CHAPTER-V

General Discussion, Conclusion and Recommendation

5.1 Summary of the Results and Discussion:

The current study has estimated the impact of different agricultural inputs on determining agricultural productivity of rice, technical efficiency of rice farmers and the role of household background characteristics in defining technical efficiency in Char Chapari areas of Assam over the cropping year 2009-10. The study determines ways in which rice production can be increased through more efficient use of farming resources. The data were obtained from a random sample of 303 rice farmers. The summary of the results of the present study are presented as below.

5.1.1 Presentation and Analysis of Data Collected for the Present Study:

Sixty percent of the sample farms have the operational holding less than or equals to one hectare of land and 33 percent of the sample farms have the operational holding less than or equals to 3 hectare and greater than 1 hectare of land whereas only 7 percent of the sample farms have more than 3 hectare of land. It clearly indicates that the farm size in the study area is in an average very small.

The average land holding is highest among sample farms (in hectares) in Jamdarhat block (i.e. 1.45 hac) among in the surveyed blocks and lowest in Mahamaya block (i.e. 1.03 hac). And the average land holding in the overall surveyed area is 1.30 hectare. It is seen that, there is no high variation in average land holding size.
The average net cropped area and average gross cropped area under paddy is largest in Chapar Block (i.e. 0.669 hac & 0.686 hac) and the same are smallest in Mahamaya Block (i.e. 0.425 hac & 0.437 hac). On the contrary, average net cropped area and average gross cropped area in overall sample household in char area are 0.52 hac and 0.54 hectare respectively. The percentage of total land holding under paddy in the sample farms in selected char areas is 48.42 and it is minimum in Birshing Jaruah Block and maximum in Chapar Block which are 40.69 and 57.55 percent respectively.

Among the total sample households 59.74 percent have small size of holdings (Small ≤ 1 hac.), 33.33 percent have medium size of holdings (1 hac. < Medium ≤ 3 hac.) and only 6.93 percent have large size of holdings (Large > 3 hac.). The distribution sizes (i.e. small, medium and large) have been made on the basis of the prevailing features of the study area.

Among the sample farms 89 percent have the area under paddy cultivation less than or equal to one hectare of land and 10 percent of the sample farms have the area under paddy cultivation less than or equal to 3 hectare and greater than 1 hectare of land whereas only 1 percent of the sample farms have more than 3 hectare of land. It throws a clear picture indicating that most of the farms in the study area cultivate paddy in a very small size of land.

In all the blocks more than 75 percent sample households have less than one hectare of land under paddy cultivation in the year 2009-10, the survey year. Among the 303 sample households, 269 (88.78%) households have cultivated paddy in less than 1 hectare of land, 32 (10.56%) have cultivated more than 1 hectare but less than 3 hectare of land and only 2 (0.66%) households cultivated more than 3 hectare of land. It indicates that, though paddy is the main crop for
cultivation for the cultivators of Char Chapari areas, they cultivate paddy in very small size of land because of small holding.

Among the sample households 100 percent household cultivate summer paddy and the number of households cultivating both winter and autumn paddy are very few in the study area. The cropping intensity in all the blocks as well as in overall sample households is more than 100 percent. It indicates that the cultivators in study area generally cultivate paddy in a single season and they do not use the same plot for paddy cultivation in different seasons.

The primary data collected show that most of the sample households use HYV seeds and it is used mainly in the summer season. Very few numbers of households use HYV seed in winter and autumn season. Number of farms among the sample farms which use local seeds are also very few in number. Thus it is evident that in the study area majority of the households use HYV seeds and mainly cultivate paddy in summer season.

From a comparative analysis of use of different types of seeds in different seasons in the study area it is found that HYV seeds are mainly used in summer season rather than winter and autumn season.

It is seen from the data collected that in the summer season the cultivators use chemical fertilizers more in comparison to winter and autumn season. In the total sample the average use of chemical fertilizers in summer, winter and autumn are 442.34 kg/hac, 101.53kg/hac and 118.25 kg/hac respectively. But in winter and autumn very few numbers of cultivators are found to cultivate paddy. The data also reveals that in the study area the cultivators are mostly using chemical fertilizers along with HYV seeds of rice.
The season wise distribution of sample farms according to use of chemical fertilizers (N+P+K+DAP) (in kg/hac.) for the overall sample size shows that the farmers of the study area use maximum quantity of chemical fertilizers in summer season followed by autumn season. And the least quantity of chemical fertilizer is used in the winter season.

Use of human labour mandays per hectare of paddy cultivation is also higher in summer season in comparison to winter and autumn. The data reveals that, in the complete sample the average use of human labour mandays per hectare in summer, winter and autumn are 197.87, 56.54 and 110.06 respectively. The data also represents that both human labour mandays per hectare and use of chemical fertilizers per hectare have been used in high amount along with HYV seeds of rice only. In case of local seed the cultivators are using less amounts of labour mandays and chemical fertilizers in winter and autumn season.

Among the total sample households, the average use of pesticides in summer, winter and autumn season are 584.58 ml/hac, 283.75 ml/hac and 244.37 ml/hac respectively.

In the present study the machine hours comprise of use of different types of machines per hour like; Tractor, power tiller, power pump, thresher and sprayer. Here also cultivators use more machine hours in summer than in winter and autumn season.

Among the total sample farm households, 91.75 percent use irrigation facility in summer season and 6.27 percent use this in autumn season but no farm uses irrigation for paddy cultivation in winter season. It might be the reason that in the char areas uses some local variety of seeds for winter season which are locally called ‘amon’ and this paddy seed is sown with summer paddy ‘asu’ or ‘aush’ but since for ‘amon’ it takes six to seven months to harvest. So it remains in the field after harvesting ‘asu’ in the month of June or July and grows in the flood period and it can
be harvested in the month of December and January. Therefore it does not require any irrigation.

Similarly, the people of char area cultivate another local variety of paddy which is locally called ‘poronga’ or ‘katari’ or ‘kaiter’. This winter paddy is sown in September or October on the alluvial clay which is created in char after flood. These paddies also do not require any irrigation.

Thus the farmers of char area cultivate some winter paddy which grow in flood period might be the reason behind no firm using irrigation in winter paddy. On the contrary only 5.61 percent of the sample households do not use any irrigation for their paddy cultivation and remaining 94.39 percent use irrigation in at least any one of three seasons. But unfortunately almost 100 percent of the irrigated farms use private irrigation by using power pump or some other sources of irrigation, like, hand pump, bamboo paddle pump, etc. Some of the power pumps have been provided by Irrigation Department through FMC.

Table: 4.11 shows the average cost of production per quintal output of rice (in Rs.) among the total sample farms is Rs.1275.90/quintal. And same is highest in Jamadarhat Block (Rs.1434.44) and lowest in Devitola Block (Rs.1151.00). Identification of factors responsible for the variation in cost of production (per quintal) demands in depth study which is out of the perview of the present job. However, the variation in irrigation cost is a factor that contributes to the phenomenon.

Study of India’s Farm Management Surveys sparked a debate in the 1960s on an observed inverse relationship between farm size and productivity (Sen 1962). In the present study it is seen that with the increase in farm size productivity per hectare of land decreases which indicates an inverse relationship between farm size and productivity. The overall trend in the present study is consistent with earlier results obtained by Sen, A.K. (1962).
Very less percentage of sample farms practice completely mechanized ploughing. The data collected and analyzed in the present study that represents that only 21.45 percent of the sample farms are using fully mechanized ploughing and 34.32 percent are using both mechanized as well as traditional ploughing whereas 44.23 percent of the sample farms are using only traditional ploughing. This result indicates that in the study area majority of farms are using bullock for cultivation of land.

It is seen from the present study that among the total sample farms, 24.36 percent of the labourers are family labour and remaining 75.64 percent of the labourers are hired labour. Among the family labourer, 63.31 percent are male and 36.69 percent are female. On the other hand among hired labourers 59.70 percent are male and 40.30 percent are female. In all the blocks, except Chapar Block, the percentage of male is high in comparison to female among family labourers as well as hired labourers. But in Chapar Block in case of hired labourer percentage of male is 43.64 percent whereas percentage of female is 56.36 percent. This exception is due to the reason that, some female labourers from outside the char area come to this area to sale their labour.

From a comparative picture of productivity according to different sizes of holdings in six sampled blocks as well as in over all char area it is seen that from the individual blocks a unique relationship between farm size and productivity can not be derived. But in over all char area, it can be stated that there is an inverse relationship between farm size and productivity in the study area which matches with the earlier results obtained by Sen, A.K. (1962).

The distribution of sample farms on the basis of level of productivity of rice is done in the present study where productivity is divided into three types, namely high, medium and low
productivity. High productivity is considered as greater than national average productivity (i.e. 2178 kg/ha.) in the year 2008-09, medium productivity is considered as greater than or equals to the average productivity of rice in the state Assam but lower than or equals to the national average (i.e. 1614 kg/ha.≤Medium≤2178 kg/ha.) and low productivity is considered as the productivity less than average productivity of rice in the state Assam (i.e. 1614 kg/ha.) in the year 2008-09. The data analysis of the present study gives evidence that 79 percent of the sample farms in the study area have productivity higher than the national average in the year 2008-09, thus it can be concluded that the productivity of rice in this area is high.

The data also reveals that in the summer season productivity of rice is very high in comparison to winter and autumn season. In the summer season the productivity of rice per hectare of land among the sample farm in the period 2009-10 is 3143.04 kg whereas it is 1196.50 kg and 1223.78 kg in winter and autumn respectively in the same year. The difference in productivity of rice is obviously due to the higher use of HYV seeds in summer season than winter and autumn season. With the HYV seeds the other inputs like irrigation chemical fertilizers, pesticides etc. are also being used in higher doses in summer season. The higher use of HYV seeds in summer season is also logical for the study area in the sense that the climatic condition is suitable for the use of the HYV seeds which are generally being used in the study area.

5.1.2 Summery Statistics of the Sample Household:

The summary statistics of the production variables and the house hold background characteristics indicate that, the mean output per farm (small, medium and large) in rice production is 1506.47 kg and the mean output per hectare of rice production is 3102.02 kg which is remarkably higher than the average yield of rice per hac. in Assam (2170 kg only as in 2008-09). The standard
deviation (SD) value calculated is 1010.14 and this high (SD) value points towards the wide variation in the yield rate across the farms in the study area and this leaves scope for further enhancing the agricultural productivity in the char Chapari areas of the state. On an average, a typical rice farmer produces an output of 3102.02 kg of rice per hectare by employing, in an average, 193.84 mandays of labour, 412.33 kg of chemical fertilizer, 584.58 ml of pesticides, and 319.59 kg of manure, 113.18 kg of seed, 252.03 hours of machine use and 111.83 hours of bullock labour per hectare of land. The average percentage area of crop under irrigation and HYV seeds is 80.94 and 79.41 percent respectively with SD value in between 31.61 and 33.08. The mean gross cropped area under rice is 0.53 hectare with standard deviation 0.47.

The fact, 80.94 percentage of area under irrigation and 79.41 percentage of area under HYV seeds in rice production are testimony to the fact that the input structure is moderately good enough in the char areas of Dhubri. However, the SD values in case of some variables again substantiate our concern that the picture is not uniformly good everywhere in the char areas of the district. The most miserable picture has emerged in case of the variable representing the educational level of the main farmer (only 4.61 years of schooling in an average). However, the average work experiences in rice cultivation of the main farmers is 26.85 years which reflects the long association of farmers with rice cultivation in the study area. The minimum (Min) and maximum (Max) values of the variables across sample units are also presented in Table: 4.16 for reasons apparent.

However among the household back ground characteristics, a typical farmer, has 4.61 years of education on an average, 26.84 years of farming experience, and is 47.12 years of age. The mean farm size is 1.29 hectare with average family size 7. Among the 303 sample farmers only 14.52 percent have accessed to credit from different institutions, 71.62 percent farmers accept farming
as their main occupation. Among the sample farmers 49.83 percent belong to joint family, 96.70 percent used to do mixed farming and 53.43 percent have their own land whereas remaining use hired land for cultivation.

As pointed out above, one interesting point of the sample characteristics is that the average productivity of rice in char area is found to be higher than the average productivity of rice in the state of Assam as a whole. This higher productivity might be due to the increase in the use of some high yielding varieties of paddy seeds which are locally called 'Iri' (No.8, No.9, No.36, Jaya etc.) and which are generally cultivated in the summer season. In other studies also the productivity of Iri paddy is observed to be about 20 mounds per bigha (Chakraborty G and Noor Alom; 2005), i.e., near about 4177.56kg of rice per hectare. Also in another study productivity of Iri paddy was found to be 57.21 qlt/ha. (Chakraborty, G.; 2009) which is same as 3861.68 kg/ha. However, these in no way undermine the importance of the present study as the general concern about the existence of high disparity in yield in the agricultural sector of India remains valid in case of the char areas of Assam.

5.1.3 The Result of C-D Production Function Model: (Role of different agricultural inputs in determining agricultural productivity of rice)

The Cobb-Douglas production function has been specified to find out the individual causal relationship between rice productivity (represented here as yield in kg/ha.) and the selected explanatory variables. The OLS estimates of the C-D Production function (Log-linear) has been determine in the present study. It is observed from the result that the model fit (Cobb-Douglas) is a good one as is reflected by F- and R-square values, the former one being a statistically significant one. The R-square is 0.713 and the adjusted R-square is 0.70 implying that the
explanatory variables included in the model could explain 70 per cent of the variation in the productivity of rice across the sample farms. The results show that some of the coefficients are not of expected sign. However, only one of the coefficients of variables having unexpected signs (MN) have turned up statistically insignificant.

The causal relationship of selected variables with yield in kg/ha. as turned up in the result, is explained below, taking one variable at a time. Since the model is a log transformation of C-D production function, the regression coefficients are the partial elasticity of yield per hectare with respect to the individual explanatory variables. Therefore, it measures the percentage change in yield per hectare for, say, 1 percent change in a particular explanatory variable, holding other variables constant. The following discussion will try to highlight the impact of individual explanatory variables, the different agricultural inputs, on the rice productivity (yield in kg/ha.).

**Irrigation (IRR)**

The variable irrigation (IRR) is found to be exerting strong positive impact on the yield of rice. The variable has also turned up statistically significant at 1 percent level. The result is in conformity with the findings of many studies which emphasized the importance of irrigation in enhancing agricultural productivity all over India. The result broadly implies that, holding the effects of other determinants on productivity constant, a 1 percent increase in the percentage area under irrigation of rice cultivation would increase the productivity of rice per hectare by 0.049 percent.

**High Yielding Variety of Seeds (HYV)**

The regression co-efficient value of percentage area under HYV seed is found to be low at 0.044. The variable also exerts positive impact on yield and it has also turned up statistically
significant at 5 percent level. The result is an expected one since application of HYV is expected to increase the productivity of rice as the existing literature suggest. Thus the result implies that, holding the effects of other determinants on productivity constant, a 1 percent increase in the percentage of HYV seeds of rice would increase the productivity of rice per hectare by 0.044 percent.

**Chemical Fertilizer (CF)**

The regression co-efficient of variable representing chemical fertilizer is found to be 0.178 with a positive sign. It is also statistically significant at 1 percent level. The positive sign and significance implies that a 1 percent increase of chemical fertilizers, other factors being constant, would increase the productivity of rice by 0.179 percent. Chemical fertilizer, as expected, has been contributing to the high yield of rice in the char areas. It has already been pointed out that iri variety of seeds which is popular among farmers in char areas needs strong doses of fertilizer for its growth and production.

**Labour Mandays (MD)**

The regression co-efficient of labour mandays is found to be 0.234 and significant at 1 percent level. The variable has strong positive impact on yield of rice per hectare. The result indicates that a 1 percent increase in labour mandays, other factors being constant, can raise the productivity of rice by 0.234 percent. The result is indicative of the fact that the rice crop sector of production in char areas is not yet overcrowded and further increase in labour mandays employed in this area still increases rice productivity. This is also contradictory to the general phenomenon of the existence of surplus labour in agricultural sector of India. Here also it may be pointed out again that the cultivation of iri requires large number of labour.
Pesticides (PST)

The regression coefficient of variable pesticides is 0.004 and is positive implying positive impact. However, although the algebraic sign is in expected line, the variable has turned up statistically insignificant. It implies that there is no significant effect of use of pesticides on productivity of rice.

Manure (MN)

The value of the regression coefficient for manure is -0.007 and it is found to be statistically significant at 1 percent level. Manure is the traditional fertilizer and largely used by farmers in char areas because of its easy availability and low cost. However, the result indicated that excess use of manures will have negative impact on yield. Due to the excess use of manure there grow too much grass (because cattle can not digest the seeds of grass) in the field which harms the productivity. This might be the cause of negative impact of excess use of manure on productivity.

Seed (SD)

The regression co-efficient of variable SD representing seeds used in kg per hectre of rice crop, is -0.065. It is negative and exerts statistically significant (at 5% level) impact on the dependent variable. It is expected and also supported by previous literature. The significant negative impact of the variable SD represents that the farmers of this area are using more than the required amount of seeds in their field.
Experience of the Main Farmer (EXP)

The regression coefficient of variable representing experiences of the main farmers in rice cultivation is 0.010. The variable has turned up statistically insignificant. It is possible because of the long association of farmers with rice cultivation indicates that all the farmers have sufficient experience in cultivation and they have good cooperation among them to share experience of cultivation and for this reason the EXP variable has turned up statistically insignificant in the present study.

Level of Education of the Main Farmer (EDU)

The level of education of farmers is a strong indicator of quality of human resources engaged in cultivation. Though the coefficient of the variable EDU has positive sign which is expected but it is not statistically significant in the char area because the cultivators have long life experience for cultivation and therefore education does not have any significant impact on productivity. And this is supported by evidences found in literatures also.

Farm Size (FS)

The variable size of farm (FS) and productivity of rice is very much contradictory in Indian studies. In the present study though the coefficient of the variable has a positive sign (i.e. 0.054) but it is insignificant. Thus it represents that there is no significant impact of size of farm on productivity of rice.

Gross Sown Area under Rice (GRSA)

The regression co-efficient of gross sown area under rice is found to be -0.101 and significant at 5 percent level. The result indicates that the variable has negative impact on yield of rice per
hectare. Earlier it is mentioned that the iri-rice cultivation in char area requires high doses of chemical fertilizers and irrigation, which is very much costly. Therefore the negative impact of the variable GRSA is possible because the poor farmers can not able to bear the increased expenditure with the increase in gross sown area under rice cultivation.

Machine Hours per Hectare of Rice Cultivation (MCHN)

Though the coefficient of the present variable has positive sign but it is insignificant in the present study. Thus it shows that the variable MCHN does not have any significant impact on productivity of rice.

Bullock Labour per Hectare of Rice Cultivation (BULK)

The regression co-efficient value of Bullock Labour per Hectare is found to be low at -0.001. The variable also exerts negative impact on yield and it has also turned up statistically insignificant. The sign is an expected one because it confirms the intrinsic and instrumental values of mechanization in developing agricultural sector into a modern one. But in the present study it has not been found significant. Thus the matter needs deeper probing.

5.1.4 Maximum likelihood estimates of stochastic frontier production function in rice production in char areas of Assam:

The Maximum likelihood estimates of stochastic frontier production function estimates of rice producing farms in char areas are also determined in the present study. The result shows that all the coefficients have the expected signs except for manure. The coefficients of irrigation, HYV, chemical fertilizers and labour mandays and manure are significant at the one percent level. While seeds, and gross sown area under rice are significant at
10 percent level. Pesticides, experience of the main farmer, education of the main farmer, farm size, machine hours per hectare and bullock labour hour per hectare are insignificant. Labour mandays and chemical fertilizer appear to be the most important variables with elasticity of 0.177 and 0.155 respectively. It implies that increasing labour use and chemical fertilizers by 1 percent individually will lead to 0.177 and 0.155 percent increase in output respectively in rice production of char areas. The coefficient of manure has been found to be negative and it is also significant at 1 percent level implies that higher the use of manure lesser the productivity of rice. The gamma value is 0.875 and significant at 1 percent level. It is an indication that 87 percent variation in output of rice is attributed to technical inefficiency. The sigma-square on the other hand is 0.13 and significant, indicating the correctness of the specified assumptions of the distribution of the composite error term.

5.1.5 Technical efficiency levels of rice farmers (%) in Char Chapari areas:

In order to address the 2nd objective of the study stated as “To measure technical efficiency of agricultural production of agricultural farms producing rice” the technical efficiency levels of rice farmers (in percentage) in char areas has been estimated. The result indicates that the technical efficiency range from 28.24 percent to 96.24 percent. The mean estimate is 78.8 percent. The efficiency distribution has shown that, about 64.36 percent of the rice farmers attained above the mean efficiency level, while only 4.29 percent have below 50 percent level of efficiency. However, about 81.85 percent of the rice farmers attained between 71 and 100 percent efficiency levels. This high level of efficiency is an indication that only a small fraction of the output can be attributed to wastage (Idiong, I.C., 2007). The result farther shows that there are allowances for the farmers to improve their efficiency by about 21 percent.
Through the estimation of technical efficiency of the rice-growing agricultural farms the 1st hypothesis of the study is tested. The high level of efficiency of the agricultural farms indicates that the 1st hypothesis stated as ‘the agricultural farms are efficient in utilizing resources available to them’ can not be accepted since there are allowances for improving efficiency further.

5.1.6 Role of Household Background Characteristics in Defining Technical Efficiency:

Once the frontier has been estimated and reasonable estimates of technical efficiency or inefficiency have been obtained, it is possible to examine the determinants of efficiency in production. Lovell (1993), however, advises that the first stage (estimation of efficiency scores) should include variables under the control of the farmer, while the second stage (explanation of the efficiency scores) should include variables not under the control of the farmer, such as site variables, demographic variables, socioeconomic variables, environmental variables and quasi-fixed factors. In order to address the 3rd objective and to test the 2nd hypothesis the following model, as specified in Chapter-III, section-3.6.4 is estimated by applying simple OLS technique.

The results estimated show that the farm’s socioeconomic and demographic characteristics have important impact on technical efficiency. The model incorporates the average education (AVEDU), average experience (AVEXP), family size (FMLSZ), joint family (JNTFMLY), alternative occupation (ALTOCCU), indebtedness (INDTNS), farm size (FS), HYV seeds (HYV) and farm mechanizations (FRMMCHN) as explanatory variables. The result indicates that, the coefficients of average education, average experience, family size, joint family, alternative occupation, and HYV seeds have positive sign. However out of these; average education, average experience, family size, alternative occupation, and HYV seeds are
significant. The education variable has the right sign and is significant. The role of education in improving farmers’ technical efficiency is widely known because it enables farmers to understand the socioeconomic conditions governing their farming activities and to learn how to collect, retrieve, analyze and disseminate information. Moreover, with higher levels of education, farmers are able to organize themselves into farmer groups or associations, thereby enabling themselves to source funding from lending institutions, especially from non-government organizations (NGOs) engaged in micro credit delivery programmes.

Education also enhances farmers’ understanding of extension recommendations. The results agree with findings obtained by Kalirajan and Shand (1985), Abdulai and Huffman (2000), Weirs (1999), and Owens et al. (2001) that education is relevant for improving efficiency.

The coefficient of the interactive term between the education and experience variables is significant for sample farmers implying that apart from the average years of education for sample farmers, they utilize their accumulated experience in rice farming. When farmers accumulate knowledge, they can keep simple farm records; they can plan and manage their farms more accurately. They are also able to do planting and weeding in due time and can use quality rice seed. Accumulated experience assists farmers in the mobilization and use of family labour instead of relying on farm agents as has been practiced by non-experienced farmers. Thus, the long experience in rice farming gives them relatively greater technical efficiency.

The positive and significant coefficient of family size along with positive significant coefficient of labour mandays indicates that that the farmers having large family uses more family labours for their farming and it gives better efficiency to their farm. Moreover, the significance of positive and significant coefficient of family size can be stated as, firstly, the large farm families
provide farmers with a variety of labour (children, youth, men and women), which leads to division of labour and specialization and secondly, small family farmers suffer from scarcity of hired labour for laborious rice activities because of the recent increase in out-migration of the youth from Char Chapari area to cities in Assam as well as out of Assam in search of jobs mainly in construction cites.

The coefficient of the alternative occupation variable is positively related to technical efficiency, supports that the rice cultivation practiced by the farmers in char area of Assam is very costly and the farmers only having alternative occupation can afford the high cost of chemical fertilizers as well as irrigation cost. Thus the finding explains that only the farmers who have adequate financial support can avail themselves of modern agricultural technology for mobilization and input use, which enables them to uplift their technical efficiency.

The result of the current analysis also gives a positive and significant coefficient for the variable, percentage of HYV seeds in total seeds used in the farming; it indicates that the farmers using more HYV seeds are more efficient.

The coefficient of the farm mechanization suggests a positive and significant relation between mechanization of the farms and technical efficiency of the farms in char areas. The significant coefficient with negative sign of the variable FRMMCHN indicates that the farms only using bullock labour are less efficient than the farms using machines. It signifies that the mechanized farms are more efficient. (FRMMCHN= Farm mechanization (Only bullock=1, Otherwise=0)
5.1.7 Results of Hypotheses Test:

The 1st hypothesis is rejected since the results indicate that there exists farm inefficiency. Only 11 percent farms have technical efficiency in the range of 91-100 percent. Hence the hypothesis that agricultural farms are efficient in utilizing resources available to them cannot be accepted.

The 2nd hypothesis is also rejected since the results suggest that household background characteristics such as education, experience in farm works, family size, occupation etc have positive role in defining technical efficiency of the farm in a statistically significant way.

5.1.8 Summary of the Main Findings:

Summary of the main findings of the present study are as under-

(i) The productivity of rice per hectare of land among the sample farmers are comparatively higher than the average productivity of rice in Assam.

(ii) There is wide range of variation in farm productivity across the sample blocks. This leaves scope for further enhancing the productivity of the agricultural farms.

(iii) Among the variables estimated for productivity analysis irrigation, HYV seeds, use of chemical fertilizers and mandays per hac. are positively and significantly related with productivity. On the other hand, use of manure, seeds and gross sown area are negatively and significantly related with productivity of rice in the Char Chapari areas.

(iv) The mean estimated level of technical efficiency of the sample farmers is also relatively high (i.e. 78.80) though there is high deviation from mean technical efficiency (SD. Value of TE 12.29).

(v) The study also provides evidence to show that technical efficiency of farmers' growing rice in Char Chapari area of Assam is significantly determined by the level of average education
of the farm family, average experience of the household labours of the farm family, family size, alternative occupation of the family, percentage of HYV seeds of rice in total seeds used in farming and the farm mechanization.

5.2 Conclusion and Recommendations:

Thus the study has revealed that the productivity of rice in Char Chapari area is high as well as the farmers in Char Chapari areas are moderately technically efficient in an average, yet there is allowance for farther improvement because there is high disparity in technical efficiency among rice farmers of Char Chapari areas.

The moderate level of technical efficiency among the rice farmers suggests the presence of managerial efficiency and efficient utilization of input resources of rice farmers. It is unfortunate that though productivity and technical efficiency is high in the study area, yet the farmers of char area of Assam are in tremendously poor economic condition. But the finding is not surprising because the rice cultivation practised by the farmers of the study area is very much costly and it might be the cause of poor condition of the farmers in this area. The reason of this paradox may be found out by cost analysis of the rice farmers of Char Chapari area. But, it is not within the domain of the present study.

The important factors directly related to yield of rice are irrigation, HYV seed, chemical fertilizer, and labour mandays. Policies aimed at improving irrigation facilities, distribution of HYV seed, and proper distribution of chemical fertilizers and improvement in the ability of agricultural labourers to provide more labour power will be useful in increasing rice productivity. Development of small irrigation projects and greater investment in the distribution
system of HYV seeds, as well as in distribution system of fertilizers are required to be emphasized at policy formulation level. Policies directed at health status of the farmers in order to increase the labour mandays performed by the farmers will also be helpful in increasing rice productivity in the study area.

Although the present study shows that the mean technical efficiency is moderately high in the poverty-stricken Char Chapari areas of Dhubri district but yet it can be stated that, the technical potential of the areas has not yet been fully realized in raising the agricultural productivity.

Since the present study has shown that education (average years of schooling), experience of farming (average experience), family size (main Farmer only), alternative occupation, percentage of HYV seed and farm mechanization have a positive and significant impact on technical efficiency, there is the need for policy makers to develop formal and informal education programmes that will improve farmers’ abilities to retrieve and process information about modern agricultural technology. Providing them with education will be a useful investment and a good mechanism for improving efficiency in rice farming. The emphasis should be on providing education that will help farmers to understand the socioeconomic and policy conditions governing their farming activities. The education package must also include the provision of farmer field schools to expose them to farm record keeping, group dynamics, resource mobilization and irrigation management. Another way is to strengthen the capacity of rice farmers through farmer centered training workshops geared towards managerial efficiency as well as resource use efficiency. This should be done in a collaborative manner involving the government, district administration and NGOs.
Alternative occupation also has positive significant relationship with technical efficiency, implying that the making and implementing of policies that would encourage farmers to engage themselves in some other occupations in off agricultural seasons will be a step in the right direction.

The positive relationship between average experience and efficiency of the farmers implies that policies that will make encouragement to the age old experienced farmers will go a long way in addressing their resource use inefficiency problems.

Farm mechanization also has positive and significant relationship with technical efficiency, which implies that the implementation of policies for mechanization of farms will help the farmers to improve their technical efficiency. It can be done by providing credit facilities to the farmers to purchase machines for their cultivation.

Steps must also be taken by the Government to increase the cropping intensity in the Char-Chapari areas of Assam.