Factors Affecting Farm Mechanization – A Case Study In Assam

Abstract

The study was conducted in Central Brahmaputra Valley and Upper Brahmaputra Valley Zone of Assam in India. The present study is an attempt to study the effect of mechanization on income and limiting factors –of farm mechanization of the sample farms–. Primary data of 240 sample farms by personal interview schedule- method was used– for examining the across affecting mechanization- adoption—. All data collected from sample farms pertains to the year 2014-15.With the help of logit regression different factors affecting the mechanization adoption was examined in the sample households where six explanatory variable to explain mechanization adoption *viz.*, age of the head of household, size of land holdings, access to irrigation, access to extension agents, area under high yielding varieties and the access to institutional credit were included and the negative value of the coefficient of AGE showed that the younger generation of farmers favoured the mechanization of farm much more compared to the old block. The coefficient of EDU (4.325) was positive and highly significant at 10 per-cent probability level confirming that the adoption of farm mechanization was more prevalent among the farms having relatively literate in the study area. It was found from the above analysis that there were different factors which affect the farm mechanization.linkage of extension functionaries with the grassroots level by creating awareness about the use of farm machineries amongst the farmers

Key words: Mechanized, non mechanized, mechanization adoption, linkage ,profitability

INTRODUCTION

Mechanization encourages to improve efficiency of production, encourages large scale production and ultimately leads to urbanization and commercialization in agricultural sector. Olaoye (2010) reported that the key factors for successful mechanization include socio-economic factors, supporting infrastructure, agro ecological and land situation, and technical skills and service of people [1]. Important agricultural equipment demand like tractors, power tillers, combine harvesters, irrigation pump sets, diesel engines, has shown an increasing trend. Introduction and adoption of agricultural machinery in the recent past has mainly been confined to the northern states of India. However, with the increase in the irrigation facilities and modernization of the cropping practices, the demand for agricultural machinery has shown an increasing trend in the southern and western parts of the country. The eastern and the north-eastern states have been less responsive to adaption of agricultural machinery. The shift from conventional flood irrigation to sprinkler, micro sprinkler or drip irrigation systems is apparently visible indicating the importance of water use efficiency for covering more area under irrigation. The Government support in the form of subsidy is serving as a catalyst to compensate for the high initial cost of the system. Further, new equipment such as precision planter, zero-till drill,

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Comment [EA1]: This sentence is too long so it makes it difficult for the meaning to stand out.

Comment [EA2]: Kindly check what this really mean. I believe the interpretation is not as stated. Your focus is on the determinants of mechanization adoption hence your interest is in factors that are likely to drive adoption. I would rather say that "Educated farmers are more likely to adopt mechanization than the uneducated. Remember that logit operates on the principle of probability.

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seed cum fertilizer drill, raised bed planter, improved weeders, plant protection equipment, harvesting and threshing machines, drip, micro sprinkler and sprinkler irrigation equipment have been made available to the farmers. As a result of the joint efforts made by the government and the private sector, the level of mechanization has been increasing steadily over the years. Since independence, Indian agriculture has been transformed from subsistence agriculture to modern agriculture. The sources of energy and power, farming practices and technologies and crops have under gone area change. This is evident from the data on number of mechanical power units used in Indian agriculture. Number of tractors, diesel engines, electric motors, power tillers and self-propelled combines has increased by manifolds during the second half of the twentieth century. Use of tractors can be essential for expanding the aggregate area cultivated by large farms, for whom hired labor represents a high production cost of production. The economies of scale associated with a large machine such as a tractor have also made mechanization a more attractive technology to reduce the time as well as labour. In developing countries tractor owners in most are typically larger farmers, who also provide hiring services to non-owners when it to helps them maximize their tractors' utilization. Such trends have been observed commonly in Asia. A significant share of mechanization in Asia has been adopted by small holders cases from Asia shows that mechanization is often driven by large farm sizes and enables farmers to further expand their landholdings, but it is not a prerequisite for mechanization to be profitable. Profitability of service provision is an important component of medium to large farmers' demand for mechanization equipment. Tractor owners can get benefit from hiring out machineries where there is high demand for mechanization among farmers, even if area expansion is not possible due to limited land or a weak tenure system. Some owners of machineries utilize to migrate with their machines to areas with different seasons for plowing and harvesting beyond hiring out services to local farmers. Tractor and power tillers can also be used beyond land preparation by using the engine to power a tractor-mounted threshing machine or water pump or through hiring out for transport services. Even though farm mechanization shows an increasing trend, across the states in India there are wide ranging disparities in the levels of mechanization. Northern States such as Punjab, Haryana, Uttar Pradesh have achieved a faster growth in mechanization than other areas in India. Throughout the country sale of other implements and machines like combine harvesters, threshers and other power-operated equipment have been increasing almost. Adoption of mechanization in north-eastern states has not been satisfactory due to constraints such as topography, socio-economic conditions, high cost of transport, lack of institutional financing and lack of manufacturing industries for farm machinery. Mechanization in Western and Southern states of the country *viz.,* Gujarat, Maharashtra, Rajasthan and certain areas of Tamil Nadu, Andhra Pradesh etc., has increased with the increase in area under irrigation. In the study area extent of mechanization adoption was found moderate. In this section different factors which influence the mechanization adoption in the study area are discussed. Rasouli*et al.* (2006) conducted a study to determine the factor affecting the implementation of national agricultural mechanization programs in Iran. The findings of the second phase of this research indicated that the mean agricultural mechanization level practiced on the sunflower producing farms was about 0.5 KW per ha of cultivated land and the amount of energy input varied between 0.0149 to 3.4973 KW. Using Multivariate linear regression, 46.9 per cent ($R^2 = 0.469$) of the variance in the level of agricultural mechanization practiced could be explained by variables such as income, total farming land, and land holdings under sunflower seed cultivation[2].Ayandiji and Olofinsao (2015) studied the socio economic factors affecting farm mechanization by cassava farmers in Ondostate, Nigeria and logistic regression analysis model to examine the factors. They found

Comment [EA7]: Dear colleague, this are information coming from existing literature, I guess. If so, please state the sources please!!

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94 that access to extension workers and access to farm machines had a positive relationship with
95 adoption and problems faced included were access to spare parts, access to skilled man power,
96 maintenance of farm machines, availability of machines in time required.[3]
97 Mwangi and Kariuki (2015) studied the factors affecting adoption of new agricultural technology
98 by smallholder farmers in developing countries and concluded that perception of farmers towards
99 a new technology was a key precondition for adoption to occur. Other factors included were
100 human specific factors, economic factors, technological and institutional factors. They reported
101 that the determinant of agricultural technology adoption did not always have the same effect on
102 adoption rather the effect varies depending on the type of technology being introduced [4]
103
104
105 **Statement of the problem**
106 In the context of farm mechanization impact and factors on agricultural production, , there has
107 hardly been any study so far in the state of Assam and therefore the present study was an
108 attempt to answer the aspects of farm mechanization in Assam with following specific
109 objectives.
110
111 **Objectives :** factors affecting farm mechanization of the sample farms
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115   **MATERIALS AND METHODS**
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117 ——————————The present study is an attempt to study the effect of mechanization on income of
118 the sample farms. The study was conducted in Upper Brahmaputra and Central Brahmaputra
119 Valley Zone of Assam. The sampling design followed for the study was four stage random
120 sampling design. Districts from the first stage unit, blocks were the second stage unit, villages
121 were the third and the sample farmers were the fourth ultimate stage of units of sampling. For
122 Central Brahmaputra Valley Zone, Nagoan district had been selected as Nagaon district is ahead
123 of mechanization compared to other districts. Dibrugarh and Jorhat district represented the Upper
124 Brahmaputra Valley Zone. In consultation with Agricultural Development Officer (ADO) and
125 Agricultural Engineering Department, Government of Assam in the selected districts, the blocks
126 having higher concentration of farm implements were selected .The present study is an attempt
127 to study the effect of mechanization on income of the sample farms. The study was conducted in
128 Upper Brahmaputra and Central Brahmaputra Valley Zone of Assam. Primary data pertaining to
129 the year 2014-15 were collected withfrom 240 numbers of sample farms by personal interview
130 method and with the help of specially designed pretested schedule were used for examining the
131 factors affecting farm mechanization. Logit regression analysis was done for various sample
132 farm in order to study the factors affecting farm mechanization. Uaiene and Rafael (2005)
133 reported the agricultural technology adoption by rural households in Mozambique and probit and
134 logit models based on normal and logistic cumulative distribution functions were used and
135 difficulty in accessing credit appeared to be one of the major constraints to technology adoption
136 [5]. Aslan*et al.* (2007) analyzed personal, physical and socio-economic factors affecting farmers
137 land consolidation adoption with the help of dummy variable constructed against dependent and
138 different independent variableby using logit regression model [6].Though it is very difficult to
139 achieve the mechanization level of the farmers, here index of mechanization was used based on

Comment [EA21]: What is the relationship between these and your paper. You have just stated what they did and the results obtained. How is this linked to your paper?

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Comment [EA23]: This does not qualify as an obective
Rephrase you objective well and add it to the previous section as the last line

Comment [EA24]: Determined by who?

Comment [EA25]: Repetition

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Comment [EA27]: What does the logit regression do? What is the theory behind this method. What is the empirical specification. What are the advantages and weaknesses of this method?
Why did you choose to use this method?

140 farmers' used and ownership of modern implements such as tractors (owned or hired), power
141 tiller (owned or hired), sprayer, harvester, thresher etc. Farmers' responses of these parameters
142 are codified as scores. Total scoring of these codification ranges from 1 to 7 on the level of farm
143 mechanization achieved by the respective farmer. Finally if the score of the farmer exceed 50 per
144 cent of the total attainable score we considered the farm as mechanized and assign a value 1to
145 that farm and 0, otherwise. Logit analysis was with the help of following formula:

146 $\qquad P = 1/(1+e^{-FM})$

147 Where, P is the probability that household achieved farm mechanization

148 $\qquad FM = a_0 + a_1*AGE + a_2*EDU + a_3*LHD + a_4*EXT + a_5*IRA + a_6*HYA + a_7*BLN$

149 Where,
150   i)   AGE is the age of head of the household(proxy for experience) in years
151   ii)   EDU is the education level of the household ;
152 Where,
153   0=illiterate
154   1= up to class IV
155   2=from class V to X
156   3=from class X to graduate level
157   4=more than graduate
158   iii) LHD is the farm size in ha.
159   iv) EXT is the level of contact with the extension functionaries;
160 Where,
161   0= no contact
162   1= contact once in a month
163   2= contact twice in a month
164   3= contact more than twice in a month
165   v) IRAis access to irrigation, 1 if yes 0,otherwise
166   vi) HYA is area grown under high yielding variety crops in ha
167   vii) BLN is access to institutional credit yes=1,0 otherwise

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169

170 **Result & Discussion**

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173   Table 1 analyzed different factors affecting the mechanization adoption with help
174 of Logit regression in the sample household. Six explanatory variable to explain mechanization
175 adoption *viz.*, maximum education level of the household, age of the head of household, size of
176 land holdings, access to irrigation, level of contact with extension functionaries, area under high
177 yielding varieties and the access to institutional credit were used for the analysis to examine the
178 factors affecting farm mechanization. Four explanatory variables *viz.,* EDU (education level),
179 LHD (landholding size), HYA (area under high yielding varieties) and EXT (level of contact with
180 extension functionaries) out of six was found to be positively significant. The coefficient of EDU
181 (4.32) was positive and highly significant at 10 per cent probability level confirming that the
182 adoption of farm mechanization was more prevalent among the farms having relatively literate
183 respondents in the study area. This implies that the higher the education level of the farmers, the
184 higher the level of adoption of mechanization for performing various agricultural operations.
185 This result is in conformity with the findings of positive correlation found between education and

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adoption of new technologies –reported byUddin_*et al.*(2015) reported the various factors affecting farmers adaptation strategies to environmental degradation and climate change effects in Bangladesh and found that age, education, family size, farm size, family income, and involvement in cooperatives were significantly related to self-reported mechanization adaptation [7].

The coefficient of LHD i.e. size of land holding (1.773) with positive and significant at 10 per cent probability level indicated that farmers having greater farm size relatively high mechanization adoption and small farmers had low adoption of mechanization. This was mainly due to larger farmers were financially sound as compared to farmers with small landholding and tend to have modern machineries easily. Again, coefficient of EXT i.e. level of contact with extension functionaries (1.854) and HYA i.e. area under high yielding varieties (1.966) were found to be significant and positive at 1 per cent probability level indicating that level of contact with extension functionaries and area under high yielding varieties playedand important role in mechanization adoption. Therefore, more emphasized should be given to increasing the level of access to extension agents to increase the level of mechanization adoption which ultimately uplift the rural community. Hence, farm size, area under high yielding varieties and level of contact with extension functionaries were considered as important explanatory variable of agricultural mechanization because it showed a positive significant relationship with mechanization adoption. Contrary to expectation, the coefficient of the variable IRA (1.49) i.e., access to irrigation and coefficient of BLN (0.32) i.e. access to intuitional credit had found positive but insignificant relationship with adoption of farm mechanization. Insignificant result IRA indicated that area under irrigated area needs more farm mechanization and similar is in case of institutional credit also means that farmers which were access to credit should be more mechanized. Lastly, the negative value of the coefficient of AGE (-2.63) showed that the younger generation of farmers favours the mechanization of farm much more compared to the old block. This result is in consistence with the findings reported by Ghosh(2007) carried out a study on determinants of farm mechanization in Burdwan district of West Bengal in India. and revealed that younger generation were more opt for farm mechanization than the older block, i.e., age-old custom acted as a hindrance to mechanize the farm practices [8]. This results is in conformity with the findings of Berg (2013) revealed that the main factors were the high age of farmers, high incidence of tractor use, access to land, high off-farm income and poor extension services and found no significant relationships between adoption of mechanization [9]. Similarly,Bac*et al.*(2010) studied the determinants affecting farmers' adoption of Vietnamese Good Agricultural Practices (VietGAP) for tea productionin Northern Vietnam. With the help of binary logit model and tobit model and found significant and positive impacts of family laborers, tea farm size, tea price, access to irrigation systems, ratio of tea income and farming experience and age of the tea farm negatively affected the conversion decision and farmland allocation [10] and Owombo*et al.* (2012) reported economic impact of agricultural mechanization adoption in Ondo State, Nigeria and found that adopted farmers in the area were middle-aged and were relatively educated and non-adopters agreed that mechanization destroys soil quality and as a result of the logistic regression revealed that education, extension visit and machine access were significant determinants of adoption of mechanization practices [11]. On the contrary Kehinde*et al.* (2017) reported factors affecting improved technologies dis-adoption in cocoa-based farming systems of Southwestern Nigeria and revealed that –education was the factors affecting dis-adoption of improved [12] .

Table 1.Logitanalysis of factors affecting farm mechanization of sample farm

Variable	B coefficient	Standard error
AGE	-2.63*	1.24
EDU	4.32***	1.68
LHD	1.77*	1.03
EXT	1.85*	1.11
IRA	1.49	0.17
HYA	1.96*	1.19
BLN	0.32	0.09

*   Significant at 10%probability level
**   Significant at 5%probability level
***   Significant at 1%probability level

Comment [EA29]: Table has no R^2 statistics, no number of observations.

Conclusion

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Mechanization is need based process which provide sufficient time gap for self adjustment of various inputs which ultimately gives positive impact on agricultural production. The present study showed the impacts of mechanization on income in Upper Brahmaputra and Central Brahmaputra Valley zone of Assam. With the help of logit regression different factors affecting the mechanization adoption was examined. Logit regression in the sample household was done where six explanatory variable to explain mechanization adoption *viz.*, age of the head of household, size of land holdings, access to irrigation, access to extension agents, area under high yielding varieties and the access to institutional credit were included and the negative value of the coefficient of AGE showed that the younger generation of farmers favoured the mechanization of farm much more compared to the old block. The coefficient of EDU (4.325) was positive and highly significant at 10 per cent probability level confirming that the adoption of farm mechanization was more prevalent among the farms having relatively literate in the study area. The study revealed that age was the hindrance of mechanization adoption and found positive correlation between land holding size and mechanization adoption.

Recommendation:

The following recommendations had been emerged from the above findings for appropriate policy measure for increasing the benefits of farm mechanization:
The following suggestions had been emerged from the above findings for appropriate policy measure for increasing the benefits of farm mechanization:

1. Development of adequate irrigation and short duration photo-insensitive varieties which would help to increase the cropping intensity which in turn will neutralize labour displacement affect in the study area.

2. Advancing credit for the purpose of purchasing of machineries should be strengthened with simplified forms of norms.
3. Increasing the uptake of improved technologies could be achieved through enlightenment programme by linkage of extension functionaries with the grassroots level by creating awareness about the use of farm machineries amongst the farmers.

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