discussions here are on estimates for the combined period (i.e., the whole agricultural year July 2012 - June 2013)

Objective

The objective of the study is to have a bird's eye view on living standards of farmer's household of Odisha through class wise analysis on income, consumption and saving.

Terminology

Household

A group of person normally living together and taking food from a common kitchen constitutes a household.

Agricultural household

An agricultural household is defined as a household receiving some value of produce more than Rs.3000 from agricultural activities (e.g. Cultivation of field crops, horticultural crops, fodder crops, plantation, animal husbandry, poultry, fishery, piggery, bee-keeping, vermiculture, sericulture etc.) and having at least one member self-employed in agriculture either during last 365 days.

Cultivation:

All activities relating to production of crops and related ancillary activities are considered as cultivation.

Livestock:

Livestock are those animals which are used for food, fibre, labour, etc.

Productive Assets:

Assets represented all the things owned by the household which had money value, e.g. land, buildings, livestock, agricultural machinery and implements, etc. Assets which are used repeatedly for producing goods or providing services are treated as productive asset.

Monthly Per capita Consumption Expenditure (MPCE)

Monthly expenditure on consumption of food and non-food items of a household divided by the household size is defined as MPCE.

Tools and Methodology used:

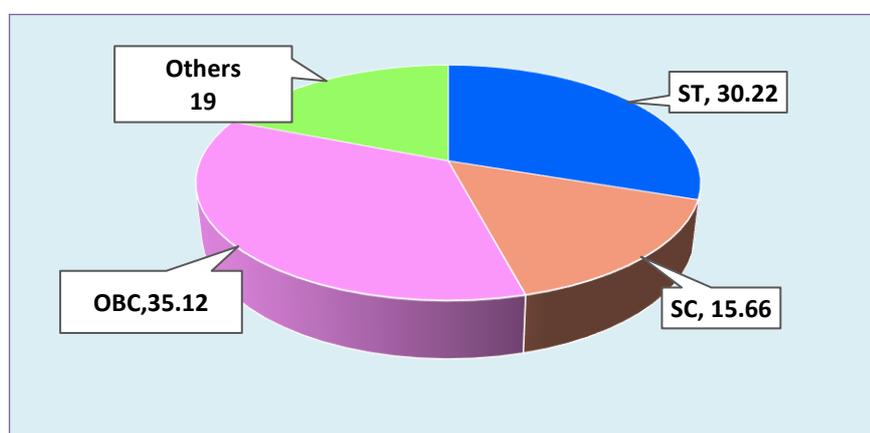
- (i) After ordering the data set chronologically on the variable MPCE it is distributed in ten decile classes. The classes are used as **economic classes** of the agricultural households. Income, consumption and savings of the agricultural households have been analysed over the economic classes.
- (ii) The **Lorenz curve** is a graphical device used to represent distributional inequality. Lorenz curve has been constructed over the economic class wise income distribution showing income inequality among farmers household of Odisha.
- (iii) **Gini co-efficient** is also used for exact measurement of inequality. It lies between 0 and 1. When it increases towards 1 inequality increases. It helps in defining the gap between the rich and the poor, with 0 representing perfect equality and 1 representing perfect inequality. In this paper Gini co-efficient has been used to show the income inequality among farmers household of Odisha.
- (iv) The **average propensity to save (APS)**, also known as the **savings ratio**, is the proportion of income which is saved, usually expressed for household savings as a fraction of household income. It is measured as the ratio of S (saving) and Y (income). The value of APS is generally less than 1, because often a part of income is saved. However there can be situations where $APS = 0$ or even negative. APS is zero when there is no saving out of income and it is negative when $C > Y$, so that saving is negative, here C is consumption. This paper tries to show the living standard of farmer households of Odisha using the APS tool.

Result and Analysis

Agricultural households by Social Groups

Among agricultural households of Odisha major shares are of *Schedule Tribe*(ST) and *Other Backward Class*(OBC) categories i.e. 30.22% and 35.12% respectively .About 19% households are from *Other* category and 15.66 % were from *Schedule Caste* (SC)category. In the following part of this paper , discussions has been made on source of income ,average monthly income ,consumption expenditure, saving and income inequality by various social group and economic class.

Figure 1 : Percentage distribution of agricultural households by social group in rural Odisha



Source of income

Table1 : Social group wise distribution of agricultural households by major source of income during last 365 days (Rural Odisha)

Social group	per 1000 distribution of households by major source of income					
	Cultivation	livestock	Other agricultural activity	Non_ agricultural enterprises	Wage/Salaried employment	Others
Schedule Tribe	775	7	2	21	170	25
Schedule caste	571	21	21	128	211	47
Other Backward Class	664	16	10	121	155	34
Others	666	14	6	70	207	37
ALL	683	14	8	82	178	34

Table 1 illustrates social group wise per thousand distribution of agricultural households by major source of income .For all social groups cultivation has a large share in the major source of income .In case of Schedule tribe cultivation is the major source of

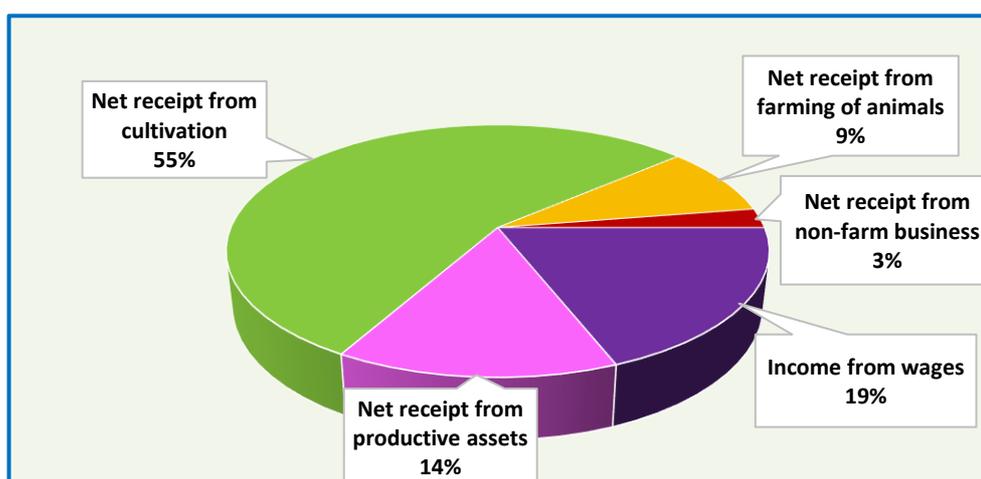
income for 775 households (per thousand) and it is 666 and 664 for others and OBC categories respectively.

Average Monthly Income by major sources and Consumption Expenditure

Table-2 Social group wise average monthly income and consumption expenditure (in Rs.) per agricultural household in Odisha.

Social Group	Income from wages and salary	Net receipt from productive assets	Net receipt from cultivation	Net receipt from farming of animals	Net receipt from non-farm business	Total income	Total consumption expenditure
Schedule Tribe	1359.63	76.61	2658.83	860.36	113.99	4992.82	3443.79
Schedule caste	1252.48	72.6	1712.07	610.06	432.49	4007.1	3969.23
Other Backward Class	1180.37	1915.63	2385.45	677.35	1079.01	5322.19	4847.65
Others	1816.61	480.98	1812.45	607.84	839.8	5076.7	5784.74
ALL	1366.92	799.83	2253.26	708.71	641.54	4970.44	4465.89

Figure 2 : Percentage distribution of monthly income (Rs.) by major source for agricultural household in Odisha



The average monthly income from different sources and average monthly consumer expenditure per agricultural household for each social group has been presented in table 2. The average monthly income per agricultural household of Odisha was estimated as ₹ 4970.44. Figure 2 depicts 55 percent of the average monthly income per agricultural

household was estimated to have generated from cultivation and 9% from farming of animals. About 19 percent of the average monthly income per agricultural household was contributed by wage/salary employment. Net receipt from cultivation is comparatively more for agricultural households of all social groups.

Average Monthly Income and Consumption Expenditure per agricultural household by economic classes

Table 2.2: Social group and MPCE Decile Class wise average monthly income and consumption expenditure per agricultural household of Odisha

Economic Class	Schedule Tribe		Schedule Caste		Other Backward Class		Others	
	Income	Expenditure	Income	Expenditure	Income	Expenditure	Income	Expenditure
1	3831.06	2501.45	6130.87	2301.97	3925.93	2649.28	3230.29	2515.5
2	3498.71	2893.62	6197.05	2612.51	5012.04	2604.94	2704.38	2844.71
3	2734.7	3028.13	2631.71	3312.38	3334.31	2978.47	4435.36	3388.06
4	3506.99	3332.12	3645.79	3510.89	3395.58	3189.12	3884.09	4089.01
5	4716	3222.99	3153.14	3449.07	4455.99	3680.13	3361.43	3901.61
6	5412.18	3608.85	5580.62	3938.4	4277.41	4284.74	4696.39	4046.02
7	4636.05	3453.83	2750.99	4047.49	3985.84	5065.1	3264.97	4286.78
8	10277.8	4839.76	4051.35	4161.7	4926.21	4880.91	5592.83	4588.52
9	9830.81	4351.74	2852.8	5893.35	7041.4	6325.9	6463.63	4688.27
10	8504.44	6508.82	2545.96	5763.05	10011.7	8532.69	6518.57	9514.83
All	4992.82	3443.79	4007.1	3969.23	5322.19	4847.65	5076.7	5784.74

Figure 2.2 : Economic class wise average monthly income and consumption expenditure per agricultural household for rural Odisha

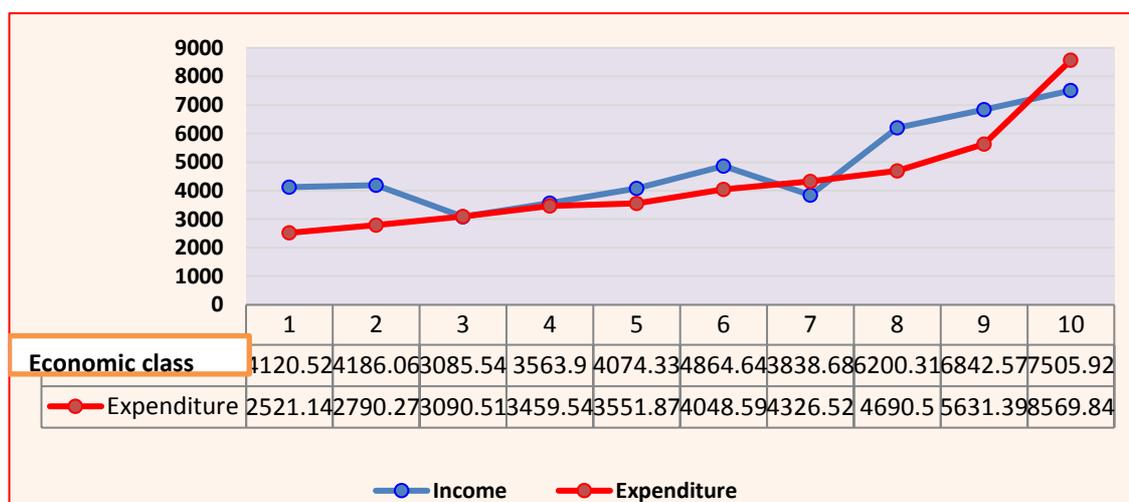


Table 2.2 shows Social group and Economic Class wise average monthly income and consumption expenditure (in Rs) per agricultural household of Odisha .In case of some economic classes like 3rd,7th and 10th expenditure incurred is more than income .This may happens as income of the agricultural households from various other non-economic activities such as pension, remittances, etc. were not collected in the survey and not included in the average monthly income .The average monthly consumption expenditure per agricultural household in Odisha was estimated at Rs. 4465.89.Figure 2.2 shows Economic class wise comparison between average monthly income and consumption expenditure per agricultural household of Odisha. In some economic classes there are some remarkable observations that expenditure is more or equal to income, which is a bad indicator of farmers living standard.

Social group wise Saving and Average Propensity to Save

Table 2.3: Social group wise average monthly income, consumption expenditure and savings (in Rs) per agricultural household for Odisha

Social Group	Income	Consumption expenditure	Savings	APS
Schedule Tribe	4992.82	3443.79	1549.03	0.31
Schedule caste	4007.1	3969.23	37.87	0.01
Other Backward Class	5322.19	4847.65	474.54	0.09
Others	5076.7	5784.74	-708.04	-0.14
ALL	4970.44	4465.89	504.55	0.10

Table 2.3 shows on Social group wise average monthly income, consumption expenditure, savings (Rs.) and propensity to save per agricultural household of Odisha. In economics, the **average propensity to save (APS)**, is the proportion of income which is saved. The average monthly income of Schedule Tribe category is Rs.4992.82 whereas its average monthly consumption expenditure is Rs.3443.79.Highest saving is found for schedule tribe category i.e. Rs.1549.03 accordingly highest APS (saving/income) is also found for this category i.e. 0.31. The average monthly consumption expenditure per agricultural house hold of 'others' category was about Rs. 5785 while its average monthly income was Rs. 5076. Here it is found that average monthly saving is negative for 'other' category i.e. Rs. (-708.04) and the APS is -0.14. From table 2.3 it is observed that economic condition of farmer households of Odisha is miserable as their expenditure is almost equal or less than income and saving is found very negligible or negative.

Figure 2.3 : Social group wise average monthly income , consumption expenditure and savings(Rs.) per agricultural household for Odisha

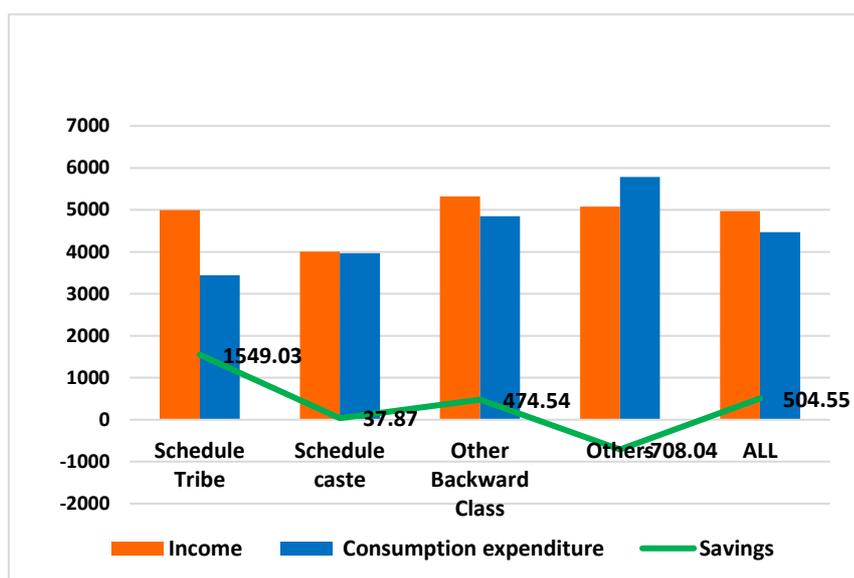


Table-3 Gini coefficient showing inequality in income distribution among agricultural households of rural Odisha

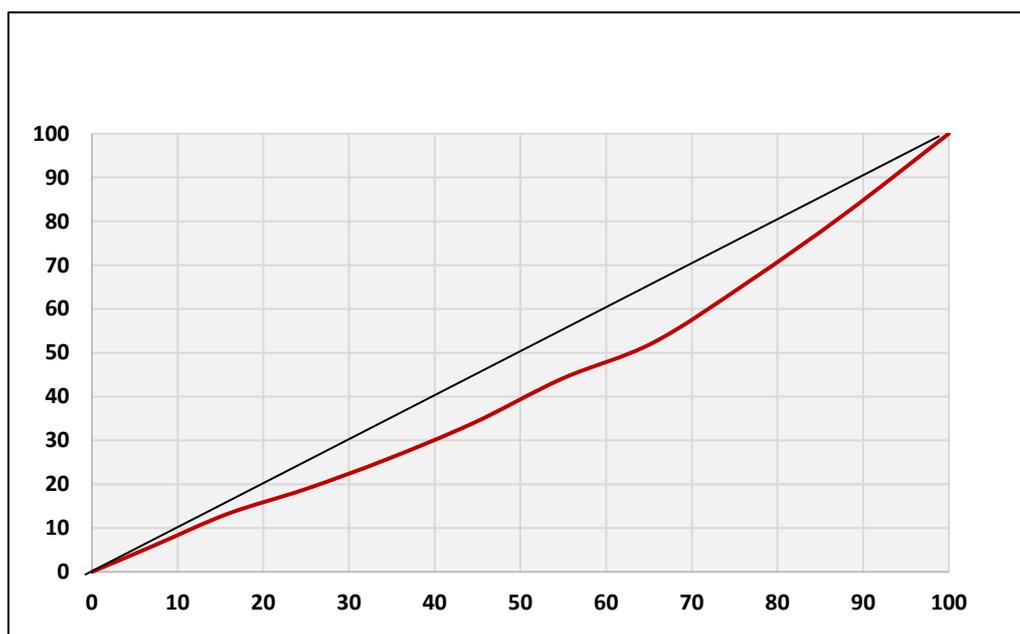
Social Group	Gini coefficient
Schedule Tribe	0.22
Schedule caste	0.1
Other Backward Class	0.18
Others	0.13
ALL	0.15

Income Inequality

Table 3 and figure 3 shows the income inequality among agricultural households of rural Odisha. The **Lorenz curve** is a graphical device used to represent distributional inequality. Here it shows the income inequality. In figure 3 the x-axis records the cumulative proportion of households ranked by income level. The y-axis records the cumulative proportion of income. If income was equi-distributed across a population (i.e. everybody had the same income), graph of the underlying income distribution would be the equidistribution line. But here inequality is found in income distribution which means poor households own less than an equidistributed share of total income and richer households own more than the same equidistributed share. Therefore, the Lorenz Curve is the convex curve as depicted in Figure3. The **Gini coefficient** is a numerical measure of

inequality based on the **Lorenz curve**. It helps in defining the gap between the rich and the poor, with 0 representing perfect equality and 1 representing perfect inequality. Table 3 depicts, among all social categories, Gini coefficient is comparatively more in case of Schedule tribe category i.e. 0.22 .It implies that income inequality is more among the farmer households belonging to Schedule Tribe category. Among all categories less Gini coefficient is found for Schedule caste category i.e.0.1 showing less income inequality for this category.

Figure-3. Lorenz curve showing income inequality among agricultural households in rural Odisha



Conclusion

This paper concludes that, economic condition of farmer households of Odisha is alarming, as in some of the cases the expenditure is almost equal or less than income from economic activities. Also saving is found very negligible or negative. Inequality in income distribution among farmer households of Odisha is also a bad indicator for the growth of agriculture in Odisha. According to NSSO report of 70th Round, the national average monthly income of an agricultural household is Rs.6,426/-.But here it is found that the average monthly income of an agricultural household in Odisha is Rs.4970/- which is well below than the estimated national average of Rs. 6426/-.As a result, diversification of people from farming to non-farming sector is found in Odisha. Now farmers are realizing the uneconomic characters of agriculture. The problem is acute as youths are in search of non- farming profession. Steps should be taken, to bring in a shift from the present level of subsistence agriculture to a profitable commercial agriculture so that people would accept agriculture as a vocation. Action should be taken for raising productivity to double farmer’s

income. Raising productivity requires massive investments in R&D, irrigation and fertilisers. We should try to enhance productivity of important crops at least to match with national average by enhancing seed replacement, availability of quality planting materials, water management, farm mechanization and technology transfer.

In Odisha, the agricultural advances by banks grew by 9.46% in 2014-15 over 2013-14. The share of agriculture sector advances to total advances by banks was 29.38% in 2014-15 as against the bench mark norm of 18%. Agriculture continue to be the high priority sector for Odisha.

139th State level Banker's Committee, Odisha, March, 2015

Indravati Project vrs Kalahandi syndrome : Green revolution revisited

Sri Bimbadhar Sethy

The economy of Kalahandi is largely agrarian in nature. Over the years there is sea of changes in the sector bringing transformation in the socio economic condition of the region. However before going in to the present scenario the past need to be analyzed.

The undivided Kalahandi district (present Kalahandi and Nuapada district) was infamous for drought, child selling & malnutrition and starvation deaths. The social activists referred to it as 'Kalahandi Syndrome'. In regular intervals there was frequent drought and famine situations, particularly during 1965-66 and late 80s the region experienced severe famine like conditions. However, in the present Kalahandi district, in the plain areas in the bank of Rivers, there used to be reasonably good production of different crops particularly paddy, pulses, oil seeds and millets depending on monsoon. The Dharamgarh sub division of the district which was getting good early monsoon rain was surplus in production. It was known as Pahil Pahar area considering the early rain fall it was receiving. In the absence of flow irrigation, farmers were adopting traditional water bodies like Kata, Munda, Bundh etc. in different locations, both for irrigation and for day-to-day use. Incidentally during the Great Bengal famine Kalahandi was able to supply 1,00,000 tons of paddy from its surplus for the survival of the distressed famine affected people.

Kalahandi is having rich heritage in farm sector. From Neolithic period, the tradition has come down to the current stage. Shifting cultivation or Podu Chas (also called Dongar Chas, Kudki Chas or Kudu Chas) was widely practiced by the tribal farmers in the hilly areas of the district. According to a survey of watershed department, 29 GPs under Lanjigarh, Th.Rampur and M.Rampur blocks are most affected by Podu cultivation. The vegetation on the hill tops and slopes are cut during the months of January and February and are left there to dry. Towards the end of April or the beginning of May the trees are burnt and the ash is spread over the land. On the approach of rains the patch of land is ploughed if the slope is moderate or worked by manual labor with the help of spades, if the slope is steeper. Various crops, often in mixed pattern, are grown on the fields so prepared. Maize, Jower, different types of pulses, oilseed and minor millets are generally grown in the fields. The fertility of the piece of virgin land so reclaimed lasts for about two to three years after which its cultivation is given up and the farmer shifts to a fresh patch and repeats the process. Podu cultivation lead to depletion of valuable forest wealth affecting

environment, where as the income generated from such cultivation is quite inadequate and can sustain the need of the farmer's family for few months only. After independence, Government have taken up many schemes like allotment of land for horticulture, plantation of fruit bearing trees, technology transfer etc to dissuade tribal people from shifting cultivation.

Kalahandi is proud of different traditional varieties of paddy and other crops. With the introduction of HYV (High Yielding Variety) and hybrid varieties, many of the traditional varieties have disappeared. A survey has revealed that 134 varieties of non-scented and 64 varieties of scented rice have been identified in the district in the year 2013-14. Although many varieties have faced extinction over the period of time the cultivation of the scented varieties are still in practice in a limited scale. Few of the popular varieties of scented rice are Tulasikanthi, Kalkati, Tulsibas, Laxmibilas, Kalajira, Jira Manji, Jagannath, Balabhadra, Kala Krushna, Baigan Manji, Laxmibhog, Mohanbhog, Lal parijat, Maharaja, Jabakusum, Parvatjira, Banchabhog, Yuvraj, Karpurjira, Jaigopal, Gopalbhog, Ganeshbhog, Kalachampa, Thakurbhog, Sitabhog, Kalia, Bas Tulsi, Mitimiti, Pruthiraj etc. Similarly many non scented varieties of Paddy cultivable in short and long duration are still in practice. Some of these are Setka, Saria, Pora dhan, Dasara mathia (short duration), Asamchudi, Harishankar, Mahipal, Galei, Puagi, Sapuri(long duration) to name a few. Most of these varieties are pest, disease resistant and drought tolerant. Varieties like Cherguda, Harishankar are good for value addition in the shape of preparation of Chuda, Mudhi etc. With the special effort of Agriculture department 91 scented and non-scented varieties of paddy have been short listed and the samples have been sent to state seed testing laboratory, Bhubaneswar for evaluation and registration. Out of these, 55 varieties have been registered in 2014-15 against the name of concern growers of the varieties. Besides Paddy, many types of crops of local varieties like Jhari , Kodo, Gurji, Kang, Khosla, Ragi, Jowar (minor millets), Maize(millet), Mung, Biri, Kandul ,Kulthi, Lentil, Khesari, Kating, Jhudung, (pulses) Linseed, Nizer, sunflower, Mustard (oil seeds), Sugarcane, Tobacco, Mesta (commercial crop) etc. are grown in the district in the past and are still in practice at present. A variety of rice called 'Paser Dhan' (Paser Paddy) grows in water automatically and generally eaten by fasting people. This rice is used for preparation of pressed rice (Chuda). Both the items have a very sweet taste. Since two decades, cotton cultivation in the non irrigated black cotton soil has come up immensely from 5000 ha in 1996 to 46152 ha. in 2015. The major Cotton growing blocks are Bhawanipatna, Kesinga, Golamunda, Narla and Lanjigarh.

With the introduction of Indravati project Kalahandi has gradually ushered in to an era of green revolution. After the foundation of the project was laid in the year 1978 it took about 20 years to start irrigation. Since then the project has changed the landscape of southern Kalahandi, leading to two crops a year. The project consist of The water released from the Power House is carried dams over Indravati River and 3 of its tributaries, 8 dykes and power house. The water from the reservoir is released through a tailrace of 900 meters long and finally picked up by the Mangalpur Barrage on the River Hati to irrigate 1,28,000 hectares through Left and Right Canal. Under Accelerated Irrigation benefit programme extension of Left and Right canals are in progress to create additional ayacut of 10,224 hectare beyond Tel River and 15,260 hectares beyond Sagada River respectively. Apart from it under Mega Lift Irrigation Scheme Lift Canal System to irrigate 26,248 hectares in Koksara and Dharamgarh blocks work is in progress. The major beneficiaries of the project till 2016 are Kalampur, Jaipatna, Dharamgarh, Junagarh and Golamunda blocks. The Right canal extension work and the lift canal construction of the project is in progress. On completion of the Right canal extension work it will benefit Bhawanipatna and Golamunda blocks and the Lift canal will benefit mostly Koksara block. Indravati project has boosted the highest number of rice mills in Kalahandi among all the districts in Odisha.

Besides invoking green revolution in the Indravati Aycut area of Indravati project in Jaipatna, Kalampur, Junagarh, Dharamgarh blocks of the district the impact have also been felt in non irrigated blocks of the district. This saw progress in the field of Paddy, Cotton, Maize, pulses and oil seeds and the district is in the green revolution phase.

It may be noted that during pre-Indravati period the irrigation potential of the district was 93400 ha during Kharif & 16624 ha. during Rabi but after construction of the project the irrigation potential of the district has increased many fold i.e. to 145305 ha. in Kharif & 105632 ha. in Rabi. As per report of Agriculture department the paddy coverage in Kharif has increased from 1,84,736 ha. in the year 1994 to 1,90,000 ha in the year 2014 . Similarly in rabi from 1034 ha. in 1994 to 65409 ha in 2014. Likewise the productivity of paddy has increased from 12 qtl./ha to 42.2 qtl./ha during Kharif & from 15 qtl./ha. to 42 qtl./ha.in Rabi during this period.

There is substantial increase of marginal farmers, small farmers and total numbers of farmers from 1984 to 2015, whereas the number of big farmers (possessing one full ceiling of land) has decreased during this period. The number of marginal farmers is 64751 in 2015 as against 35917 in 1984, the number of small farmers is 42516 and 28657 and the number of big farmers is 54820 and 63534 respectively. Thus the total numbers of farmers has

reached 162087 in the year 2015 as against 128108 in the year 1984. There is substantial change in land use pattern, change in cropping pattern, mechanization process, seed replacement ratio, agro based industries etc in the district after Indravati. Now Kalahandi is the 2nd highest rice and Maize growing and the highest Cotton growing districts of the state. It is also immensely contributing in the field of Pulses and oil seed production.

Alternative Land use found in the district during kharif season of 1994-95 & 2014-15/2015-16.

Sl. No.	1994-95		2014-15	2015-16
	Crop	Area in ha	Area in ha.	Area in ha.
1	Paddy	184,736	190,000.0	180403*
2	Maize	8,862	82089	59302 *
3	Millets	17,082	22084	22290
4	Pulses	95,432	83,341	83777
5	Oilseeds	41,589	16,268	15021*
6	Vegetable	19,052	29,702	26615*
7	Cotton	1,358	44,677	46152
8	Spices	2,227	2,531	2308*
9	Sugarcane	2,996	2,017	2161
	Total	374,965	391,354	438029

*2015-16 is drought year

Cropping pattern & crop rotation

Paddy is the main crop which alone accounts for 60% of gross cropped area of this district. Other crops are wheat, bajra, jowar, cotton, maize, ragi and pulses. Rice is the staple food of the people. Major maize growing areas are Thuamal Rampur, Karlamunda, Lanjigarh, Madanpur Rampur, Narla, Kesinga and Jaipatna. Ragi is cultivated mainly during kharif season. Jowar is cultivated mainly in hilly slopes by the tribal people. Til is grown on high lands (bhata) both in rabi and kharif seasons. Sugarcane is cultivated in a limited scale in the irrigated pockets, on river banks and in homestead lands. Thus about 29 and about 27 varieties of crop are grown in Khariff and in Rabi respectively.

The cropping pattern indicates that paddy, cotton, oilseeds, pulses and vegetables are the main crops and the cropping intensity has reached 167%.

Seed Replacement Rate (SRR)

In the field of replacement of seeds the district is now the leading district in the State. The detail of SRR from 1994 to 2015 is given in the Table below.

Seed replacement rate(SRR) in rice (Khariff)

Year	Quantity (Qtl.)	SRR (%)
1994	2373	1.71
1995	3590	2.57
1996	5249	3.81
1997	9105	6.31
1998	14339	10.7
1999	15598	11.4
2000	6086.8	4.4
2001	14582	13.0
2002	5991	5.8
2003	-	8.9
2004	-	7
2005	-	10
2006	13870	14.56
2007	18006	19.02
2008	25057	27.49
2009	46059	54.37
2010	40647	51.22
2011	48411	43.2
2012	53217.3	50.11
2013	56351.26	65
2014	67621.4	64.15
2015	73407	73.02

Processing and Storage

Kalahandi district is one of a major paddy procuring district in the state. About 500 lakh qtl of paddy is being procured from the farmers of this District every year through the state procuring Agencies like OSCSC, TDCC etc. The paddy is being milled through the Rice Millers. Prior to Indravati project there were only 12 rice mills in the district and now there are 130 rice mills. Out of these units as many as 78 Rice Mills are involved in procurement. The Rice is being stored in the FCI, OSWC, RRC-DSC godown of this district, the storage capacity of all godowns is about 900000 qtl.(Table IV-23) The resultant rice from the paddy of 50.00,000 Qtl. of paddy comes to 34,00,000Qtl. The yearly consumption of rice towards Public Distribution System of the District comes to 80,000X12=960000 qtl. The

requirement of PDS is being met out of the own procured rice and rest 2440000 qtl. is being dispatched/ supplied to other District and States as per their requirement.

Agriculture Credit:

Three types of loans are provided to the farmer of Kalahandi to meet their financial requirement.

1. Short term loans.
2. Medium term loan.
3. Long term loan.

The advance to Agriculture in Kalahandi district has increased from Rs. 645.1 Crores in the year 2013-14 to Rs. 812.68 Crores in the year 2014-15 due to the popular “interest Subvention Scheme” on Agriculture Term loan. In the 2015- 16 Kharif the volume of Agriculture term loan was Rs 220.12. This reflects that commercial bank plays the vital role in advancing the credit to Agriculture in Kalahandi district. The farmers also are given the scope for crop insurance. This scheme is undergoing a change for the benefit of the farmers. There is great potential in the districts for Dairy, Pisciculture and Poultry farming. Specific thrust is required under farm mechanization, plantation, cash crop cultivation and horticulture where performance must be improved.

Agricultural credit is an important input for improving agricultural production and productivity and mitigating farmer distress in the district of Kalahandi.

Paddy procurement Automation System (P-PAS) is operative by which the registration of farmers and procurement of paddy is computerized. The information is available in the internet. The value of the sale of paddy is e-transferred to the account of the farmer in the declared bank.

Agriculture Implements and Mechanization

Mechanization has been well received in Kalahandi as one of the important elements of modernization of agriculture. It is also evident that farm power input has to be increased further to achieve higher food grains production, the composition of farm power from different sources to be properly balanced to meet its timely requirements for various farm operations. Mechanization of cultivation of various crops has also shown a steady increase over the years as the power availability on the farm increased. The availability of farm power is 1.8 kW/ha which is quite less than the average farm power availability in

India (2.02 kW/ha). Productivity and unit power availability is associated linearly. Power is needed on the farm for operating different tools, implements and during various farm operations. Mobile power is used for doing different field jobs, while the stationary power is used for lifting water and operating irrigation equipment; operating threshers, shellers /decorticators, cleaners, graders and for other post harvest operations. The mobile farm power comes from human, draught animals, power tillers, tractors and self- propelled machines; whereas the stationary power is obtained from oil engines (diesel, petrol and kerosene) and electric motors. The draught animal power and human muscle power still remain major power sources for agriculture in the district. Mechanization is being introduced through various sponsored schemes and it is taking place gradually. There is a trend to opt for self-propelled and small power operated equipment and power tillers by the farmers. The government has carried out many popular programs under work plan on Agriculture under Macro Management Scheme. The equipment to be popularized under Agricultural Mechanization Work Plan of the State Government are tractors, power tillers, tractor operated Rotavator, self propelled reapers, power operated equipment for horticulture, bullock drawn/ manually operated implements.

Special centrally sponsored scheme of national food security mission to increase production and productivity of Rice, Pulses & Cotton in a sustainable manner, agricultural technology management agency with an aim for new institutional arrangement, Rastriya Krushi Vikash Yojana, Horticulture Mission are some of the special schemes in operation to improve agricultural sector and farmer's economy in the district. Kalahandi is progressing on the path to be the food basket of the state in the near future.

Biju Krushaka Kalyan Yojana(BKKY), launched in 2013-14 in Odisha covered 55 lakh farmer families in 2014-15 is providing financial support through health & accident insurance. This is an inspiring step forward to farmers welfare in Odisha.

Odisha Economic Survey, 2015-16

Changing Cropping Pattern in Odisha

Sri Rama Krushna Satapathy

Abstract

The key objective of this study is to analyse the area under different crops variation in agriculture sector from 2004-05 to 2014-15. Crop diversification signifies practicing of multiple cropping systems which is also an integral part of structural transformation of an economy. Data related to study were collected from DES and DAFP, Odisha, Bhubaneswar. It has also been noticed that the level of area diversification under different crops in the State have shown an increasing or decreasing trend during the study period.

Introduction

The economy of Odisha is fully dependent on agricultural up-liftment. Agriculture supports a large segment of population by providing opportunities for employment and earning a livelihood. Near about 70 per cent of families living below the poverty line (1997 BPL list of Government of Odisha) and out of the total working population 23.40 per cent are cultivators and 38.42 are agricultural laborers (Census of India, 2011). Furthermore, frequent recurrence of drought and flood has created situation like starvation, epidemics and mass migration in the districts. Therefore, the present study has attempted to measure the changing of area index number of different agricultural crops in the district over ten years.

Base Period

Base period should be recent enough to have a meaningful comparison. If the time difference between the current year and the base year period is longer, it will be more difficult to interpret the index number series as satisfactory indicators of area, production and productivity. As a way of updating the base to a nearby year and keep it in harmony with the other series of indices such as Index of Industrial Production, Whole Sale Price Index and series of National Accounts Statistics and the area in Agriculture head are fluctuating a great deal from year to year, the average of area over the triennium ending 2006-07 is taken for determining the base level of area against which the area of the succeeding years is to be compared.

The base period should preferably be one which is used for other allied series of index number, so that comparison with other series/sectors of the economy or their joint use in economic analysis, economic planning and policy making is facilitated.

Coverage

The present series of index numbers are prepared for 22 important crops, which cover about 90% of the total cropped area of the state. Other crops have not been taken into account due to non-availability of reliable statistics on those crops covered under the series have been classified into two main groups viz; (i) food crops (ii) Non-Food Crops.

- i. The food crops are further divided into two sub-groups viz; (a) cereals and (b) pulses.
 - a. Crops like rice, jowar, bajra, maize, ragi, wheat and small millets are classified as Cereals and
 - b. tur, gram, mung, biri, kulthi and other similar crops as pulse.
- ii. The Non-food crops are also classified into three sub-groups namely
 - a. Oil seeds, (b) Fiber and (c) Miscellaneous crops.
 - a. Fiber crops such as cotton, jute and mesta are classified under category and
 - b. Other crops like sugarcane, tobacco, potato, chillies (dry) and ginger (dry) are segregated as miscellaneous crops.

I. The indices of area under crops for all individual crops as well as groups and sub-groups are worked out directly from area under them in different years. Thus there is inmate weight of in the proportion of the area under individual crops to the area under those crops to the base period.

The index number of net area sown and cropping intensity are un-weighted indices.

Sources of Data

The area estimates of paddy, potato, ground-nut, til, mustard, jute, sugarcane, wheat, maize, ragi, mung, biri, kulthi and nizer prepared by the *Directorate of Economic and Statistics* are used. The figures in respect of 13 other important crops namely; jower, bajra, small millets, tur (Arahar), Gram, other pulses, linseed, caster, chillies, ginger, cotton, tobacco and mesta are taken from the *Directorate of Agriculture & Food production, Odisha*.

Concepts

- i. The index no. of area under crops are computed on the basis of gross area.
- ii. The index no. of net area sown is based on the aggregate gross area sown minus area under double or multiple cropping. It includes all food and non-food crops.

Methodology for Index Number of Area under different Crops

The weighted arithmetic average is used for calculating the index number. No explicit weightage is given to different crops for calculating composite sub groups, groups and all crops indices. The indices relating to 22 crops are calculated using the following formula.

Let a_{ijk} = the area under i^{th} Crop in the j^{th} year in k^{th} state.

A_{jkiok} = the area under i^{th} Crop in the base year period in k^{th} state.

For the state k and for the year j , individual crop indices are calculated as below:

$$\text{Index number of area} = \frac{a_{ijk}}{a_{iok}} \times 100 = IA_{ijk}$$

For any sub group-wise, group-wise for different groups of commodities, the indices for the j^{th} and state k are calculated as below:

$$\text{Index number of the area} = \frac{\sum a_{ijk}}{\sum a_{iok}} \times 100$$

The indices worked out crop-wise, sub group-wise, group-wise for different groups are given in Appendix-II.

Analysis of Indices of Agricultural Area

The Index Number of area under different crops in Odisha for the period from 2004-05 to 2014-15 are given below.

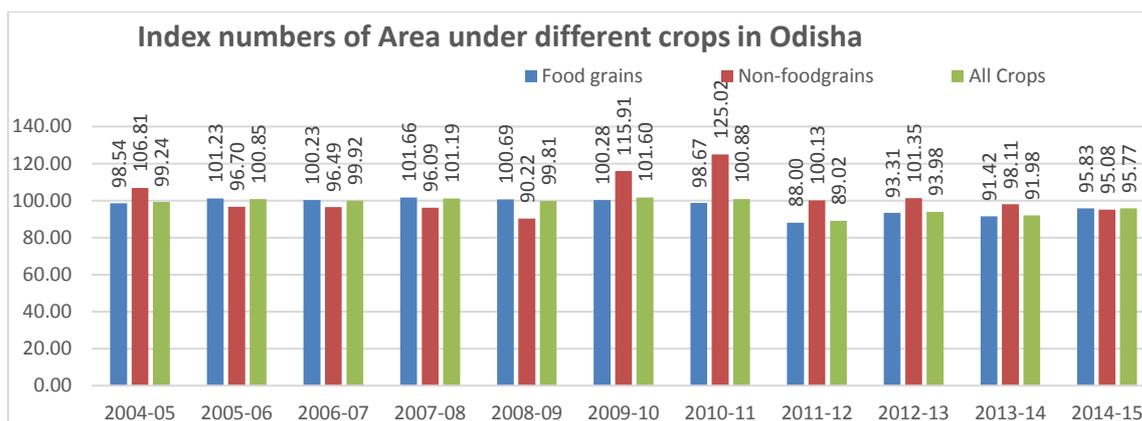


Table -1 : *Index numbers of Area under different crops in Odisha for the period from 2004-05 to 2013-14 with Triennium ending year 2006-07 as base*

Year	Food grains	Non-food grains	All Crops
2004-05	98.54	106.81	99.24
2005-06	101.23	96.70	100.85
2006-07	100.23	96.49	99.92
2007-08	101.66	96.09	101.19
2008-09	100.69	90.22	99.81
2009-10	100.28	115.91	101.60
2010-11	98.67	125.02	100.88
2011-12	88.00	100.13	89.02
2012-13	93.31	101.35	93.98
2013-14	91.42	98.11	91.98
2014-15	95.83	95.08	95.77

Food Grains:

The index number of area under food grains presented in column 3 of Table –I show that there was no wide variation in the index number of area over years. In the series, the lowest was 88.00 in 2011-12 and highest was 101.66 in 2007-08. It may be added that Rice covered major portion of the area under food crops.

Non-Food Grains

There is significant variation in the Index number of area in the series. It varies between 90.22 during 2008-09 and 125.02 during 2010-11.

All Crops:

There is no wide variation in area index of all crops combined in the series. It is highest i.e. 101.60 during 2009-10 and lowest i.e. 89.02 during 2011-12.

Index number of area under different sub groups for the period from 2004-05 to 2014-15 with triennium ending 2006-07 as base is presented in Table no.2

Figure 2 : Area under different sub groups for the period from 2004-05 to 2014-15

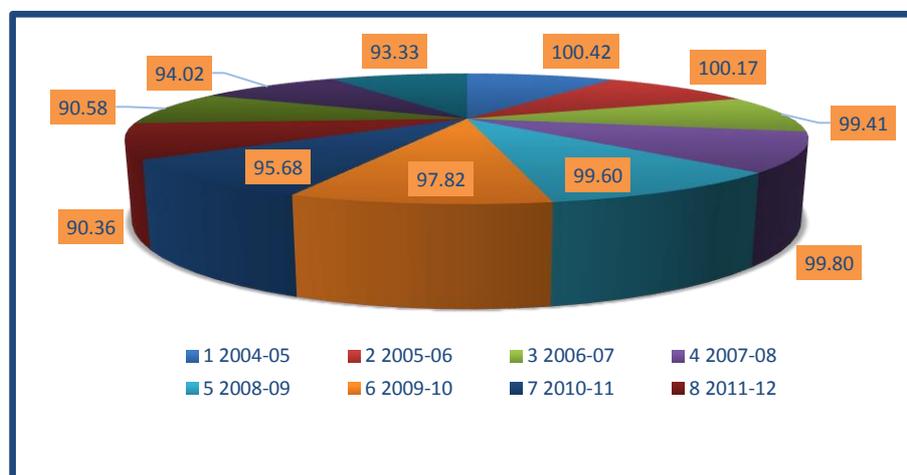


Table -2 : Sub-Group wise Index numbers of Area under different crops for the period from 2004-05 to 2013-14 with Triennium ending year 2006-07 as base

Year	Cereals	Pulses	Oil Seeds	Fibres	Non-foodgrains	All Crops
2004-05	100.42	86.89	114.30	92.65	106.81	99.24
2005-06	100.17	107.82	95.31	101.47	96.70	100.85
2006-07	99.41	105.29	90.39	105.88	96.49	99.92
2007-08	99.80	113.15	92.85	95.96	96.09	101.19
2008-09	99.60	107.42	85.11	98.16	90.22	99.81
2009-10	97.82	115.55	124.85	116.91	115.91	101.60
2010-11	95.68	117.15	141.38	111.40	125.02	100.88
2011-12	90.36	73.43	88.28	141.18	100.13	89.02
2012-13	90.58	110.22	85.81	155.51	101.35	93.98
2013-14	94.02	75.30	78.78	159.93	98.11	91.98
2014-15	93.33	110.08	74.56	159.93	95.08	95.77

Cereals

The index numbers of area under “Cereals” show a decreasing trend from 2004-05 (100.42) to 2006-07 (99.41). It increased to 99.80 during 2007-08 and again showed a decreasing as well as increasing trend i.e.99.60 to 97.82 during 2008-09 and 2009-10. From 2009-10 to 2014-15, slight decreasing variation was observed in the index number.

Pulses

The index number of area under “Pulses” shows an increasing trend from the every alternative year. From 2004-05 to 2010-11, no wide variation was observed in the series of index numbers, it was highest i.e. 117.15 during 2010-11 and the lowest i.e. 75.30 during 2013-14.

Oil Seeds

The index number of area under “Oil seeds” has shown a declining tend from 2004-05 till 2008-09. The highest area index of 124.85 was in the year 2009-10 and the lowest of 74.56 in 2014-15.

Fibers

The index number of area under “Finer crops” significantly increased trend from 92.93 to 105.88 in 2004-05 to 2006-07. A sudden fall i, e, 95.93 & 98.54 was observed during 2007-08 and 2008-09 and then it regained in 2009-10. The highest of 159.93 was observed in 2013-14 and 2014-15.

Non Food Grains

The index numbers of area under “Non food grains” show an decreasing trend from 2004-05 (106.81) to 2008-09 (90.22) and then sudden increasing 115.91 and 125.02 during the year 2009-10 and 2010-11 and again slight decreasing variation for the year 2011-12 onwards.

All Crops

The index number of area under “All crops” has remained more or less static with little variation during the period from 2004-05 to 2009-10. In the series the lowest area index was 89.02 in the year 2011-12 of the highest of 101.15 was observed in 2009-10.

Conclusion

In order to study the rate of increase in agricultural sector in every sphere, an index number is essential to derive frequently in short interval with scientifically which reflects a clear picture relating to useable area under different agricultural crops of the state.

Suggestion

- ✓ Since index of area under different crops are decreasing, efforts may be made for more production and productivity.
- ✓ Farmer should be sensitized to adopt best agricultural practices at regular intervals.
- ✓ Besides, proper marketing/storage facility need be developed.

The average annual income of the medium farmer net of production costs from cultivation is less than 20,000 in 17 States including Odisha.

NSS,SAS Round 70, Indian Economic Survey, 2015-16 Page-73.

Feminization of Agriculture: A challenge for Rural Women of India

Dr. Aliva Mohanty,

Introduction

The economy of India is predominantly agriculture oriented. The majority of the Indian workers are agricultural labourers who constitute the major segments of rural work force. With the rural population of 741 million (73.3 per cent of the total) India continues to live in villages (6,07,491 villages in 592 districts). Indian women population stands at 496 million out of the total population of 1027million, thus accounting for 933 women for every 1000 men.2011 Census reveals that there were 72 million female workers as compared to 240 million male workers, indicating a smaller work force of women in the economy.

Female economic activity rate was 42.2 per cent and it is only 50 per cent of male economic activity rate of the country. The rural women are largely contributing to the nation's economy, which is mainly based on agriculture and allied sectors. The labour force participation rate of women is 31.56 per cent as compared to men's rate of 68.44 per cent.

Agriculture from Gender Lens

Agriculture is found to be highest employer of women's labour to the extent of 84 to 97 per cent in India. Farmwomen carry out 75 to 80 per cent farm work live stork, more than 90 per cent of the work is done by women. Female economic activity rate was 42.2 per cent and it is only 50 per cent of male economic activity rate of the country. The rural women are largely contributing to the nation's economy, which is mainly based on agriculture and allied sectors. The labour force participation rate of women is 31.56 per cent as compared to men's rate of 68.44 per cent. Agriculture is found to be highest employer of women's labour to the extent of 84 to 97 per cent in India. Farmwomen carry out 75 to 80 per cent farm work live stork, more than 90 per cent of the work is done by women. Their economic activities are usually under paid, unskilled, semi skilled and drudgery filled jobs.

Problems of Women in Agriculture

Some of the problems faced by them are

- Scarcity of resources,
- Economic deprivation and gender bias in wages,
- Deprival in decision-making,
- Denial in using income generated by farm activities.

Role of Women in Agriculture

- ✓ Farmwomen have tremendous workloads with dual responsibilities for many of the farm activities with **management of home**.
- ✓ Farmwomen have played and continued to play key roles in **conservation of basic life support systems** such as land, water, flora and fauna.
- ✓ They tend to look at **problem in their totality**. i.e. from sowing of the crops to its ultimate utilization of food, feed, raw materials of socioeconomic status perform almost all the activities related to farm. However their role differs according to their socio-economic status.
- ✓ Women belonging to large cultivating households generally do not work in field, such household engage wage labourers for manual work both farm and homestead activities. They perform some **supervisory functions**.
- ✓ Women who have adequate land for subsistence do not seek wage employment. They generally work as **unpaid family labourers** in own field or exchange labourers in other's farm.
- ✓ Women belonging to landless household or sufficient land had to hire themselves out as wage labourers to fulfill the **minimum requirement of family need**.
- ✓ Person (1979) classified the role of farmwomen into the following categories.
- ✓ Independent producers, who manage farm largely by themselves.
- ✓ Agricultural partners, who share most aspects of work, responsibilities, and decision making with their husbands.
- ✓ Agricultural helpers who only participate in the farm work at busy time when extra time is needed and
- ✓ Farm homemakers, who contribute to the farm production indirectly by preparing meals and attending those working in the field.

Economic Role of Women: Global Experiences

The stages of economic development, through which the society has been passing, determines the extent of women employed outside the house. The involvement of women

in economic activities is closely related with stage of development of the society, socio economic attitude towards women role and socio economic status. In a developed economy many activities of women are monetized and considered as employment. Whereas, in India such activities are not recognized and as such, they remained invisible. Due to inconsistencies and poor method in data collection and reporting and because of narrow definition of work and employment in national statistics, data often fails to capture the real contribution of women's work in developing countries like India.

- Economic role of women in terms of female work participation rate is above 40 per cent, in countries like
 - Romania (48 per cent),
 - Bulgaria (46 per cent),
 - former USSR (44 per cent),
 - between 25-40 per cent in Germany (40 per cent).
 - Denmark (37.8 per cent),
 - Japan (37.6 per cent),
 - U.K. (32.25 per cent),
 - Australia (25 per cent) and
 - below 20 per cent in countries like India (14 per cent),
 - Pakistan (8 per cent).

In developing countries, female work participation rate is higher in agricultural sectors. Such countries where agriculture is dominant sector are grouped into three categories:

- ✓ The first group of countries where participation is very high but confined to agriculture includes Haiti, Nepal, Nigeria, Thailand and Turkey.
- ✓ In the second group the Female participation is medium high level includes country like India, Malaysia, Morocco, Tunisia.
- ✓ The third group of countries where participation of women in farm operation is less includes countries like Latin America, Iraq and Pakistan.
- ✓ In India, agriculture sector employs 80 per cent of all economically active women in the country as compared to 63 per cent of men about 50 per cent of these are agricultural labourers and over one third are cultivators. The roles of women in agriculture vary from region to region. Throughout the country women belonging to high caste do not engage in fieldwork. On the other hand most of the field works are assigned to female labour from scheduled/low cast or scheduled tribes. Level of participation of women in various enterprises in

the rice based farming system is greater than that of men in hills and at par with men in plains.

Employment of women in agriculture

The employment of agriculture is characterized by peak and slack seasons. The nature of demand for female labour in rural labour market is different from that of female labour exist through the agricultural season. Farm activities of female spread during a span of 9 month i.e. May to January. Demand for female labourers increases sharply during transplanting, harvesting, post harvest operation as there were done mainly by female. Participation of women also varies depending on cropping system. Women's participation was much greater in rice based cropping system than in dry land farming. (FAO, 1980) The world economic profile of women shows that women represent 50% of population,

- Make up 30 per cent of the official labour force,
- perform 60 per cent of all working hour,
- receive 10 per cent of the world income
- And own even less than one per cent of the property.

Participation of Farm Women in Agriculture

The whole range of agricultural operations except those involving animal and machine power is performed by women jointly or independently. Except ploughing, car driving, arranging farm inputs, and selling products, women were found to have been engaged in all other farm operation, like compost making. Sowing, weeding, application of fertilizer and manure, protection of crops from birds, harvesting, winnowing and storing. In most part of the country the job traditionally done by women are generally transplanting, sowing, weeding, harvesting winnowing and threshing.

Devi and Reddy (1984) studied role expectation and role performance of farmwomen in Andhra Pradesh. It was observed that farmwomen belonging to low economic categories performed all agricultural activities. Whereas, women of high and medium categories performed allied agricultural activities. It was also reported that women belonging to small farm holdings lower caste with low socio economic status with less education with less material possessions and with having less urban contact were participating more in agricultural activities.

Devi (1987) identified eight major roles with eighty sub roles to find out the actual performance of role. The study revealed that harvest and post harvest role has ranked first,

followed by pre-sowing and sowing, food preparation, Child and family care, allied agriculture, inter-cultivation, housekeeping and social cum leisure time activities. In the case of post harvest operation joint participation of farm women with female members was relatively more i.e. 49%, followed by joint participation with male (37 per cent), and 14 per cent performed these activities independently. In the case of life stock management 44 per cent were joint partners with male, 34 per cent were joint partners with female and 22 per cent emerged to be independent workers.

Participation of both men and Women in Agriculture

Further, joint participation with men to a higher extent was observed in the activities like seed selection, seed treatment land preparation, Nursery raising, sowing, fertilizer application irrigation management, plant protection threshing and marketing.

Kaur & Punia (1998) studied participation of farmwomen in farm, home, and allied activities in Haryana. It was revealed that 60 per cent of the respondents were involved in activities related to farm. Few activities such as paddy transplanting weeding, harvesting and winnowing were entirely performed by women either independently or jointly with women.

Farm Women in Decision-making

- Decision-making is considered as the smallest unit of management. It is inescapable and indispensable in any phase of management. It is the process of consciously choosing course of action from available alternatives and integrating them for achieving desired goal.
- In the farm households though the women are active partners of male counterpart in all aspects of activities, yet their participation in decision-making is not visible. The success of farm business depends upon how meticulously family members follow the farm decisions and to what extent the family members follow the farm decisions, particularly the farm women is consulted and how often her views are considered seriously.
- The involvement of farm women in decision making process is influenced by the level of knowledge, age, experiences, marital status, socio-economic status, exposure to outside world and knowledge gained through training as well.
- Outwardly decision-making is the prerogative of the male head of the farm family Since in Indian economy, farm business is a family enterprise participation of farmwomen in farm decision is of utmost important.

- Because cumulative effect of everyday decisions made and implemented both by the husband and wife in the areas of farm enables smooth functioning of farm business and thereby strengthen the rural economy.

Kadlag (1999) observed that there is a positive impact of participation farm women in decision-making on productive crops. She also confirms the fact that dominance of men in the family, illiteracy of farm women, less exposure to outside world, lack of confidence, shyness, lack of knowledge regarding improved agricultural technologies are the common reasons for low participation in farm decisions. Further it is observed from several studies that women are usually consulted in decisions related to transplanting, harvesting, storing retention of seeds for future consumption and amount to be marketed etc.

Sharma & Singh (1970) reported that larger proportion of women participated in decision-making in the areas of seed storage and harvesting. The study further reveals that joint decision with male was highest for purchase of agricultural and input and implements, marketing of farm produce and to a considerable extent for sowing related matters crop care and nurturing, retention of seed for storage and marketing of farm produce. Further, the decision areas in which highest percentage of farm women did not take decision included seeking employment as farm labour, employment and management farm labour, repayment of loan, obtaining loan and credit for farming.

Kaur (1987) observed that women of middle and upper middle age group were more involved in decision making process. Usually elder women were consulted before taking any final decision. It was also reported that extent of participation in decision making was higher in the case of women belonging to nuclear family, medium farm size group, middle and upper caste, medium socio-economic status.

In Assam to find out the problems fare by farmwomen in decision-making in agriculture were lack of economic resources under their control (90 %), lack of contract with information sources (87 %), lack of pertinent knowledge about agriculture (81%).

Farm Women and Drudgery involved in work

Drudgery is usually conceived as physical and mental strain, agony, monotony and hardship experienced by human being that ultimately lead to reduction of her efficiency, productivity and over all dissatisfaction. Women in general, farm women in particular are subjected to physical and mental fatigues exploitation, pain, economic stress, malnutrition etc. In addition to it they are exposed to biological, chemical, physical and mechanical hazards while working in the field. Improved work, worker and workplace interaction is the emerging issue which need to be considered seriously while formulating policies and

implementing them inaction. It was observed that transplanting cutting/uprooting and weeding activities were performed by maximum numbers of women.

Impact of Drudgery prone Activities of Farm Women

It is observed that most of the farm women perform farm activities with traditionally designed tools, which leads to low efficiency and output, coupled with dissatisfaction and drudgery. Since the entire farm activities are performed under scorching sun and rainy season with a awkward posture they have to suffer from health problems such as sun burn, skin diseases, abortion, miscarriage and server muscular skeleton problems.

The **feminization of agriculture** warrants that women should adopt technologies to increase their production and work efficiency, overcome strain and stress, improve time use pattern and enhance quality products.

Relevance of Technology for Women in Developing Countries

Basic aim of application of farm technology includes increasing productivity, reducing drudgery, improving quality of products and produced diversification of output and enriching quality of life of rural households. Available evidences reveals that improved farm technologies due to green revolution tend to improve productivity and expansion of livestock.

Strengthen Women's Assets

Redressing the gender gap in assets is key to improving agricultural productivity. Policies and programs that strengthen women's assets are likely to have long-term effects because they not only increase women's ability to adopt improved technologies or engage in more remunerative livelihood strategies, but also contribute to women's empowerment in the household and the community. Key assets in this regard include tangible ones such as land, water, tools, and technologies, as well as less tangible—but no less important—ones such as financial, human, and social capital.

Land

Joint titling and reform of inheritance laws are two major policy reforms being employed to strengthen women's property rights. For example, land is being jointly certified in the names of both husbands and wives in Ethiopia, and reforms to the Hindu

Succession Act in India are allowing daughters to inherit land. However, legislative reforms alone are not enough to affect the lives of rural women because customary land rights and inheritance practices often remain strong. Full implementation of any legislative reform is crucial. Legal literacy programs are needed to make both communities and the implementing agencies aware of the reforms and the rights that women can claim.

Water

Reliable access to clean water is especially important to women, who are often responsible for obtaining water for domestic use and for plants and animals under their care. Although domestic water supplies and irrigation systems are often developed separately, some studies suggest that creating multiuse water systems helps women meet their domestic as well as productive water needs.⁸ Homestead-scale systems such as wells and water harvesting require substantial private investment; community-scale systems can transport water from longer distances and may offer technical efficiency gains. However, community-level systems require effective organizations. Women's participation in decision making in community water systems is crucial to ensure that their particular needs and priorities are addressed.

Tools and technologies

A gender-aware approach to closing the gender asset gap in agriculture requires ensuring that women have access to and control over the tools and technologies that men already have. A gender-transformative approach requires asking whether technologies are designed to meet women's needs and whether women are involved in the innovation systems, both as clients and as providers of innovations. For example, women and men often have different trait preferences for crop or livestock varieties; participatory plant or animal breeding programs that involve women can take these differences into account.⁹ Ergonomically designed equipment for women can reduce strain and make their labor more productive. Many agricultural research and development programs focus on the period from planting to harvest and neglect postharvest processing, which is more likely to be women's domain. Improvements in processing can reduce food losses, increase incomes, improve nutritional content, and save labor—all of which are of special concern to women.

Financial capital.

Microfinance programs have often successfully made savings and credit available to poor women, but women should not be locked into microfinance alone; a ladder of finance is also required. In addition, women need more than credit: ways of making and receiving payments, such as through mobile phones, allow women to participate in markets for inputs and produce. These mechanisms can be particularly important in societies that

restrict women's mobility, because women there must rely on male family members or friends to take their produce to market.

Human capital

Much attention is rightly given to increasing girls' enrollment and retention in school. Later in life, however, women also need greater access to agricultural extension and advisory services; women have consistently lower access to extension than men. More gender-equitable extension systems would not only recognize women as farmers, but also address their needs for information, technology, and market access. They should employ female extension agents or alternative delivery mechanisms such as group-based approaches and experiential techniques that are specifically designed to be gender equitable, depending on what is most effective.

Social capital

Both governments and nongovernmental development organizations have embraced group-based approaches as a way to reduce the cost of delivering services to many individuals and make program outreach more cost-effective. Participation in groups can also be empowering. For women, the opportunity to get out of the house and meet with other women, create solidarity, and build confidence to speak in public can increase their bargaining power within their households as well as with outsiders. Informal social networks and kinship ties can also be important sources of information, influence, and assistance. But, as with other assets, men often have stronger social capital than women have. Ensuring that the formal rules and informal practices of groups do not discriminate against women can help redress this gap. For example, membership rules should allow multiple household members to participate instead of just the head of household; meetings should be scheduled where and when women can attend and should be conducted so that women feel they can be heard.

Engage in Real Partnerships

- Ultimately, translating political will into gender-equitable agricultural development requires forging partnerships with women's organizations so that they have voice and agency. Instead of having to anticipate women's needs, programs should make it possible for women to identify their own needs, place demands on service providers, and increase accountability of programs. This approach should be adopted not only by government and nongovernmental organizations, but also by private input and information suppliers, land administration services, and marketing agents.

- **This is not to suggest ignoring men:** indeed, enlisting men's support and ensuring that their needs and concerns are also addressed are crucial for the advancement of both men and women. Effective partnerships have the potential to transform how women are perceived. Instead of being seen as victims of inequitable conditions or beneficiaries of programs, women can be seen as key actors in implementing programs and achieving sustainable development, food security, and poverty reduction.

Conclusions

Attention to gender in agriculture is not new, but it has not always been acted upon. The accumulating evidence shows that empowering women is not only important in its own right, but also often highly conducive to improving agricultural productivity, food security, and nutrition. Gender-blind programs too often fail in these objectives and may even make matters worse by encumbering women with additional uncompensated duties or depriving them of control of resources in a manner detrimental to their welfare.

The renewed commitment to gender-responsive and gender-transformative agriculture now needs to be translated into more systematic policy actions, including integrating gender in agricultural strategies and programs. Research and development of agricultural technologies and interventions should begin with an understanding of how men's and women's interests as producers and consumers dovetail and diverge and should work to address the needs of women as well as men. Paying specific attention to closing the gender gap in assets is also expected to have long-run effects in empowering women and improving productivity and food security. Delivering on this potential will require systematic collection of sex-disaggregated data to improve our understanding of what works and a commitment to making actors at all levels, from government agencies to project staff, accountable for results.

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Sectoral share of agriculture to GSDP of Odisha depletes over years. But the sector still remains a high priority sector in the State because of its imposing rural livelihood support & employment generation in unorganized sector.

Odisha Economic Survey, 2015-16.

Statistical Literacy : Real life need

Dr. Bijaya Bhusan Nanda

Abstract

In this information laden society, the people from all walks of life should have Statistical literacy. This is a key ability expected of citizens to understand, appreciate the abundant flow information in news paper, television, internets, and publications and make use of it in real life situation. This paper proposes a conceptualization of statistical literacy and describes its key components. Statistically literate behavior is presupposes of five interrelated knowledge bases- literacy, numeracy, probability, context, and critical reasoning, together with a cluster of supporting dispositions and beliefs. This paper outlines the importance of spread of statistical literacy among all citizens from all walks of life and tries to enumerate small steps in this direction and has a plan to develop a strategy document in future.

Key words & phrases:

Statistical literacy, Numeracy Skill, Probability, critical reasoning

What is Statistical Literacy?

Background

The world is becoming more and more complex due to flow of abundant information. Citizens from all sections irrespective of age, gender, occupation, social groups are faced with big flow of information both in numerical (quantitative) and text (qualitative) form to arrive at decisions in their real life. This poses a bigger challenge. They need to understand the information to take decision in different walks of life. Take for example a person wants to purchase a two wheeler. Thirty years hence there were only two options- either to purchase a Bajaj / Lambreta Scooter or a Rajdoot / Bullet Motor Cycle. But now a day, there are innumerable brands, types, segments coupled with promo advertisements. The person is confused and he wants to make the best choice as per his requirements. For this he has to understand the specification of various brands, types and take decision. Take another example a citizen needs to admit his ward into a school. In good old days it is either a Government School or a Government aided school. To-day, options are many, Government Schools, numerous brand of Public Schools, Kendriya Bidyalaya etc. Making the best choice

in view of the resource and requirement is really a difficult proposition. The list is never ending be it consumer items, durable non durable assets, investment, the citizen need to take intelligent decision by the use of data.

Thus in order to take decisions in the real life the citizens irrespective of groups needs to have the capability to understand the data and information. That is where the appreciation and capability of making use of data available in different sources such as media, internet, advertisements, become important. Statistics are required to make sense of societal functioning, such as crime rates, the spread of diseases, population growth, employment rates, educational achievement and assessing chance based situations such as insurance policies. Developing an understanding of these trends from the earliest possible age is necessary, since this information is essential to understanding society (Gal, 2004). Knowledge of how to use and communicate statistics is therefore necessary if citizens are to become intelligent consumers of our society, capable of making critical and informed decisions (NCTM, 1989; Wallman, 1993).

Statistical literacy

Statistical literacy is the ability to understand Statistics. This is necessary for citizens to understand material presented in publications such as newspapers, television, and the Internet. The prerequisite to being statistically literate is numerical skill. One should also distinguish between a conjecture and theory. To be statistically literate, one must also have a solid understanding of probability theory. Studies have shown that human beings' estimations of probabilities are heavily influenced by context and wording [*Kahneman, Daniel (2013)*]. For example, people typically underestimate the probability of being involved in a car accident because their everyday interaction with vehicles gives the impression that they are safer than they actually are Likewise, they tend to overestimate the probability of being attacked by a shark because of media or other influences. Being statistically literate is sometimes taken to include having both the ability to critically evaluate statistical material and to appreciate the relevance of statistically-based approaches to all aspects of life in general. H.G. Wells is often cited as saying that statistical understanding will one day be as important as being able to read or write [*Wallman, Katherine K. (1993)*]. That day has ushered.

Level of Statistical Literacy in our society

During my journey as a Statistician for 27 years, I had the opportunity to discuss with administrators, doctors, engineers, social scientist, statistician, teachers, students,

common citizens, in Odisha on matters relating to trivial social aspects to research field and have formed a hypothesis that there is gross lack of statistical literacy among citizens of all walks of life. Of course, this is my hypothesis, which needs to be tested and verified by systematic research. Few examples, I can quote. One reputed professor of medicine, once said, to a group of students in seminar, 'Smoking Causes Cancer'. Later on, I interacted with the Professor, is it true? Then he quipped what is wrong in that. I mentioned yours is a definite causal statement rather it should have been a probabilistic statement. Then he realized. Many a time's people, even researchers refer to random selection as arbitrary selection. I have come across Administrators, taking decision, even planning projects on the basis of their own perception rather than on the basis of evidence based upon systematic data collection. People in and around also lack the aptitude to systematically appreciate the flow of information in news paper, internet, television and they count little on that for arriving at a decision in real life. I have come across numerous teachers, students, who are only keen on finding a significant difference statistically to establish their hypothesis. This is gross lack of statistical literacy. Therefore, there is a necessity to spread statistical literacy among the people in all walks of life.

Statistical literacy – International concern and effort

Statistics Canada and the Australian Bureau of Statistics have realized the significance of statistical literacy and therefore have launched programs to educate students in schools about the nature of statistics. The International Statistical Literacy Project (ISLP) is a project initiated by the International Association for Statistical Education (IASE), which is the education section of the International Statistical Institute (ISI). The main objective of the ISLP is to contribute to promoting statistical literacy across the world, among young and adults, in all walks of life. To this end, there is an online repository of international resources and news in Statistical Literacy, international activities to promote the resources and the individuals and institutions behind them, and outreach activities to increase awareness [Sanchez, Juana, et al.2011].

The United Nations Economic Commission for Europe has taken the notion of statistical literacy as the subject for its fourth guide to making data meaningful. Recognising the obligation of its royal charter to promote the public understanding of statistics, in 2010 the Royal Statistical Society launched a ten year statistical literacy campaign [getstats.org.uk].

Statistical Literacy – Way ahead

A lack of statistical literacy can lead to '... misunderstandings, misperceptions, mistrust and misgivings about the value of statistics for guidance in public and private choices.' (Wallman, 1993). Citizens and organizations need to use statistical information to make informed decisions [*Wallman, Katherine K. (1993)*].

There should be a systematic effort to promote statistical literacy among young and adults, in all walks of life. To be more specific, the target group should be students, professionals, politicians, administrators, journalists, entrepreneurs, housewives, etc. The main objective of statistical literacy should be to contribute to promoting understanding and appreciation of statistics and making them capable of taking informed decision.

The responsibility certainly lies with the organizations who are producers of Statistics. The Central Statistical Office, National Sample Survey Organisation, Registrar General of India, Statistical Wings of other Ministries and Departments and all State Directorates in India should take the lead in this area. Besides, the academicians and all professional bodies in the field of Statistics should come forward to take the mantle to generate Statistical Literacy in the society.

The question is how to do this? Ours is a vast country with varied and huge complexity. So the job is huge and complex. The attempt has been made to list out some small step. But latter on there is a plan to develop a strategy document on this.

- i. Professional Statisticians need to study the work done by Statistics Canada and the Australian Bureau of Statistics, and International Association for Statistical Education (IASE) in the field of Statistical Literacy.
- ii. The people at the top echelon need to be made aware of about the significance of statistical literacy and its need to be spread among the citizens of all walks of life. This requires a strong awareness and advocacy campaign.
- iii. At the curriculum level the course need to be oriented for practical application of the subject. In precise the focus should be on application of Statistics at Post Graduate and Graduation level.
- iv. The statistics with simple application need to be introduced at the school level.

- v. Each and every college student irrespective of stream of education should have a basic course on statistical application. At the college level statistical application need to be taught in all streams be it science, arts or commerce.
- vi. Many a times it is seen that the subject is taught by non-statistics faculty. Statistics should be taught by experienced statistician.
- vii. Seminars and workshops need to be conducted at school, college level, for the teachers and students on different aspects of statistical literacy.
- viii. Media, print and electronic need be used to spread the concept and skill of Statistical Literacy.
- ix. Each Department in the Government should have a Statistics Cell manned by professional statistician.
- x. Working statistician and faculty need to be oriented in the field of applied Statistics.

Price dispersion (measured as ratio of maximum price received by farmers to minimum price in country) in crop sector in India is very high in stark contrast to USA implying no common agriculture market in the country. This lead to higher cost to farmers and consumers alike.

- India Economic Survey,2015-16.

Farmers Welfare in Odisha through Cooperative Initiatives

Dr. Patanjali Tripathy

Abstract

For the benefit of farming community, cooperative institutions like PACs, LAMPs and OSCB have been playing crucial role of providing credit facility making available of fertilisers and other benefits. PACs have shouldered the responsibility of paddy procurement since 2009-10. State Government have also provided financial assistance of Rs.67 crore for implementation of Core Banking Solutions (CBS). In order to achieve agriculture growth, welfare of farmers remain crucial and need be addressed sincerely. This paper provides detail picture on initiatives taken for welfare of farmers of the State through cooperative institutions.

Introduction

No doubts, agriculture is instrumental to sustainable development and livelihood. Dr. A.P.J Abdul Kalam, the Late President of India in his book " Target 3 Billion "observes: "The Agriculture sector is by far the largest employer in terms of human resources in India as well as elsewhere in the world. Ironically, at the same time, it is also the smallest sectoral contributor to the GDP of the nation". As regards the state economics scenario in Odisha as stated in the Odisha Economic Survey , 2015-16, "Development of Agriculture is necessary for inclusive and sustainable growth of Odisha economy. The state economy no more remains primarily agrarian in recent years. But the sector bears enormous implications in development strategy of the State in each plan period as its net area sown still covers 35% of geographical area of Odisha and more than 62% of States total workers population predominantly depend on agriculture for their sustained livelihood. Agriculture and its allied activities have remained crucial for Odisha's Economy

Farmers welfare in Odisha

The cooperatives do play a vital role in development of agriculture as a sustainable livelihood for the farming community of the State which lost network is present at grass root level of Odisha. State. The Short Term Cooperative Credit Sector (STCCS) comprises of the Odisha State Cooperative Bank (OSCB) at the apex level with its 14 Branches, 17 District Cooperative Central Banks (DCCB) with 317 Branches mostly at Block levels and Primary Agricultural Cooperative Societies (PACs) at grass root level serving 2 or 3 Gram Panchayat in an average. In recent pasts, many innovative initiatives have been

taken for welfare of the farmers of the state. Out of around 55.22 lakh agricultural families of the State, 54.89 lakh no of families has been enrolled as > members of PACS / LAMPCS reflecting 99.40% of total families. It is expected that the PACSs will accomplish the task of 100 percent coverage by end of 2016-17. Agricultural families brought under the fold of PACSs during last three years is as follows.

Table 1 : Year wise Members enrolled by PACS

(In lakh rupees)

Years	Total Agricultural families	Members enrolled by PACS
2013-14	55.22	53.7
2014-15	55.22	54.66
2015-16	55.22	54.89

With a view to ensuring availability of timely and adequate agriculture credit without any hassle to the farmer members, Kissan Credit Card Scheme (KCC) was introduced by the Government of India during 1998-99. PACSs have provided 46,04,902 KCC to the farmer members reflecting 76 % of the market share while the commercial Banks taken together in the state have provided 19.89 lakh KCC .

The indispensability of the Short Term Credit Cooperative Sector lies in disbursement of crop loan to the farmers commanding a stake of 65% market share. The commercial Banks with their vast networks of branches enjoy market share of 35 % Ironically these commercial banks enjoy market share of 96% of the deposit mobilization in the State as compared to less than 4% by the Short Term Credit Cooperative Sector. Despite of the resource constraints, the STCCS have been striving to render the much required agricultural credit services to the farmer members almost at their door steps.

Achievement in disbursement of crop loan during last 3 years by PACSs vis-a-vis Commercial Banks during last 3 years is indicated Table 2.

Table 2 : Achievement in disbursement of crop loan by PACS and commercial bank (2013-14 to 2015-16)

Year	Disbursement of Crop loan		Market Share	
	Coop. Bank	Commercial Bank	Coop. Bank	Commercial Bank
2013-14	7096.64	3103.86	70	30
2014-15	8543.6	4590.89	65	35
2015-16	9572.21	6210.16	60.65	39.35

Interest Subvention Scheme have been implemented with the financial assistance from Government of India and the State Government to motivates the farmers to avail agricultural credit at subsidised rates of interest i.e. 5% . Moreover, incentive for timely repayment of loan is provided @4% reducing the effective rate of interest to 1%.

The PACS/LAMPCS and 92 outlets of MARKFED made sincere effort for availability of different chemical fertilizers at grass root level to farmers to achieve higher productivity & production. During 2015-16, 3.80 lakh MT of chemical fertilizer have been provided by

MARKFED through PACS/LAMPCS.

All the 317 branches of DCCB and 14 Branches of OSCB are now CBS (Core Banking Solution) enabled banks providing modern banking services to their customers at remote areas at par with Nationalized banks. The Government of Odisha provided financial assistance to the tune of Rs.67.00 crore for implementation of CBS. The assistance of the State Government for implementation of CBS and computerization of the STCCS is first of its kind in the country. Besides, initiatives have been taken to bring all the PACS to the digital platform facilitating modern banking service at the grass root levels.

For the benefit of farmers, initiatives have been taken for easy availability of seeds at PACS level sale centre of Agriculture department during 2015-16. Quintal of seeds have been sold by 988 PACS to farmers.

Many parts of Odisha is characterized by hilly terrain. With a view to providing minimum banking and other essential financial services at these unbankable areas, mobile van Banks, (Banks on Wheels) have been introduced in with financial assistance of Rs.6.00 crore under RKVY. Presently, 20 mobile vans with ATM facilities are plying in 16 districts. Marketing of agricultural produces ensuring remunerative prices is big challenge. The role of PACS in paddy procurement facilitating payment of MSP to farmers is a quite predominant accounting for 93% of total procurement of paddy in the state. With vast network, infrastructure and human resources, PACSs have shouldered the responsibility of paddy procurement since 2009-10 in a credible way. Online transfer of sale proceeds to the farmers' SB account maintained with any bank on the very next day of sale of paddy through Paddy Procurement Automation System(P-PAS) has been proved to be very beneficial to the farmers of the state. The P-PAS software application model has been appreciated by the Government of India as an innovative model to be replicated in other states. Implementation of CBS by branches of DCCBs facilitated the on line transfer of funds. Achievement in paddy procurement during last three year is furnished in Table 3.

Table 3 : Paddy procurement in Odisha (2013-14 to 2015-16)

Year	No. of PACS	No. of Farmers	Quantity Procured (In MT)
2013-14	2317	10,14,783	47,93,118
2014-15	2431	10,03,321	49,60,285
2015-16	2438	9,10,397	37,99,128

Availability of infrastructure like Storage go-down, Paddy platform was an insurmountable challenge during initial years. But with the timely support of the Government of India and the State Government, 298 storage go-downs with storage capacity of 300 MT each have been constructed with financial assistance of Rs.47.00 crore

out of RKVY funds. The State Government provided assistance borrowing funds from NABARD under Rural Infrastructure Development Fund (RIDF) and Ware Housing Infrastructure Fund (WIF) for construction of storage go-downs at PACS level to strengthen paddy procurement.

With the advent of Information Technology and digital platform as mainly as 337 PACS have opened Common Service Centers(CSC) at remote places providing web-based services to the citizen both Government to Citizens (G2C) and Business to Citizen (B2C) services as part of implementation of the National e-Governance Programme.

Conclusion

With the sincere and relentless endeavor, Cooperative institutions mostly PACS strive for bringing about welfare of the farming community of the state. Multi-dimensional constraints do deter the growth and progress to some extent .The spirit of determination and the inspiration to render meaningful services of the farmers would definitely pave the path for achieving major strides fostering welfare of the farmers of the state.

Odisha is endowed with rich potential of fishery resources. The fish consumption of the State is equally high. The per capita fish consumption of Odisha remains at 11.2 kg which is higher than WHO norm of 11 kg.

Odisha Economic Survey, 2015-16

Pradhan Mantri Fasal Bima Yojana (PMFBY): An overview

Sri Benudhar Jena

Abstract

When farmers were celebrating festivals like Lohri, Pongal and Bihu, the government has given a gift in the form of Prime Minister's Crop Insurance Scheme,". The scheme would bring about "a major transformation" in the life farmers' by empowering them financially in terms lowest premium and higher subsidy. it entails easy usage of technology like mobile phone, quick assessment of damage and disbursement of claims within a time-frame." .The scheme will ensure a safety net against all type of crop losses due to natural calamities. Its implementation depends on vibrant functioning of multiple agencies and extensive use of technology.

The government and the policy makers have always faced few challenges on food security, agricultural growth and adequate jobs in agriculture sector. There has been always a long felt need to bring together at one place all conceptual issues, detailed institutional framework and operational details related to farmers' welfare, risk management of farming community and the crops during drought and floods and other localized risk factors. India is the land of farmers where the maximum proportion of rural population depends on agriculture. So it is very much necessary to strengthen their crop insurance scheme so as to prevent them incur heavy losses even if the crops get damaged due to natural calamities and other unavoidable circumstances. Most farmers take loans for buying agricultural seeds, fertilizers, irrigation facilities, pesticides and other agricultural machineries for cultivation of crops. But sometimes unavoidable natural disasters like flood, draught, fire pest attack etc. strike and destroy crop yield. Then farmers suffered from depression and even suicide which is a burning issue in India. As per the report of Home ministry, about 3000 farmer's suicide has been registered in India, during the last three years itself. The Hon'ble Prime Minister of India Shree Narendra Modi has launched a new crop insurance Scheme on 13th January 2016. This crop insurance scheme is called "Pradhan Mantri Fasal Bima Yojana (PMFBY)" which has been implemented in every state and UTs of India in association with the respective State governments. The Crop Insurance Scheme has been administered by the Ministry of Agriculture and Farmer's Welfare, Government of India.

Under the new scheme that would cost government Rs 8,000-9,000 crore annually, the farmers' premium has been kept at a maximum of 2 per cent for foodgrains and oilseeds for Khariff , for Rabi crops, the farmer's share has been fixed at 1.5 per cent, and for year-long cash crops and horticulture crops, this has been capped at 5 per cent . The remaining share of premium will be borne equally by the central and respective state governments. Private insurance companies will be roped along with Agriculture Insurance Company of India

PMFBY is a replacement scheme of NAIS / MNAIS, there will be exemption from Service Tax liability of all the services involved in the implementation of the scheme. It is estimated that the new scheme will ensure about 75-80 per cent of subsidy for the farmers in insurance premium. It is worth mentioning that the government is already shelling out around Rs 5000 crore annually average for the last five years for various disaster relief measures even as the government's new move will now mean a tentative expenditure of about Rs 9000 crore. This will be more helpful especially for farmers as the risk factor would be looked into. Allocation of the scheme presented in budget 2016-2017 is Rs.5, 550 cores.

The risks leading to crop loss are to be covered under the scheme include: Yield Losses (standing crops, on notified area basis). Thus a Comprehensive risk insurance is provided to cover yield losses due to non-preventable risks, such as Natural Fire and Lightning, Storm, Hailstorm, Cyclone, Typhoon, Tempest, Hurricane, Tornado. Risks due to Flood, Inundation and Landslide, Drought, Dry spells, Pests/ Diseases also will be covered. Similarly in cases where majority of the insured farmers of a notified area, having intent to sow/plant and incurred expenditure for the purpose, are prevented from sowing/planting the insured crop due to adverse weather conditions, shall be eligible for indemnity claims upto a maximum of 25 per cent of the sum-insured. In post-harvest losses, coverage will be available up to a maximum period of 14 days from harvesting for those crops which are kept in "cut & spread" condition to dry in the field. For certain localized problems, Loss / damage resulting from occurrence of identified localized risks like hailstorm, landslide, and Inundation affecting isolated farms in the notified area would also be covered.

This scheme will help in decreasing the burden of premiums on farmers who take loans for their cultivation and will also safeguard them against the inclement weather. Moreover, it has been made clear that there will be "no upper limit" on the Government subsidy. Even if balance premium is 90 per cent, it will be borne by the Government. Earlier, there was a provision of capping the premium rate which resulted in low claims being paid

to farmers. This capping was done to limit Government outgo on the premium subsidy. This ceiling has now been removed and farmers will get claim against full sum insured without any reduction.

The new scheme envisages among other things that there will be use of technology. More technology and science will be encouraged. Smart phones will be used to capture and upload data of crop cutting to reduce the delays in claim payment to farmers. Remote sensing will also be used to reduce the number of crop cutting experiments. Making use of technology mandatory will also improve operational efficiency and will be beneficial to both - the farmers and the insurers. Additionally, since farmer's premium will be down, the uptake of policies would be high. Moreover making the new crop insurance scheme mandatory for states will also mean there will be increase in the list of policy takers

It has also been decided to make the settlement process of the insurance claim, fast and easy so that the farmers do not face any trouble regarding the crop insurance plan. The Ministry of Agriculture and Farmers' welfare designated empanelled AIC and some private insurance companies presently to participate in the Government sponsored agriculture, crop insurance schemes. The choice of which private company is left to the states. There will be one insurance company for the whole state. Private insurance companies will be roped along with Agriculture Insurance Company of India Limited (AIC) to implement the scheme.

Selection of Implementing Agency may be made for up to three years however, the State government/ UT and the concerned insurance company are free to renegotiate the terms if relevant. This will facilitate the insurance company to establish the credibility among the farmers through investment out of the premium savings in various welfare activities for socio-economic development.

All farmers including sharecroppers and tenant farmers growing the notified crops in the notified areas are eligible for coverage. The non-loanee farmers are required to submit necessary documentary evidence of land records prevailing in the State Records of Right (RoR), Land possession Certificate (LPC) etc. moreover, applicable contract, agreement details, other documents notified permitted by concerned State Government. Compulsory Component All farmers availing Seasonal Agricultural Operations (SAO) loans from Financial Institutions (i.e. loanee farmers) for the notified crops would be covered compulsorily The Scheme would be optional for the non-loanee farmers.(Voluntary

Component) Special efforts shall be made to ensure maximum coverage of SC/ ST/ Women farmers under the scheme. Budget allocation and utilization under this should be in proportion of land holding of SC/ ST/ General along with Women in the respective state cluster. Panchayat Raj Institutions (PRIs) may be involved for the implementation and also obtaining framers feedbacks on these crop insurance schemes. The Scheme shall be implemented on an '**Area Approach Basis**' (i.e., Defined Areas) for each notified crop for widespread calamities. The assumption that all the insured farmers, in a Unit of Insurance, should be defined as "Notified Area" for a crop, face similar risk exposures, incur to a large extent, identical cost of production per hectare, earn comparable farm income per hectare, and experience similar extent of crop loss due to the operation of an insured peril, in the notified area. The Unit of Insurance can be demographically mapped with region having homogenous Risk Profile for the notified crop. For Risks of Localized calamities and Post-Harvest losses on account of defined peril, the Unit of Insurance for loss assessment shall be the affected insured field of the individual farmer.

Banks have a vital role to play in increasing the coverage under the scheme. As the scheme is compulsory for loanee farmers availing Seasonal Agricultural Operational (SAO) Loans/Kisan Credit Card (KCC) holders for the notified crops in notified areas, 100% coverage of loanee farmers in notified areas growing notified crops is required to be done by all concerned bank branches. This scheme is voluntary for non-loanee farmers, but there is a prerequisite in the scheme that they should have an account to be eligible for coverage. Under the Pradhan Mantri Jan Dhan Yojana (PMJDY), most of these poorest of the poor farmers have got their bank accounts opened and the banks have to focus on supporting these farmers in getting crop insurance including guiding them through the entire process. The detailed role and responsibilities of the Rural Financial Institutions including Commercial Banks and Regional Rural Banks have been defined in the Operational Guidelines of the Scheme including specified seasonality discipline for acceptance of proposals/premium, remittance of premium along with consolidated proposals to the concerned Implementing Insurance Companies, uploading of requisite details of insured farmers on Crop Insurance Portal and credit of claim amount in the accounts of the farmers for effective implementation of the schemes.

Conclusion

The PMFBY is undoubtedly a pragmatic approach towards the panacea of farmers. But there are so many apprehensions about the success in the short run. The task of implementation is daunting in the context that multiple agencies are involved in its

implementation, among which a strong coordination is mandatory factor. There are government agencies, bankers, insurance agencies , weather scientists. remote sensing agencies, IT professionals, PRIs and the farmers themselves to be involved in implementation. Each agency has to do its own job perfectly within the time bound and harmonious manner. There is no single administrative mechanism to control and coordinate the activities at different stages. Besides the manpower shortage at various sectors has to be efficiently addressed. Network of IT has to be strengthened with a time bound manner which will provide real-time information for planning and execution of the scheme. Technically and professionally sound consultants and coordinators has to be involved in the process. PRIs has to contribute to the full capacity with the implementing agencies and farmers, besides creating public awareness. Infrastructures on weather forecast and IT networks has to be strengthened throughout. The dedication to duty bunched with optimism can lead to success in implementing the farmer friendly scheme because the farmers of our country are the real producer of our nation. Improving the conditions of farmers meant for improving the economy of our country.

Instability in agriculture in Odisha is not alarming. As per a decadal analysis of measure of instability in agriculture (SD of LN (y^{t+1})(y^t) where y^t is NSDP of agriculture sector at 2004-05 base) for 1980's,1990's& 2000's, the degree of instability in agriculture sector in Odisha falls to 14% as compared to much higher percent of instability in few major stage like Madhya Pradesh and Rajasthan etc.

IGIDR, 2012-13

Agricultural productivity in Odisha : A temporal assessment

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Introduction

It is commonly agreed that productivity is the ability of a production system to produce more economically and efficiently. So agricultural productivity can be defined as a measure of efficiency in an agricultural production system which employs land, labour, capital and other related resources as per Dwertt (1966)

India ranks second world wide in farm output. The economic contribution of agriculture to India GDP is steadily declining with country's broad based economic growth. Still agriculture is demographically the broadest economic sector and plays significant role in the over all socio economic fabric of India.

Agricultural productivity is measured as the ratio of agricultural output to agricultural input. There are some sources of agricultural productivity are 1) Mechanization 2) High yield variety 3) Fertilize 4) Irrigation 5) Pesticides.

The productivity of a region's farms is important for many reasons. Increasing productivity of farms affect the regions prospects of growth and competitiveness on agricultural market and savings and labour migration. An increase in agricultural productivity implies efficient distribution of scarce resources. Increase in agricultural productivity lead to agricultural growth and help to alleviate poverty in poor and developing countries.

However, it is not only the people employed in agriculture who benefit from increase in agricultural productivity. Those employed in other sector also enjoy lower food prices and more stable food supply their wages also increase. In Odisha more than 62% of state's total worker population depend on agriculture where net area sown covers 35% of geographical area of Odisha. Out of total cultivated area of 56.36 lakh hectares of Odisha in 2014-15 the food grain production covered 91.66% area followed by oilseeds 3.77%, fibers 2.57% and other crop 2.00%. Rice is the principal crop in the State that cover 74% of total cultivated area.

Objective

The study is aimed at measuring the agricultural productivity of Odisha during the period 2005-06 to 2013-14.

Methodology

The present study is based on secondary sources and the data have been collected from the Directorate of Economics and Statistics, Department of Planning, Directorate of Agriculture and Food Production, Government of Orissa, Bhubaneswar. Data pertaining to area, yield and production (AYP) of crops, Crops/crop groups selected for the study are cereals, pulses, oilseeds. Crop group such as cereals, pulses and oil seeds were treated as single crops (crop groups) for all purposes of analysis. The study covers a period of 9 years 2005-2006 to 2013-14. The study has made an attempt for a temporal assessment of agricultural productivity in Odisha . A Composite Productivity Index (CAPI) – the statistical technique as formulated by Bhatia, S. S. (1967) has been used for the said purpose. According to Bhatia per hectare yield expresses all the physical and human factors connected with the production of crops and the distribution of area under cultivation among various crops. Thus, a weighted average of yield productivity of all crops, would give a measure of composite agricultural productivity. The method followed to estimate CAPI for Odisha is as follows:

$$I_{ya} = \frac{Y_c}{Y_r} \times 100 \quad (1)$$

Where, I_{ya} is the yield index of crop 'a'

Y_c is the acre yield of crop 'a' in Odisha.

Y_r is the acre yield of crop 'a' in India.

Then, the Composite Agricultural Productivity Index (CAPI) is estimated as follows:

$$CAPI = \frac{I_1 * C_1 + I_2 * C_2 + I_3 * C_3 + I_n * C_n}{C_1 + C_2 + C_3 \dots \dots \dots C_n}$$

Where I_{ya} , I_{yb} I_{yn} are the yield indicators of various crops and C_a , C_b , C_n are the percentage share of crop and under different crops.

Analysis and Interpretation

Measurement of agricultural productivity is very much complicated since it needs to consider a host of factors such as soil, climate, landholding pattern, land utilization, cropping pattern, irrigation facilities, use of fertilizer, high yielding variety programme, flow of credit to agriculture and the extent of mechanization. Looking into the above aspect in details an attempt has been made in this section to measure the agricultural productivity of Odisha on the basis of a composite agricultural productivity index (CAPI).

Crops and crop groups such as cereals, pulses, oilseed were taken into consideration for measuring the level of agricultural productivity in Odisha for the years from 2005-06 to 2013-14. It is observed from the Table that composite agricultural productivity index (CAPI) for Odisha remained below 75 for 2 years, crossed 75 mark only for 5 years during the whole period under study.

Composite Indices of Agricultural Productivity (CAPI) in Odisha

Year (t)	Indices (U_t)
2005-06	76.04
2006-07	74.66
2007-08	77.21
2008-09	69.46
2009-10	75.13
2010-11	70.95
2011-12	60.48
2012-13	93.81
2013-14	75.66

Further to make a gradation of Odisha on the basis of CAPI values a frequency distribution table was prepared. Frequency of years as per the class interval of index values has been depicted in Table . It is revealed from the table that Odisha experiences low productivity level for more years.

Level of Agricultural Productivity in Odisha

Sl. No	Degree of Agri. Productivity	Index Values	Number of Years
I	Very High	Above 75	5
II	High	70-75	2
III	Medium	65-70	1
IV	Low	60-65	1

Source: Table 3

Conclusion

The scenario of agricultural productivity in Odisha was not found to be encouraging. There have been a significant changes in the productivity during the period 2012-13, whereas there is significant declining trend for the period 2008-09 & 2011-12 which seems to be a disturbing feature for the development efforts by the planners. To increase the agricultural productivity the emphasis should be laid on land reform measures (consolidation), technological change, infrastructure development (mainly irrigation) and adequate flow of funds to agriculture. Above all, priority will have to given to agricultural resources and education to evolve how varieties and breeds of crops to suit the geo-climatic conditions of Odisha. At the same time, it is necessary to bring about changes in the attitude of farmers and aware them about selection of crops and new firming methods.

References

- Economic Survey, Govt. of Orissa

& Agricultural Statistics at a Glance 2014-15,. Govt. of India

Directorate of Economics & Statistics, Odisha is the nodal authority that collect farm harvest prices (84 crops & by products), retail prices(219 crops & non agriculture products), producers and whole sale prices of crops, by products, live stocks and non agricultural products for rural & urban Odisha.

Price Division, DE&S, Odisha