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Modern Technology in Agriculture and Perception of the Farmers: A Case Study in Odisha

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ABSTRACT

Farm mechanisation is essential to reduce the costs of production and improve the productivity and equipping the farmers to take up timely and quality agricultural operations. The present study attempts to reveal the perception of farmers towards the use of modern technology in the study area. It is derived from the study that more than half of the farmers still use the traditional method of cultivation using bullocks and ploughs. Except the use of HYV seeds and chemical fertiliser, the farmers mostly use bullocks and ploughs and other traditional techniques of farming. The significant constraints behind the non-use of modern farm technology are high rate of interest of non-institutional credit, inadequate irrigation facility and low price of agricultural produce. Use of modern technology in agriculture is significantly affected by income from primary occupation, income from secondary occupation and the availability of agricultural credit to the farmers.

Key Words : Farm machineries, Agriculture produce, Productivity

INTRODUCTION

Agriculture sustains to rule as the fundamental priority in the case of sustainable development and poverty reduction in developing countries. Thus it is advocated to improve the agriculture sector for the progress of an economy especially the developing ones. As a matter of fact majority of population encompassed in the developing world stick to the rural areas. Therefore it becomes well evident that world's developing nations' agriculture turns out to be the kingpin in providing employment and national income. Agricultural activities somewhere push the population of an economy to become self-reliant and self-sufficient. Agriculture and allied sector still capture a vast area of contribution relating to total GDP. However, look at the misfortune of developing countries that they are marked upon low productivity of agriculture and allied sector. Thus it becomes the point of concern, how to raise the productive capacity of agriculture sector by efficient application of land and labour productivity in developing Nations. The booming population growth and swelling demand for land in non-agricultural use succumb any ray of hope for bringing in new land area under cultivation. Therefore the agricultural technologies or cultivation techniques must be given a massive push to put forth a way of enhancing agricultural productivity. However, enhancing the production techniques is not enough; the farmers should also be made aware of how to employ modern or advanced technology in production in a skilled manner to obtain a satisfactory and improved output. According to Feder *et al.* (1985), it is believed that the introduction of new technology increases productivity, adoption of technological innovations in agriculture has attracted the attention of development economists and policymakers.

Agriculture and allied sector is still the only most significant contributor in the Indian economy, contributing about 13.92 per cent to total GDP (at constant 2004-05 prices) during 2011-12 (Government of India, 2012). Although the agricultural sector leads the way in providing a livelihood in comparison to any other sector in India still, it faces many difficulties and is subjected to many

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problems. In recent years, the agricultural sector's performance in the economy has shown up to be quite dissatisfactory due to a sharp deceleration in the growth rate of GDP in agriculture and allied sector. Hence a punch of innovation in the sphere of cultivation techniques is very much essential to improve the productive capacity of the agricultural sector, which would further give a pace for smooth rate of GDP growth in the economy. Thus it is required that new technology of agricultural production should replace the traditional practices. It observed that traditional agricultural activity depended primarily on inputs like bullocks, simple ploughs, other primitive agricultural tools, etc. and it was also wholly dependent on biological sources of energy, rain and dung manure. However, as time proceeded the modern techniques replaced the traditional ones. This paper is more specific to Odisha, and thus as we move further, there will provide more data regarding the State's agriculture sector and farm mechanisation.

Odisha shows up to be an agrarian State. Agriculture serves to be the lifeline of the State's economy just because it employs 62 per cent of the total workforce of the State in approx. Total cultivated land constitutes about 39.69% which is 61.80 lakh hectares out of the total geographical area of 155.71 lakh hectares of the State. More than 90% of the farming community is constituted by small and marginal farmers. The State is divided into four Zones, from the physiographic point of view, *viz*. (i) the Northern Plateau, (ii) the Eastern Ghat zone, (iii) the Central Table lands and (iv) the Coastal zone. The State has been categorised into 10 Agro-Climatic Zones on the basis of climate, soil, rainfall, topography and cropping patterns. The natural resources endowment of the State offers immense scope for agricultural growth and is eminently suitable for a wide variety of food grains, cash crops, horticultural crops.

For the development of agriculture and allied sectors, the State has taken several steps. A separate Agriculture budget is being presented from 2013-14 thereby enhancing the budget outlay of agriculture and allied sectors from 7162 crores in 2013-14 to 14930 crore during 2017-18 in order to provide particular emphasis on growth and allocation of funds to these sectors, and it has further been proposed to enhance to 16765 crores during 2018-19.

An unparalleled growth of nearly 20 per cent in the year 2016-17 was recorded in agriculture post severe contraction of over (-) 13 per cent in 2015-16. The low base and weather turned out to be a significant factor. It has been observed in the recent past that even though there has been an exceptional negative growth in every alternative year, for the period 2011-17 the annual average growth rate (CAGR) for the sector is 2.8 per cent. The Agriculture sector of the State to be specific as the above tale.

In 2016-17, productivity of 24 qtl/h and a bumper harvest of 97 lakh MT was recorded for rice production. Over 90 per cent of the total foodgrain production was constituted by the rice production which was further marked as the principal crop. Due to intensive cultivation and irrigated land expansion, the State's crop yield and cultivation area of rice has levitated. Making agriculture remunerative for the farmers and commercial viability of agriculture has been possible due to increase in Rice crop areas diversion to HYV paddy and also to cash crops. With additional potential of 1.17 lakh hectare generated in 2016-17, the State's total potential of irrigation was positioned at 55.91 lakhs hectare (*Kharif*-37.83 hectare and *Rabi* 18.08 hectare). However, the yields of principal crop are less than the Country's leading States, and only about one-third of net sown area is irrigated.

Some short gestation projects like Mega Lift Irrigation Projects, Deep Bore well Construction Programme, and Check Dam Construction Programme has been launched by the State Government, with a hope to swiftly meet the farmers' irrigation requirements. By the end of 2019, Another 10 lakh hectare of cultivable land under irrigation cover has been targeted to be brought under irrigation cover.

Although there is an increase in the coverage of farm mechanisation in India, it is chiefly region specific, as initially, it has proved its superiority over the traditional practices only in certain selected areas like Punjab, Haryana and Uttar Pradesh. Still, there are a large number of regions those continue to remain aloof from these advancements in agricultural techniques of production, these states encompass Odisha, Bihar, Madhya Pradesh, Assam, etc. Thus this paper aims to discuss the problems and prospects of agro-technology transfer in one of the backward zones, that is Odisha and more specifically in Cuttack district. A brief note is to be presented on how farm mechanisation can be put to work in this backward zone to increase the productivity and for the development of this area and the economy as a whole.

Farm Mechanisation :

There has been a great significance of farm mechanisation for reducing the costs of production and improving the productivity and equipping the farmers to maintain agricultural works in a timely and quality enhanced manner. It is; therefore, NFSM and Sub Mission on Agriculture Mechanisation schemes have been advocated under Central Sector Schemes to popularise modern farm equipments and machineries (Activity report of department of agriculture and farmers empowerment, 2016-17) Also immense farm mechanisation programme is being taken up under "Popularisation of Agriculture Implements, equipments and diesel pump sets" under State Sector Schemes and RKVY. During 2017-18, various agricultural implements and machineries are being popularised extending subsidy worth rupees 34350.00 lakh which includes rupees 26500.00 lakh from State Sector Scheme and rupees 7850.00 lakh from Central Sector Schemes, out of which rupees 28863.80 lakh has been utilised (till Feb'2018).

Literature Review :

With a point in mind to construct a skeleton with the aid of which one can get a lucid sketch of how to interpret the problem involved in the study, there arises a pretty good need of a substances idea about the study area, which could only be achieved by going through several relevant literatures that has a direct or indirect bearing on the conceptual design dealt within the study. It is very much evident from a considerable number of sources like journals, books, theses and dissertations that many studies have been conducted in the sphere of New Agricultural Technology at the national, regional and district level.

There are more than seven billion people in the world, and that number is expected to grow to nine billion by the year 2050 (Simmons, 2011). From the above statement It can be concluded that with the aid of advancement in agricultural system, it is possible to manage a provision to feed many people by maintaining safety and nutrition in food. Ninety per cent of the U.S. population, over 200 years ago lived on farms and they produced food for their consumption. Prax in 2010, was of view that a mass of two per cent now a days produces the food, which includes fruits, vegetables, meat and dairy, that is consumed by everyone. It is a massive switch in the amount of people associated with producing food and making sure that everyone has enough to eat. Farmer adopts technology for a fructifying world to make advances in producing more food. At present, a farmer can feed 155 people only due the adoption modern technology, but in past, more precisely in 1940, one farmer could feed just 19 people (Prax, 2010).

According to Sahu and Mishra (2013), Odisha is one among the Indian states which has the highest proportion of poor persons in its population, and a study on factors that influence farmers' adaptability of new agricultural technique in Kendrapada district of Odisha has been made by Sahu and Mishra (2014), they analyzed various socio-economic factors that influence farmers' adaptability of modern technology. As per their analysis, there is an ambiguity regarding the size of household's influence upon the decision to adapt. Household size turns out to be a proxy to labour availability, and the labour constraints are lowered. However, as per Tizale (2007), to help out the consumption pattern of large families a part of their family members are forced to work in the off-farm sector.

Mendis and Udomsade (2005) made a study in Kalutatra district on paddy to determine the association between socio-economic factors, identify the socio-economic factors of farmers related to adoption and recommended crop management practices. They put forth that factors relating to farmer's adoption of crop management practices were farmer's level of education, land size, income, credit, source of information, land tenure, participation in extension activities, extension office visits, and membership in farmer's organisation. They addressed that the significant problem of the farmers were high cost of fertilisers and agro chemicals, high prices and lack of quality paddy seeds, shortage of labour and high rates of labour and tractors, cultivation problems, irrigation and drainage problems, lack of suitable varieties and credit. Saka *et al.* (2005) conducted a study in South-Western Nigeria on adoption of improved rice varieties among smallholder farmers. The result witnessed significant positive relation of level of adoption and rate of yield of the improved rice variety, farmers' membership of associations, rice farms size, educational attainment level, participation of farmers' in intervention programmes, availability of alternative income sources, processing quality of rice variety, and frequency of extension contact. No significant influence were found on intensity of use of improved varieties by factors like farmers use of fertiliser in rice production, drought tolerance and disease rating attributes of the improved varieties, access to credit

facility and number of sources of information. Adoption of modern technology rate was negatively affected by age of farmer, access to credit facilities and number of sources of information also.

In order to increase the farm production and productivity the process of using agricultural machinery to mechanise the work of agriculture is stated to be mechanised agriculture. Now a day it is becoming crucial to avail labour to work in agriculture sector. In Indian economy, the population dynamics of agricultural workers shows that by 2020 will be about 230 million out of which 45% will be the female workers. The population in rural areas has been predicted to fall around 62.83% in 2025 and to 44.83% in 2050 (Mehta *et al.*, 2014) but to feed ever increasing population in the country there is a need to double the food production by 2020 (Sahana *et al.*, 2017). They were of view that, the seedbed preparation power requirement and for cultivation and harvesting of food crops for huge population of the State, the existing human and animal power in the country appears to be inadequate.

Over the past few years there is a huge rise in demand for tractors, combine harvesters, threshers, rotavators, power tillers, and rice transplantors etc. Labour saving farm implements along with availability of farm power is positively correlated with judicious utilisation of farm productivity. By making farming an attractive enterprise, poverty can be alleviated, and productive utilisation of various agricultural inputs can be enabled through agricultural mechanisation.

From the precursory discussions, and review of literature, it is very much lucid that many factors may come to the aid to explain the technology adoption pattern. As priorly discussed, they involve market forces, social factors, management characteristics, institutional factors, information delivery mechanisms etc. These factors may act as either stimulant or hurdles to technology adoption.

Objective :

The objective of the paper is to discuss the extent of use of technology in agricultural activities and the constraints behind its non-use.

Farm Machineries used in Odisha :

It is very much essential to provide data regarding the use of modern technology in the agricultural sector of Odisha, and thus the following data is presented in the Table 1. The Table 1 includes data relating to the use of tractors, power tillers, water pump sets for irrigation purpose and many other technologically advanced types of equipment that are used in agricultural sector of Odisha.

METHODOLOGY

To study the farm mechanisation in agricultural sector, Cuttack district is selected purposefully as it is one of the advanced districts of the state. There are 14 blocks in Cuttack district. Kantapada block is selected by using simple random sampling technique. There are 14 gram panchayats in Kantapada block, and 2 gram panchayats Kantapada panchayat and Govindpur

Table 1 : Farm Machineries used in Odisha from the period of 2006-07 to 2013-14

Year	Tractor	Power Tiller	Self Propelled Reaper	Self Propelled Transplanter	Rotavator	Power Operated Implements	Special Power Operated Implements	Power Thresher	Hydraulic Trailer	Manual Implement	Combined Harvester	Pump Sets
2006-07	1247	2974	107	4	32	205	107	NA	248	NA	NA	NA
2007-08	705	3364	93	15	47	253	215	NA	4	3400	NA	NA
2008-09	1500	5280	292	45	38	13	396	831	536	2946	49	8331
2009-10	2325	7615	454	26	36	13	492	1412	451	3721	72	25877
2010-11	4750	12742	869	42	311	254	805	2437	1407	10373	123	29255
2011-12	5317	11257	693	45	NA	725	537	3480	2091	7553	78	28490
2012-13	5977	12503	1076	2478	NA	2748	1189	4972	1943	4552	103	40816
2013-14	4534	16144	660	609	399	4013	2446	6100	NA	16992	394	46110
GR From 2006-7 to 2013-14	2.635	4.428	5.168	151.25	11.468	18.575	21.859	NA	NA	NA	NA	NA

Source: Directorate of Economics and Statistics, Odisha, Bhubaneswar

panchayat are selected using simple random sampling technique. Three villages from each gram panchayat are selected: Balipada, Govindpur and Gopalpur villages from Govindpur Gram Panchayat and Olatpur, kantapada and Sisua villages from Kantapada panchayat to conduct the survey, 50 households are randomly selected from each village. Thus the total sample units collected for study becomes 300. Structured questionnaire is used to collect the required data from the respondents. Percentage, growth rate and logistic regression analysis have been used to interpret the result.

RESULTS AND DISCUSSION

Use of modern technology in various farm activities:

In Kantapada block paddy is the major crop. However few farmers also cultivate vegetables, groundnut, biri, mung dal, etc. The following Table 2 describes the use of modern technology in various agricultural activities by the farmers.

Table 2 : Use of modern technology in various farm activities (N=300)

Sr. No.	Activities	No. of Adopters	No. of Non-Adopters
01	HYV Seeds	300	0
02	Fertilisers and pesticides	279	21
04	Cleaning of Land	135	165
05	Ploughing	135	165
06	Levelling	90	210
07	Sowing	60	240
08	Watering	120	180
09	Weeding	6	294
10	Harvesting	30	270
11	Threshing	30	270
12	Picking	0	300
13	Winnowing	15	285
14	Husking	0	300
15	Storing	0	300
16	Transportation	280	20
17	Listening Radio and Watching TV (Programs related to Agriculture)	270	30
18	Use of Mobile/Internet (for agricultural purpose)	60	240

Source: Field Survey

So the study reveals that all the sample household farmers are using HYV seeds. 93% of the farmers are applying chemical fertilisers and pesticides. These two statements imply that farmers are not using the traditional seeds and using very less of organic manure/compost. For cleaning of land, ploughing, levelling farmers use modern technology that is tractor and associated equipments. In the study area, its use is 45%, 45% and 30%, respectively. Thus more than half of the farmers still use the traditional method of cultivation using bullocks and ploughs. As per the data presented in the above table a majority of the sample household farmers fail to adopt modern technology, the table shows that many farmers revealed that they hesitate to apply modern techniques for farming purpose like for sowing seeds, watering farm area, harvesting and picking yield. From the table the percentage figure with respect to farmers not employing modern technology for farming can be visualized, that is 80%, 60%, 90%, 100% of farmers said that they do not apply modern techniques of farming for sowing, watering, harvesting and picking, respectively and rather they go for the conventional way.

Weeding, threshing, winnowing and husking are also done in traditional method by most of the sample household farmers, and the use of modern technology percentage can be stated as 2%, 10%, 5% and 0%, respectively. In addition to these, the sample household farmers do not at all adopt modern technology for storing of the produce (100%) and 80% of the sample household farmers do not know and are ignorant about how to use mobile phones and internet for getting information regarding agriculture such as market price of agricultural produce, government schemes relating to farmer benefit, etc. Thus the use of modern technology in various agricultural activities is not satisfactory.

Important constraints for the adoption of modern technology as perceived by the farmers :

Farm mechanisation has got an important role to play for timely operation of agricultural activities further raising production and productivity of agricultural sector. Increasing the productive capacity of agriculture through higher land productivity and labour productivity is of utmost importance in developing countries. As the scope of bringing in new land area under cultivation has become severely limited due to high rate of population growth and increasing demand for land in non-agricultural use, the important way to enhance agricultural productivity is through introduction of improved agricultural technologies. However, mere development of productivity augmenting technologies is not enough. If agricultural technologies

developed for farmers of such developing economies are not adopted accordingly, all the efforts by the researchers who developed new technologies would have been worthless. Thus, it becomes quite essential to list out the problems that create hindrance in the path of the farmers for adopting modern technology, the Table 3 presents data in relation to various constraints for the adoption of modern technology.

The Table 3 reveals various constraints (as farmers' perceived) for adoption of modern technology, the major constraints are high rate of interest of non-institutional credit (90%), inadequate irrigation facility (80%), low price of agricultural produce (75%), lack of institutional credit (65%), high cost of input (63%), lack of own capital (70%) and lesser contact with the government (60%). Kantapada block, the study area, is well connected to the markets of Bhubaneswar and Cuttack. Therefore 60% of the farmers do not consider lack of transportation facility as a major constraint. Similarly, 80% of farmers do not accept the occurrence of natural calamities like flood and drought as a major constraint for the adoption modern technology.

The Table 4 reveals that the use of modern technology in agriculture is significantly affected by income from primary occupation, income from secondary occupation and availability of agricultural credit to the

Table 3 : Important constraints for the adoption of modern technology as perceived by the farmers (N=300)

Sr. No.	Types of Constraints	E	M	S	N	NI
1.	Not profitable	140	123	17	10	10
2.	Lack of capital	210	85	3	0	2
3.	Lack of institutional credit	195	75	20	8	2
4.	High rate of interest of non-institutional credit	270	15	7	0	8
5.	High cost of inputs	189	80	18	6	7
6.	Risk and uncertainty	230	35	15	15	5
7.	Small holding	150	127	20	1	2
8.	Lack of timely assured supply of inputs	158	120	5	7	10
9.	Complexities	220	45	12	5	18
10.	Lack of Information	120	128	22	10	20
11.	Inadequate irrigation facility	240	30	15	4	9
12.	Erratic supply of electricity	160	92	36	7	5
13.	Lesser contact with government	180	90	7	15	8
14.	Low price of agricultural produce	225	35	25	7	8
15.	Transport problem	10	20	80	180	10
16.	Marketing Problem	240	23	17	10	10
17.	Lack of education/training	125	20	100	5	50
18.	Lack of storage facility	150	82	40	20	8
19.	Occurrence of natural calamities like flood and drought	7	8	15	240	30

E= Extreme, M= Moderate, S= Somewhat, N= Nil, NI= No Idea
Source: Field Survey

Table 4: Logistic regression result dependent variable: Use of Modern Technology in Agriculture

Variables in the Equation	B	S.E.	Wald	df	Sig.	Exp(B)
Age	-.016	.010	2.437	1	.119	.984
Year of education	-.003	.029	.010	1	.921	.997
Income from PO	.000	.000	2.983	1	.084	1.000
Income from SO	.000	.000	15.734	1	.000	1.000
Credit availability	.000	.000	38.504	1	.000	1.000
Size of holding	.019	.013	2.437	1	.120	.994
Constant	.798	.556	2.062	1	.151	2.221

-2 Log likelihood	Cox and Snell R Square	Nagelkerke R Square
497.105	.162	.244

farmers. This implies that more income from primary occupation and secondary occupation and availability of agricultural credit lead to more use of the modern technology in agriculture. This may be due to the fact that income and credit availability would economically empower the farmers to bear the relatively higher cost of the modern technology. However, this is not influenced by age, years of education and size of holding as they are not significant. The insignificant impact of years of education could be because of the positive externalities of education, which means even farmers with lower education or no education can reap the benefit of modern technology in agriculture.

Conclusion :

In advanced countries, 2-3 percentage of labour force are engaged in agriculture. The produce is sufficient to meet the domestic demand, and they export the surplus produce and earn foreign exchange. In developing countries like India more than 50 per cent of labour force is engaged in agriculture, but still, the output is not sufficient to meet domestic market demand. The agricultural productivity of the developing nations is very low in comparison to that of developed countries. There are various reasons behind this low productivity, and one of the major causes is less use of modern technology. Methods of cultivation in India is still very much labour intensive from the field survey it is observed that all the farmers are using the HYV seeds, but in other agricultural activities like ploughing, weeding, levelling, etc. they are still using the conventional/traditional methods. The majority of farmers know about the modern technology but not adopting in practice. Lack of institutional credit, lack of own capital, high rate of interest of non-institutional credit, lack of irrigation facility, low price of agricultural produce are the major constraints as revealed by the sample household farmers in the study area. It is obvious that majority of the farmers are poor and therefore unable to afford the use of modern technology in their fields. Provision of sufficient and timely institutional credit, expansion of irrigation facilities, publicity of facilities provided by the government, etc. will definitely encourage the farmers, especially the marginal and medium farmers to adopt modern technology in agriculture.

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