CHAPTER FOUR

DATA INTERPRETATION AND ANALYSIS

4.1 Agriculture and Human Development Performance in Barak Valley

Since our major objective is to study the interrelationship between agricultural performance and human development, we have analyzed them along with their all components. The analysis is based on the collection of data in the sample locations of six ADO circles while different tables, statistical calculation and diagrams have been used to make the analysis concrete.

4.1.1 Land distribution in ADOs:

The table 4.1 depicts the land holding pattern of the farmers in the study area. Out of 450 samples from 6 ADOs in 3 districts, most of the farmers are small, semi-medium and marginal. The land size has been categorised according to the classification of the government of Assam. Land holding below 1 hectare constitutes 9.34% of the total samples while a total of 42 are marginal farmers. Small farmers are those who have land holdings 1-2 hectare. They are a total of 156 or 34.67%, which indicates that large section of farmers are small farmers. Semi medium farmers are the most in the study area as 161 or 35.78% of samples belong to them. They hold 2-4 hectare of land. 84 are medium farmers i.e.18.66% of the total and they hold sizable farm land in Barak Valley. The large scale farmers according to the survey are only 7; as in Barak Valley only a few large scale farmers are there and practice commercial agriculture.

Table- 4.1

Land Holding Pattern of Sample Farmers in Barak Valley

ADO	Marginal (Below 1.0 hectare)	Small (1.0 – 2.0 hectare)	Semi medium (2.0 – 4.0 hectare)	Medium (4.0 – 10.0 hectare)	Large (10.0 hectare & above)	Total
Dullabcherra	4	34	21	15	1	75
Sadarashi	4	26	27	17	1	75
Arunachal	7	17	29	21	1	75
Sonai	4	25	32	13	1	75
Motinagar	9	29	25	10	2	75
Hailakandi	14	25	27	8	1	75
Total	42	156	161	84	7	450
Percentage of farm families	9.34%	34.67%	35.78%	18.66%	1.55%	100

Source: Field Survey, 2012-13.

Chart- IV.1

Size Class distribution of Land in Sample Farms

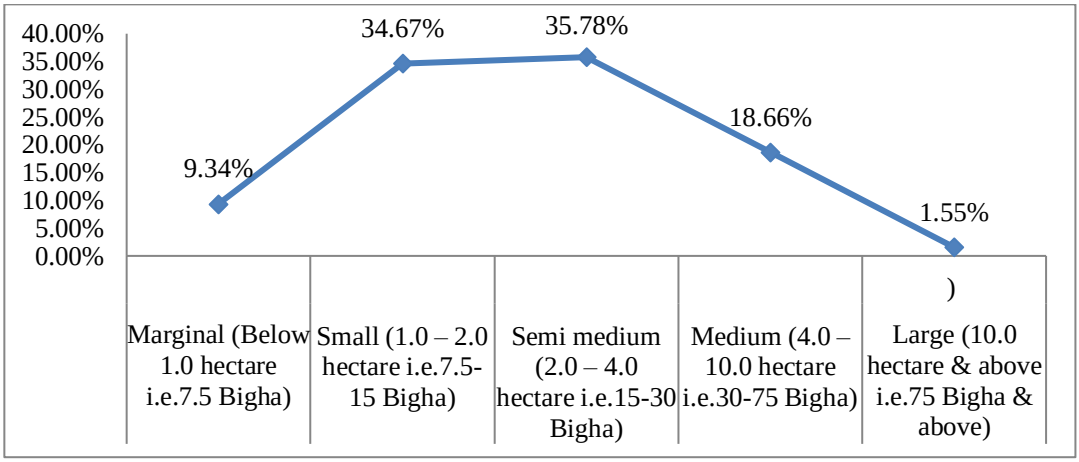
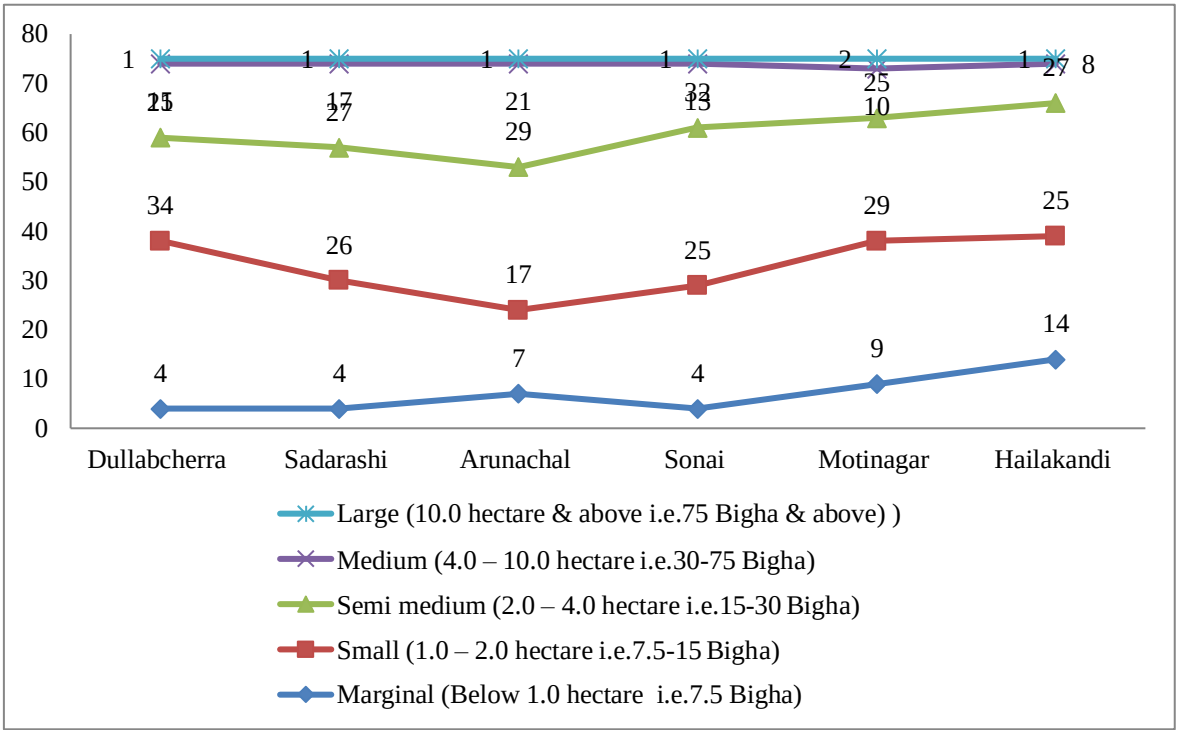


Chart- IV.2

Size Class distribution of Land in Sample Farms Across ADOs



4.1.2 Land fertility index

Land fertility denotes the level of output in relation to the size of land. Barak Valley have land on the basin of river Barak and her tributaries which carry alluvial and sedimentary soil that provides the natural fertility to the agrarian land. Moreover the hardworking farmers make it possible to produce higher output even with the problem of floods and infrastructral bottlenecks. Land fertility is measured by the output per hectare. The production per hectare of land has been calculated for all 450 samples. Then dimension index for 450 farmers i.e. Land Fertility Index has been calculated by using the formula mentioned in methodology chapter.

Table- 4.2

Descriptive statistics of Land Fertility Index

Statistics	Value
Maximum	0.98
Minimum	0.01
Mean	0.51
Standard Deviation	0.15

Source: Calculated by the author

Land fertility index is of enormous importance in Barak Valley since the natural fertility of the soil contributes largely for the crop production in right time and in required amount in the midst of infrastructural bottlenecks. Land fertility index has been made to analyse properly the land's contribution in output. The mean observation is 0.514 in Barak Valley which shows moderate performance in this regard. The maximum value is 0.98 and the lowest is 0.01 which shows the range of performance and the standard deviation is 0.15 which shows that the dispersion or variability in the distribution is not very high. To take a better understanding of the distribution of performance, beta distribution is used.

[1]Since the values of the land fertility index lies in between 0 and 1 , the beta distribution is used to classify the performance of the farmers. Four class

[1] After obtaining the LFI of all the samples, the probable distribution is to be derived. Since, the values of LFI lies between 0 and 1 so one is to select the two parameter beta distribution of type I as a probable distribution. The beta distribution is generally a skewed distribution and its probability density function is given by,

$$f(x) = \frac{1}{\beta(a,b)} x^{a-1}(1-x)^{b-1}$$, $0 < x < 1$ and $a, b > 0$

$= 0$, *otherwise*

$$\beta(a,b) = \int_0^1 x^{a-1}(1-x)^{b-1} dx$$

intervals have been taken assuming equal weitage to each class. The values of β parameters and their class interval is-

Table-4.3

Beta Distribution for LFI

Beta Regularized [z, a, b] Function Evaluation $I_{0.25}(5.05756, 4.78014) \approx$ 0.0413234	Beta Regularized [z, a, b] Function Evaluation $I_{0.5}(5.05756, 4.78014) \approx$ 0.463225	Beta Regularized [z, a, b] Function Evaluation $I_{0.75}(5.05756, 4.78014) \approx$ 0.939022

After calculating beta distribution parameters, the c.d.f. for class intervals has been calculated.[2]

Table- 4.4

Distribution Of Farmers According To Performance In Land Fertility Index

Indicator	Number of farmers	% of farmers
High (> 0.939022)	2	0.44%
Medium (0.463225- 0.939022)	297	66%
Low (0.463225 - 0.0413234)	150	33.3%
Very low/Negligible (<0.0413234)	1	0.22%
Total	450	100

Source: Calculated by the author.

[2] http://functions.wolfram.com/webMathematica/FunctionEvaluation.jsp?name=BetaRegularized

The Land Fertility Index is concentrated around mean performance in Barak Valley. A few farmers have got their land very highly fertile or very low fertile. In Chart IV.3, 66% of the and 33.3% of the farmers belong to the medium and lower medium category. Thus natural fertility of the soil is not largely varied among the sample farmers.

Chart- IV.3

Distribution of Land Fertility Index in Barak Valley

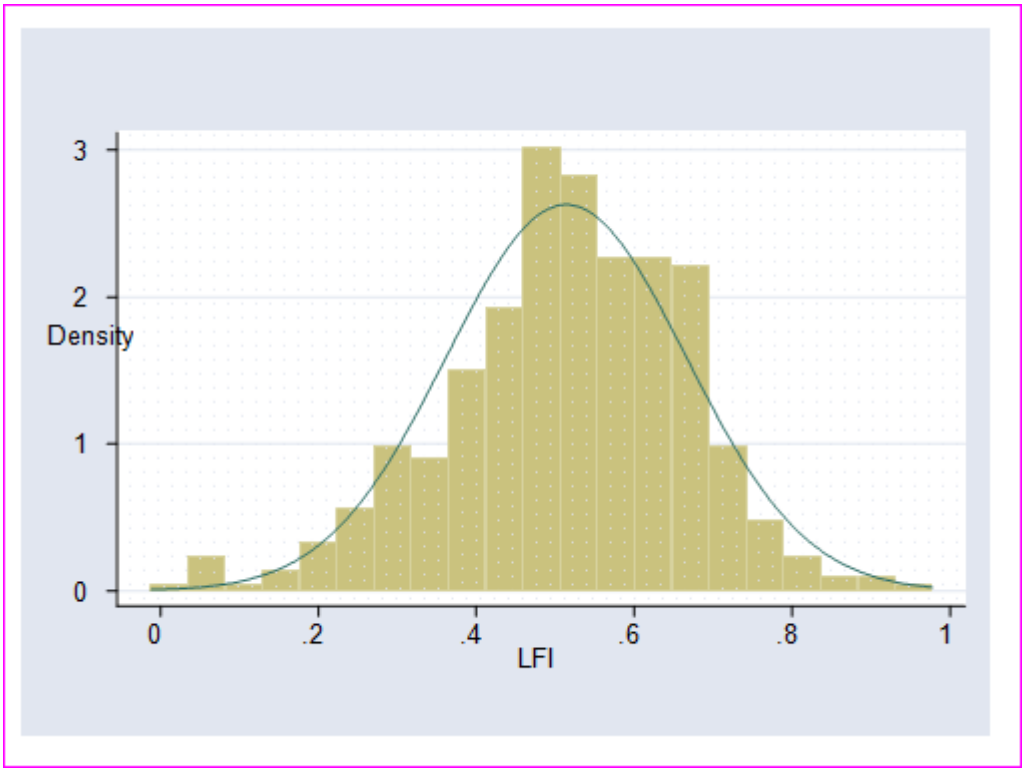


Table- 4.5

Output per Hactare in Barak Valley for sample farmers

Mean observation	2.97 quintals
Max	14.66 quintals
Min	0.6 quintals

Source: Calculated by the author.

Output per hectare in Barak Valley is 2.97 quintals per hectare which is not bad at all. The natural fertility of the soil along with application of modern technology is proving good for the productivity. The maximum observation is 14.6 quintals and the lowest one is 0.6 quintals per hectare.

Table- 4.6

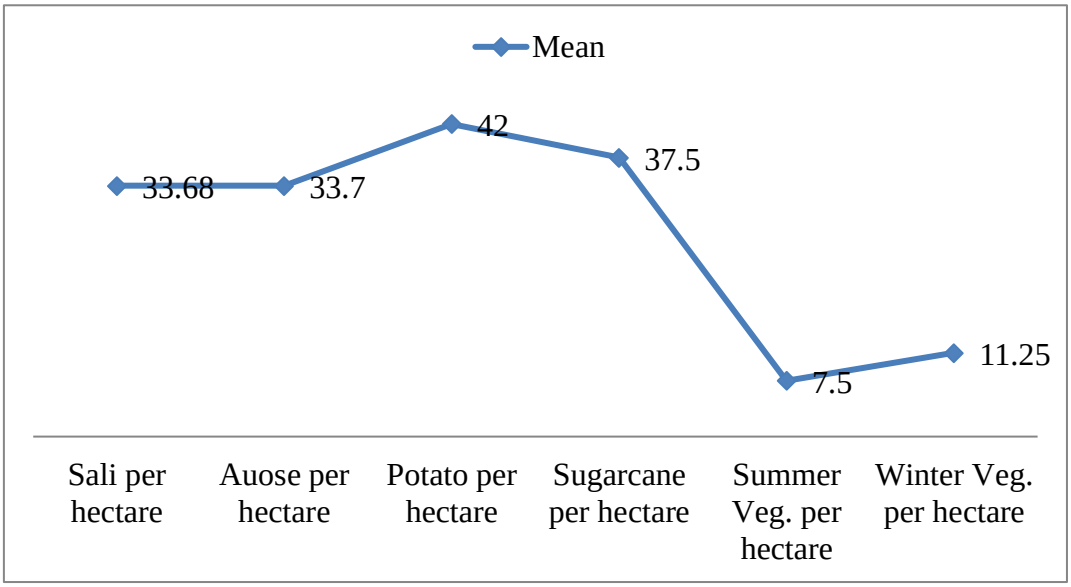
Descriptive Statistics for land productivity (In Quintals/ per hectare)

	Mean	Maximum	Minimum	Std. deviation
Sali	33.68	46.87	8.25	4.27
Auose	33.7	45	0	8.03
Potato per	42	45.75	0	14.1
Sugarcane per	37.5	45	26.25	4.5
Summer Veg.	7.5	12	5.25	1.5
Winter Veg.	11.25	15.75	5.25	3.2

Source: Calculated by the author.

Chart- IV.4

Distribution of Different Crops in Barak Valley



The Sali paddy per hectare and Auose per hectare is almost same with 33.6 quintals per hectare. It ranges between a maximum of 46.8 quintals to a minimum of 8.25 quintals per hectare. The potato is 42 quintals per hectare and sugarcane

37.5 quintals per hectare. There are some small and marginal farmers who do not produce any Auose or potato. Sugarcane is an important cash crop for the farmers of Barak Valley and ranges between 45 quintals per hectare to 26.2 quintals per hectare. But the summer vegetables and winter vegetables recorded very low productivity along with 7.5 and 11.2 quintals per hectare respectively. The production of horticultural crop is very poor in most of the ADOs and the Valley is not self sufficient while the consumers have to depend on outside supply for vegetables and fruits. Sali paddy is the major crop of the valley and Auose also contributes to some extent, thus rice is still the prominent crop of the locality. The output per hectare shows that there is enough scope for increasing the productivity of the land following sustainable land management and technological improvement.

Table-4.7

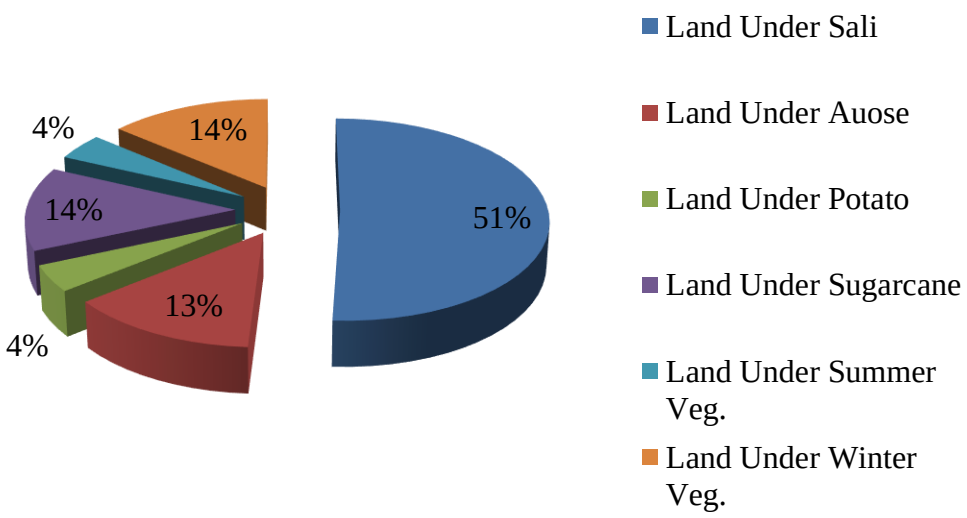
Descriptive Statistics for land use (In hectares)

Land under crop	Mean	Maximum	Minimum	Std. Deviation	Total
Land under Sali	1.5113	5.33	.13	.99098	680.06
Land under Auose	.3967	2.67	.00	.34996	178.5
Land under potato	.1265	1.33	.00	.14620	56.93
Land under sugarcane	.3981	2.67	.07	.34874	179.13
Land under summer veg.	.1264	1.33	.00	.14623	56.8
Land under winter veg.	.4114	2.67	.07	.34608	185.13

Source: Calculated by the author

Chart- IV.5

Land under Different Crops in Barak Valley



The table 4.7 and chart IV.5 depict that land under Sali paddy is the highest in Barak Valley. For the sample farmers a total of 680.06 hectares of land or 51% is covered by Sali crop while Auose crop covers 178.5 hectares of land or 13% of the total. Thus paddy covers 64% of the total land under cultivation. The mean land under Sali and Auose is 1.5 and 0.38 hectares respectively for the 450 sample farmers under the study. The standard deviation of the Sali and Auose paddy indicate that there is high dispersion in the distribution of the land under cultivation. The total land under potato is 56.93 hectares or 4% of total land under cultivation. The land under sugarcane is 14% of the total and 179.13 hectares for the sample farmers. The land under vegetable is in deplorable condition as only 56.8 hectares is under summer vegetables and 185.13 hectares under winter vegetables. They constitute 4% and 14% of the total land for summer and winter vegetables respectively. The mean land under cultivation shows the increasing pressure of population on land and the holding is getting fragmented day by day.

Table- 4.8

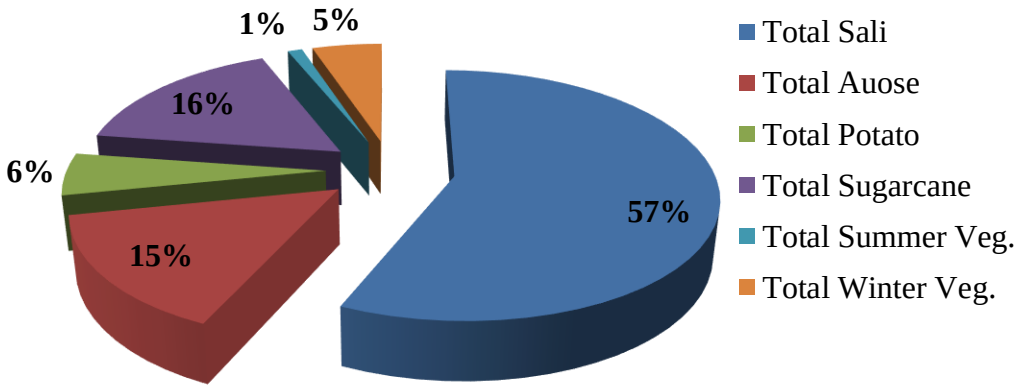
Descriptive Statistics for output (In Quintals)

	Mean	Maximum	Minimum	Std. Deviation	Total
Sali	52.3	195.0	4.0	36.63165	23577.8
Auose	13.9	100.0	.0	13.30429	6279.5
Potato	5.0	60.0	.0	5.60301	2284.3
Sugarcane	15.2	99.2	2.0	13.61541	6850.2
Summer Veg.	0.95	14.0	.0	1.28633	445.5
Winter Veg.	4.7	31.5	.4	4.49407	2135.2

Source: Calculated by the author

Chart- IV.6

Share of Different Crops in Production in Barak Valley



In table 4.8 and chart IV.6, the total production of different crops in the study area shows that Sali paddy is the major crop covering 57% of the total output and 23577.8 quintals of paddy produced by 450 sample farmers. Auose paddy covers 15% of the total crop and a total of 6279.5 quintals of paddy. The mean output of Sali and Auose is 52.3 quintals and 13.9 quintals per farm household respectively which shows the huge gap between Sali and Auose paddy. The total production

of potato is 2284.3 quintals and is only 6% of the total crop of the Valley. A total of 6850.2 quintals of sugarcane is produced by 450 farmers in 6 ADOs i.e. 16% of the output which is an important source of earning cash apart from paddy. The mean observation is 15.2 quintal which is a little higher than that of Auose paddy. The summer vegetables is 445.56 quintals only for 450 sample households showing a deplorable condtion which constitutes only 1% of the total output in the study area. The winter crop is a little better with a total production of 2135.2 quintals or 5% of the total crop. The mean value is 4.7 quintals for 450 sample farms.

4.1.3 Market Index

A market index has been calculated to observe the level of commercialisation of agriculture. In Barak Valley, out of 450 sample their amount of produce has been taken that they have sold. The percentage of output sold has been calculated for 450 farmers and market index has been calculated accordingly (refer Table 4.9).

Table- 4.9

Descriptive statistics of Market Index

Statistics	Value
Maximum	1.0
Minimum	0.0
Mean	0.526
Standard Deviation	0.305

Source: Calculated by the author

In table 4.9, the mean Market Index is 0.526 in Barak Valley which is moderate. There are many farmers selling more than 70-80 percent of their output who are mostly large and medium scale farmers. Hoever in Barak Valley the major supply comes from small and semi medium farmers who can sell 50-55 percent of produce in the market. The maximum value is 1 i.e. who is selling the entire output. The value of 0 indicates those who are subsistence farmers and could sell nothing. The standard devviation shows that there is high dispersion in the distribution of the produce in the market.

The class intervals with the help of probability of beta distribution is shown in Table 4.10, 4.11 Chart IV.7-

Table-4.10

Beta Distribution for Market Index

Beta Regularized [z, a, b] Function Evaluation	Beta Regularized [z, a, b] Function Evaluation	Beta Regularized [z, a, b] Function Evaluation
$I_{0.25}(0.884155, 0.796748) \approx 0.244194$	$I_{0.5}(0.884155, 0.796748) \approx 0.465773$	$I_{0.75}(0.884155, 0.796748) \approx 0.697803$

Source: Calculated by the author

After calculating beta distribution parameters the c.d.f. for class intervals have been calculated[3].

Table- 4.11

Distribution Of Farmers According To Performance in Marketing

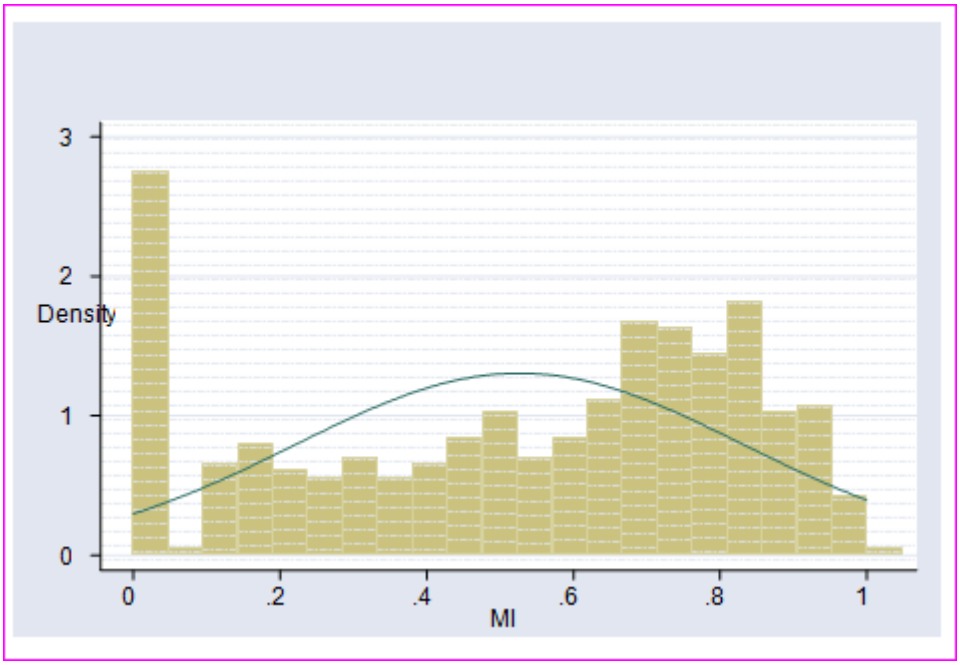
Indicator	Number of farmers	% of farmers
High (>0.697803)	179	39.7%
Medium (0.465773-0.697803)	100	22.2%
Low (0.244194 - 0.465773)	62	13.7%
Very low/Negligible (<0.244194)	109	24.2%
Total	450	100

Source: Calculated by the author.

[3] http://functions.wolfram.com/webMathematica/FunctionEvaluation.jsp ?name= Beta Regularized

Chart- IV.7

Distribution of Market Index in Barak Valley



The important findings are:

1. The distribution of farmers according to score in Market Index shows that 39.7% of them have performed in the high group i.e. a total of 179 farmers have sold out their 75-95% of the produce in market. Most of these sample farmers belong to medium, semi-medium and large scale category. They contribute the most to the supply of agricultural produce in the local markets.
2. But some small farmers have also been found that they have been able to sell most of their produce. About 22.2% farmers have been able to sell 40-50% of their produce in the market i.e. a total of 100 farmers are able to market their produce successfully even after so much of infrastructural problems.
3. However 13.7% of the farmers in Barak Valley can sell insignificant amount of their output. Most of these farmers are marginal and small farmers who face a lot of troubles to sell their output. Most of the part is kept for self while small portion is left for market.

4. About 24.2% of the farmers sell almost nothing in the market. Out of that, 13% of the farmers i.e. 59 have been found to be totally subsistence farmers who sell nothing.

4.1.4 Technology Achievement Index

Technology Achievement Index is a composite measure which depicts use of improved seeds i.e. HYV seeds and other modernising tools. Adoption of modern technology by the farmers in Barak Valley has been calculated by percentage of output by HYV seeds, use of tractor/powertiller, use of pumpset, use of sprayer, use of harvester/thresher and application of fertiliser and pesticides. All these six dimensions have been given weightage as- $1/5^{th}$ for percentage of output by HYV seeds and $1/10^{th}$ for each of of other five dimensions. Thus Technology achievement index for 450 samples have been found out accordingly and presented in Table 4.12.

Table- 4.12

Descriptive statistics of Technology Achievement Index

Statistics	Value
Maximum	1.0
Minimum	0.10
Mean	0.542
Standard Deviation	0.239

Source: Calculated by the author

The technology achievement in Barak Valley is shown with the help of technology achievement index-TAI. The mean value is 0.542 showing moderate performance in the application of moderan technology. The maximum value of 1 indicates the farmer who has used all the implements- HYV seeds, poertiller/tractor, fertilizer, pesticide, pumpset, sprayer, harvester and thresher. The lowest value is 0.10. Actually all the sample farmers have been found to use fertilizer to some extent. But there is wide disparirity in the application of other tools like use of tractor/powertiller, sprayer, pumpset etc. the standard deviation

value of 0.23 shows the high dispersion in the achievement by the sample farmers.

Table-4.13

Beta distribution for Technology Achievement Index

Beta Regularized [z, a, b] Function Evaluation $I_{0.25}(1.81842, 1.5366) \approx$ 0.137412	Beta Regularized [z, a, b] Function Evaluation $I_{0.5}(1.81842, 1.5366) \approx$ 0.430731	Beta Regularized [z, a, b] Function Evaluation $I_{0.75}(1.81842, 1.5366) \approx$ 0.769032

http://functions.wolfram.com/webMathematica/FunctionEvaluation.jsp?name=BetaRegularized

After calculating beta distribution parameters, the c.d.f. for class intervals have been calculated with the help of above web service provider.

Table- 4.14

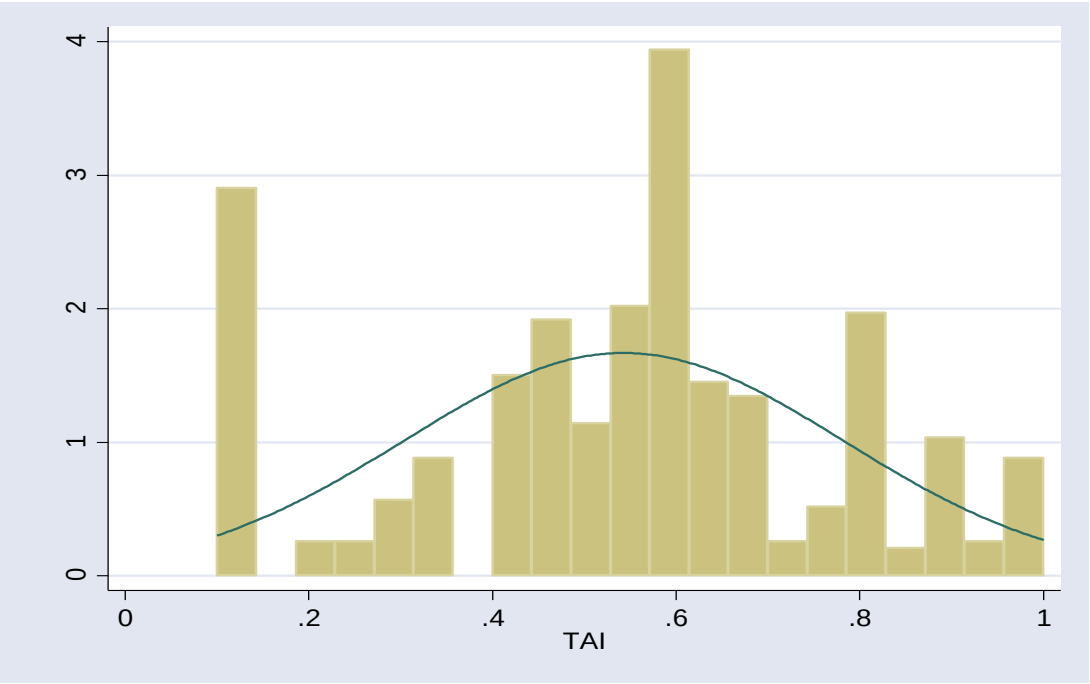
Distribution of farmers according to performance in technology adoption

Indicator	Number of farmers	% of farmers
High (>0.769032)	84	18.6%
Medium (0.430731-0.769032)	243	54%
Low (0.137412 -0.430731)	67	14.8%
Very low/Negligible (<0.137412)	56	12.4%
Total	450	100

Source: Calculated by the author.

Chart- IV.8

Distribution of Technology Achievement Index in Barak Valley



The important findings are:

1. The value of Technology Achievement Index estimated at 0.542 which is good in the present circumstances of Barak Valley. The distribution of farmers shows that those who have performed more than c.d.f of beta distribution of 0.769 is regarded as high and 84 farmers have been found to belong to this group. This group has accepted all the modern tools of farming practices mentioned above.
2. Most of the farmers belong to the medium category which means that some of the modern tools have been adopted by them. They constitute 54% of the farmers. The low and very low performers make a sizable portion of the farmers which indicates that regarding technology achievement the valley still have to go a long way.
3. Technology adoption or access to modern technology is a major leap forward anywhere in the world for agricultural development. Green revolution in India took place only after successful implementation of technical change in agrarian practices though may be in a few states or in

few areas. In Barak Valley technology adoption has been undergoing a slow progress mainly due to lack of proper infrastructure like transport and communication mainly with the other parts of the country, warehousing facilities for the better crops so that farmers can be able to market their output at due prices. Even with all these constraints some farmers have been showing interest in adoption of modern technology for higher output as revealed from the data presented in Table 4.14 and Chart IV.8.

Table- 4.15

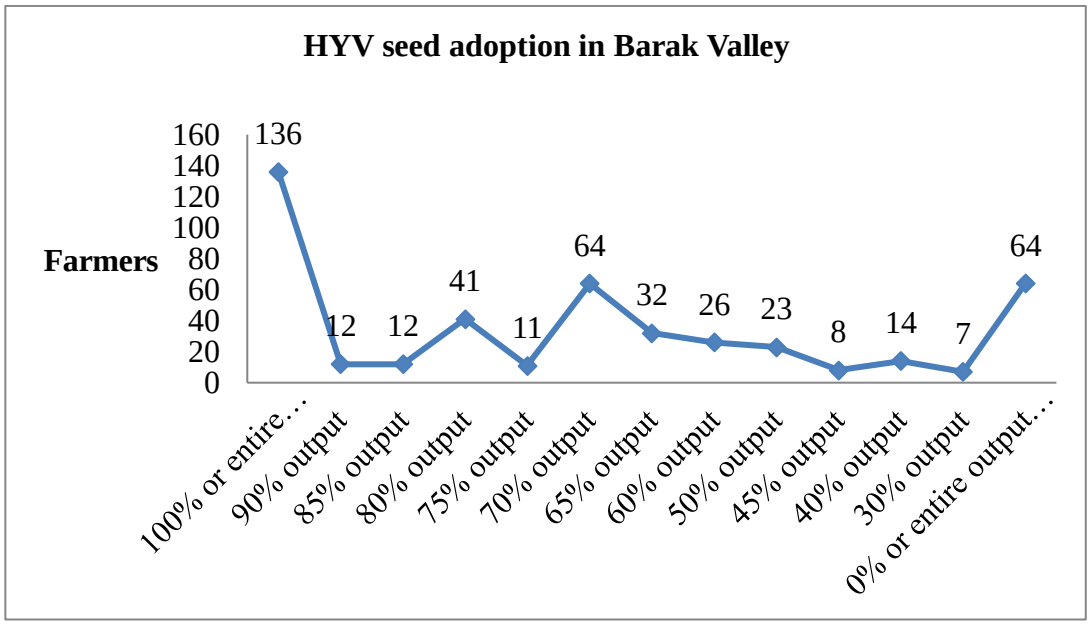
HYV Seed Adoption in Barak Valley

% of output by HYV seeds	**Number of farmers**	**% of farmers**
100% or entire output by HYV seeds	136	30%
90% output	12	3%
85% output	12	3%
80% output	41	9%
75% output	11	2%
70% output	64	14%
65% output	32	7%
60% output	26	6%
50% output	23	5%
45% output	8	2%
40% output	14	3%
30% output	7	2%
0% or entire output by Traditional seed	64	14%
Total	450	100

Source: Calculated by the author.

Chart- IV.9

Adoption of HYV seeds in Barak Valley



The important findings from the above analysis are:

1. The table 4.15 chart IV.9 depicts the percentage of sample farmers about their crop production and percentage of the crop covered by HYV seeds. A total of 136 farmers or 30% of the farmers have adopted and used completely new seeds i.e. entire output has been covered by HYV seeds. This adoption level is really significant in the context of constrains in the Barak Valley.
2. A total of 12 or 3% of the farmers have produced 90% of their output by using new seeds. Another 12 or 3% have produced 85% of their output by new seeds. About 80% of the crop is coverd by 41 farmers or 9% of total sample.
3. About 2% or 11 farmers have produced 75% of their output by HYVseeds. A total of 64 farmers or 14% of them covered 70% of the crop by HYVseeds. 32 farmers or 7% have produced 65% of theiroutput by new seeds. 26 or 6% samples have covered 60% of the crop by new seeds.

4. About 5% or 23 have covered 50% or half of the output by HYV seeds. 2% or 8 have gone covering 45% of their crop by new seeds. 14 farmers have produced 40% of the output by HYV seed. 7 have produced 30% of the crop by new seeds.
5. The traditional seed users are still 14% of the total farmers in Barak Valley.

Access to modern tools and techniques begins with High Yeilding Variety (HYV) of seeds. HYV seed has the advantage of quicker matuirity along with higher quantity than that of traditional seed. Among the HYV seeds the varities or types popular among the farmers of Barak Valley are Pankaj, Ranjit, Lakhimi, Bahdur, Kushal etc as presented in Table 4.16.

Table- 4.16

HYV Seed Features observed during the survey

Major HYV seeds of Barak Valley	**Duration of maturity**
Pankaj (Winter Rice-Sali)	145-150 days
Ranjit (Winter Rice-Sali)	150-155 days
Lakhimi (Winter Rice-Sali)	140-150 days
Bahadur (Winter Rice-Sali)	150-155 days
Kushal (Winter Rice-Sali)	150-155 days
KMJ 10-2-2 (Winter Rice-Sali)	150-155 days
TTB 101-15 (Winter Rice-Sali)	150-155days
Satya (Winter Rice-Sali)	130-135 days
Monohar Sali (Winter Rice-Sali)	155-160 days
Swarnaprova (Winter Rice-Sali)	115-120 days
IR-50 (Summer Rice-Auose)	105-110 days
Govind (Summer Rice-Auose)	100-105 days
Rasi (Summer Rice-Auose)	120-125 days
IR-36 (Summer Rice-Auose)	130-140 days
Kalang Barak (Sugarcane)	60-80 days

Source: Field survey

Apart from the varieties as mentioned in Table 4.16 many other HYV varieties have been extensively used by the farmers to produce different vegetables and other horticultural crops in summer and winter season. Use of HYV seeds needs better irrigation facilities which is very poor in Barak Valley. Even without irrigation facilities the farmers are not lagging behind in adopting HYVseeds. The output will definitely increase if the irrigation facility is improved. The use of different farm equipments and other improved practices are shown in Table 4.17 and Chart IV.10.

Table- 4.17

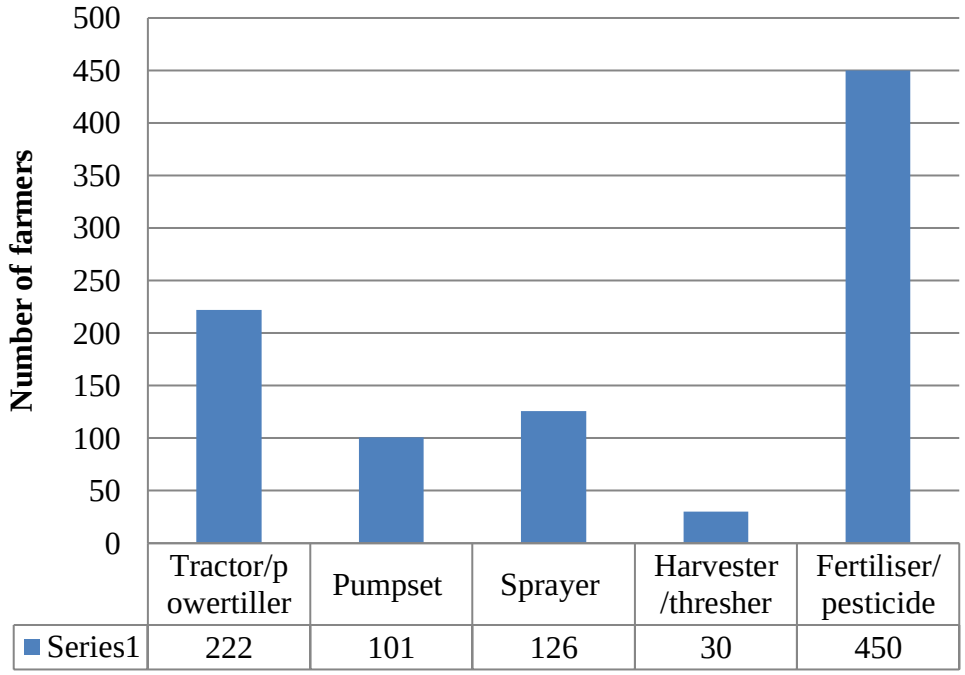
Farm Mechanisation in Barak Valley

Indicator	Adopted	% of adoption	Not adopted
Tractor/powertiller	222	49.33%	228
Pumpset	101	22.44%	349
Sprayer	126	28%	324
Harvester /thresher	30	6.66%	410
Fertiliser/pesticide	450	100%	0

Source: Field survey

Chart- IV.10

Farm Mechanisation in Barak Valley



The important findings from the above analysis are mentioned below:

1. The table 4.17 and chart IV.10 shows some interesting results about the technology addption in Barak Valley, more specifically about the trend of farm mechanisation. About 49.33% of the farmers in Barak Valley have used tractor or powertiller for tiiling of the land. Most of the farmers who have tractors for tilling the land are big farmers having land holding more than 10 hectares and the medium level farmers having land holding 4-10 hectares. All of them do not own tractors rather most of them hire the same for tilling the land. However 222 farmers owned powertiller while semi-medium and small farmers hire powertiller to till the farm land.
2. The pumpset is an important item for watering the land in Barak Valley. The pumpset users are 22.44% of the total or 101 out of 450 samples. Since there is shortage or absence of major or medium irrigation projects, most of the agricultural land in BarakValley are not covered by irrgation. As a result pumpset is a major equipment to provide water in the land with the help of electricity from nearby source, mostly nearby pond or

river. Howevevr most of the farmers in Barak Valley still depend on the nature or monsoon for water. If there is much rain, farm land is flooded or in case of less rain it suffers from drought.

3. About 28% of the total or 126 farmers have reported to own and apply sprayer for spraying pesticides. Harvester or thresher users are only 6.66% while almost every farmer or 100% have started using chemical manures and pesticides.

4.1.5 Labour Productivity Index

Labour Productivity Index is prepared to measure the efficacy of human labour. LPI is calculated as output per worker of each sample. From the data on total output and total number of workers, output per worker has been calculated while on the basis of output per worker, dimension index has been found out for 450 samples by using the formula as mentioned in methodology. The estimated results are presented in Table 4.18.

Table- 4.18

Descriptive statistics of Labour Productivity Index

Statistics	Value
Maximum	1.0
Minimum	0.0
Mean	0.290
Standard Deviation	0.126

Source: Calculated by author

The labour productivity index is 0.290 in Barak valley region which is very low. The standard deviation shows that disparity is not much higher. Actually the size of land makes huge gap here. In Barak Valley it has been observed that, 1 to 2 members of family work in the farm land in case of all the marginal farmers. Small and semi medium farmers have the tendency to hire workers during tilling of the land and mostly in the time of harvest. Medium and large farmers do hire workers and the number ranges between 8 to10. The variation in the productivity

index is highly determined by the size of farm land. But it is a fact that the productivity is poor in this Valley. Moreover heavy dependence on farm land is increasing due to increase in population and lack of other employment opportunities, thus raising the land fragmentation and making the farm activities unprofitable.

Table-4.19

Beta Distribution for labour productivity index

Beta Regularized [z, a, b] Function Evaluation	Beta Regularized [z, a, b] Function Evaluation	Beta Regularized [z, a, b] Function Evaluation
$I_{0.25}(3.44194, 8.42681) \approx$ 0.414754	$I_{0.5}(3.44194, 8.42681) \approx$ 0.936583	$I_{0.75}(3.44194, 8.42681) \approx$ 0.999583

http://functions.wolfram.com/webMathematica/FunctionEvaluation.jsp?name=BetaRegularized

After calculating beta distribution parameters the c.d.f. for class intervals have been calculated with the help of above web service provider.

Table- 4.20

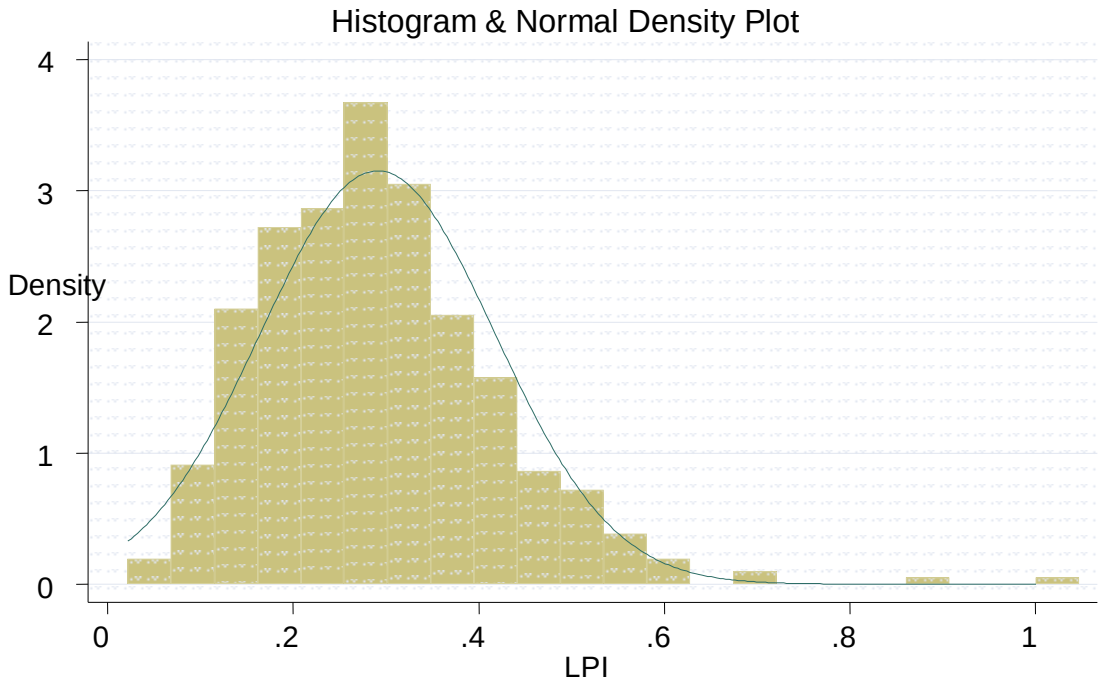
Distribution of farmers according to performance in Labour Productivity Index

Indicator	Number of farmers	% of farmers
High (>0.999583)	0	0
Medium(0.936583-0.999583)	1	0.2%
Low (0.414754 -0.936583)	346	76.8%
Very low/Negligible (<0.414754)	103	22.8%
Total	450	100

Source: Calculated by the author .

Chart- IV.11

Distribution of Labour Productivity Index in Barak Valley



The distribution of workers produvctivity index shows that most of the workers are low level performers. But it should be taken care of that the probability distribution has considered a large range of data in one class interval. However it is found that only a few farmers could perform better.

Table- 4.21

Output per worker in Barak Valley (In quintals per worker)

Mean observation	41.4
Maximum	120.6
Minimum	8.9
Std. deviation	13.8

Output per worker in BarakValley is 41.4 quintals. It ranges between 120.6 quintals to 8.9 quintals per worker. The productivity is determined mainly by the size of land under cultivation, number of labourers applied, the extent of technology adoption, irrigation (amount of rainfall is very important in rainfed agricuture of Barak Valley) etc.

4.1.6 Agricultural Performance Index in Barak Valley

Agricultural performance is a measure of the changes (positive or negative) in the principal variables that constitute the agricultural sector. The study has considered all aspects related to farm practices and included in performance so that an agricultural index can be able to indicate the entire scenario of agriculture and rural development. Agricultural Performance Index is a composite index of all four dimension index-Land Fertility Index, Market Index, Technology Achievement Index and Labour Productivity Index having equal weights.

Table- 4.22

Descriptive statistics of Agricultural Performance Index

Statistics	Value
Maximum	0.854
Minimum	0.071
Mean	0.468
Standard Deviation	0.160

Source: Calculated by the author

The mean Agricultural Performance index is 0.468 in Barak Valley which is moderate. It ranges in between 0.071 to 0.854. There is wide disparity in the distrbution of performance indices, the value of std. deviation is 0.160. The acievement in agricultural performance is determined by achievement of different factors. Broadly it can be divided in to four dimension indices i.e. variation in land fertility, marketing of goods, technological achievement and labour productivity which have determined the variation in API. Agricultural performance is moderate in Barak Valley in the sample six ADOs and this implies that there is a long way to go in this regard.

Some common features which have been observed are- technology adoption is not bad in Barak Valley but they do not have proper guidance to apply them for their benefit. The attitude towards adoption of modern technology is highly positive among the farmers but the resource and infrastructure of agriculture are real constraints for them. That is why labour productivity is very poor in Barak Valley and it is still highly affected by the size of land under cultivation. Marketing of goods depends on whether the farmer is a subsistence one or not. There are large number of farmers who are selling 60 to70 percent of the produce or at least 50% of the produce but the problem is that most of the farmers are small and semi-medium farmers whose total produce is much lower than the actual capacity. The land fertility suffers from poor infrastructure and sustainable practices though natural fertility of the soil is not bad at all.

Thus the entire picture of the agricultural performance has been portrayed in the index value which is a little less than the average. The variation in the distribution of the agricultural performance index can be better shown by the beta distribution function.

Table-4.23

Beta Distribution for Agricultural Performance Index

Beta Regularized [z, a, b] Function Evaluation	Beta Regularized [z, a, b] Function Evaluation	Beta Regularized [z, a, b] Function Evaluation
$I_{0.25}(4.01357, 4.56243) \approx$ 0.0926299	$I_{0.5}(4.01357, 4.56243) \approx$ 0.578054	$I_{0.75}(4.01357, 4.56243) \approx$ 0.957975

http://functions.wolfram.com/webMathematica/FunctionEvaluation.jsp?name=BetaRegularized

After calculating beta distribution parameters the c.d.f. for class intervals have been calculated with the help of above web service provider.

Table-4.24

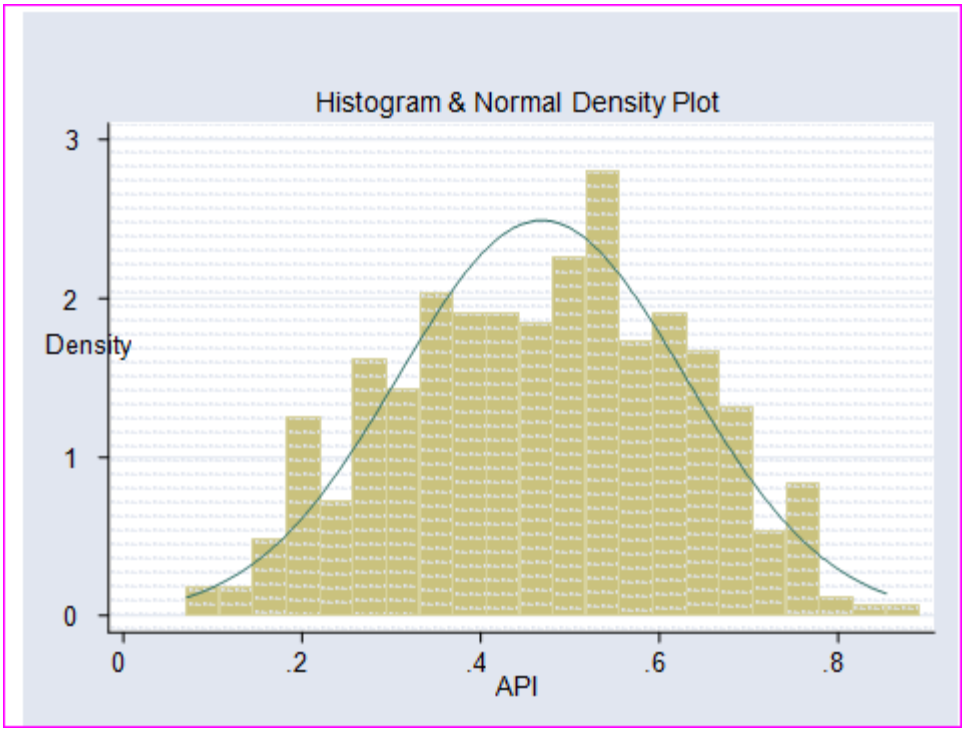
Distribution of Farmers According to Score in API

Indicator	Number of farmers	% of farmers
High (>0.957975)	0	0
Medium (0.578054-0.957975)	126	28%
Low (0.0926299 -0.578054)	321	71.3%
Very low/Negligible (<0.0926299)	3	0.66%
Total	450	100

Source: Calculated by the author

Chart- IV.12

Distribution of Agricultural Performance Index in Barak Valley



The important findings are:

1. The mean value of Agricultural Performance Index is 0.468 in Barak Valley which shows moderate achievement. The maximum or the best perfomer scored 0.854 who belongs to Dullabcherra ADO circle which is

lower than the probability distribution of the beta function i.e. 0.958. The minimum one is the 0.071 in Motinagar ADO and 0.072 in Sadarashi ADO. Those who have scored more than 0.578054 belongs to the medium group and there are only 126 in the study area i.e. 28% of the total households. Agricultural performance is indicative of all aspects of agricultural development land fertility or labour efficacy or technology or marketing. Thus the API in Barak Valley shows the medium or moderate performance.

2. Those who have performed between 0.093 to -0.578 belong to the low level performer but it is better to say they are lower medium level performer because there are large number of farmers who have perfomed near the mean value.

Human Development Performance in Barak Valley

Human development performance is measured by three dimension indices- wealth index, educaion index and health index. The human dvelopment is denoted by QLI or Quality of Life Index which is calculated by the three indices having equal weightage.

4.1.7 Wealth index

Wealth index does not mean that it has been calculated by only property and income of the farmers, rather wealth index is a composite measure of 28 all such indicators which include every facets of human life and his/her different choices. They are 1) House type 2)Separate room for cooking/Kitchen 3) Ownership of house 4) Flooring 5) Toilet facility 6) Source of Electricity/Lighting 7) Main fuel for cooking 8) Source of Drinking Water 5) Car or Tractor 9) Moped or Scooter 10) Telephone 11) Refrigerator 12) Colour TV 13) Black and white TV 14) Bicycle 15) Electric fan 16) Radio 17) Sewing machine 18) Mattress 20) Pressure cooker 21) Chair 22) Cot or bed 23) Table 24) Clock or watch 25) Ownership of livestock 26) Water pump 27) Bullock cart 28) Harvester/Thresher. On the basis

of individual scores of 450 samples, dimension index or wealth index has been made.

Table- 4.25

Descriptive statistics of Wealth Index

Statistics	Value
Maximum	0.980
Minimum	0.260
Mean	0.560
Standard Deviation	0.151

Source: Calculated by the author

The mean value of Wealth Index is 0.560 in Barak Valley which is moderate. The achievement in wealth index ranges between o.260 to 0.980. The richness is measured by above mentioned guidelines which includes not only economic possessions but also access to basic amenities of life, housing charactestics and assets required for a farmer. The standard deviation is 0.151 showing disparity in the achievement in wealth index.

Table-4.26

Beta Distribution for wealth index

Beta Regularized [z, a, b] Function Evaluation	Beta Regularized [z, a, b] Function Evaluation	Beta Regularized [z, a, b] Function Evaluation
$I_{0.25}(5.4393, 4.27374) \approx$ 0.0212731	$I_{0.5}(5.4393, 4.27374) \approx$ 0.347869	$I_{0.75}(5.4393, 4.27374) \approx$ 0.890240

http://functions.wolfram.com/webMathematica/FunctionEvaluation.jsp?name=BetaRegularized

After calculating beta distribution parameters the c.d.f. for class intervals have been calculated with the help of above web service provider.

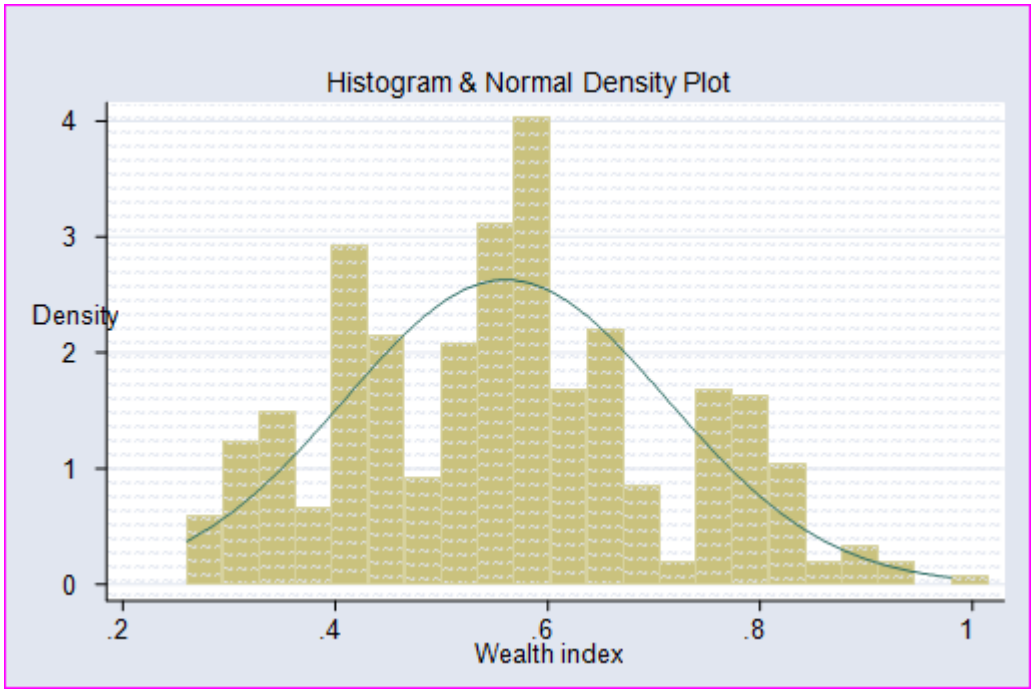
Table- 4.27
Distrbution Of Farmers According to score in Wealth Index

Indicator	Number of farmers	% of farmers
High (>0.890240)	5	1.11%
Medium (0.347869-0.890240)	408	90.66%
Low (0.0212731 -0.347869)	37	8.22%
Very low/Negligible (<0.0212731)	0	0
Total	450	100

Source: Calculated by the author

Chart- IV.13

Distribution of Wealth Index in Barak Valley



The important findings are:

1. Wealth index is a composite measure of economic and social parameters of life of a man. It includes different facets of human life comprising

essential household commodities, utility services or basic civil amenities, electronic gadgets, vehicles etc. The parameter is not only indicative of economic richness rather social and environmental aspects of human life.

2. Wealth index indicates that there is huge concentration in one class interval but it is noticed that the beta function covers wide range of data from 0.347 to 0.890. Thus there exists wide variation among those farmers who scored between 0.3 to 0.4 and 0.7 to 0.8. The farmers less than index value of 0.4 are really poor. The farmers with index value 0.7 to 0.8 or above are rich but are very few in number. Those who have scored between 0.5 to 0.7 are medium level performers and having the highest concentration in the distribution.

Since the medium level distribution has wide range of data, there exists significant differences among the farmers belonging to 0.3-0.4, 0.4-0.5, 0.5-0.7, 0.7 -0.8 & above. Thus the diagrametic distribution and normal density plot show a better picture of the wealth index in Barak Valley.

4.1.8 Schooling of Farmers in Barak Valley

Education is one of the most important aspect of human development. Education index is prepared to analyse the level of improvement in social development parameter. In Barak Valley education has played an important role in fostering human development. Education index is measured by two dimensions- literacy level and child enrolment. Level of schooling of the farmers have been taken as years of schooling.

The table 4.28 shows level of schooling of the farmers in Barak Valley. The achievement in schooling denotes that they are getting conscious day by day about the need of education in life to promote the living standard or human dvelopment.

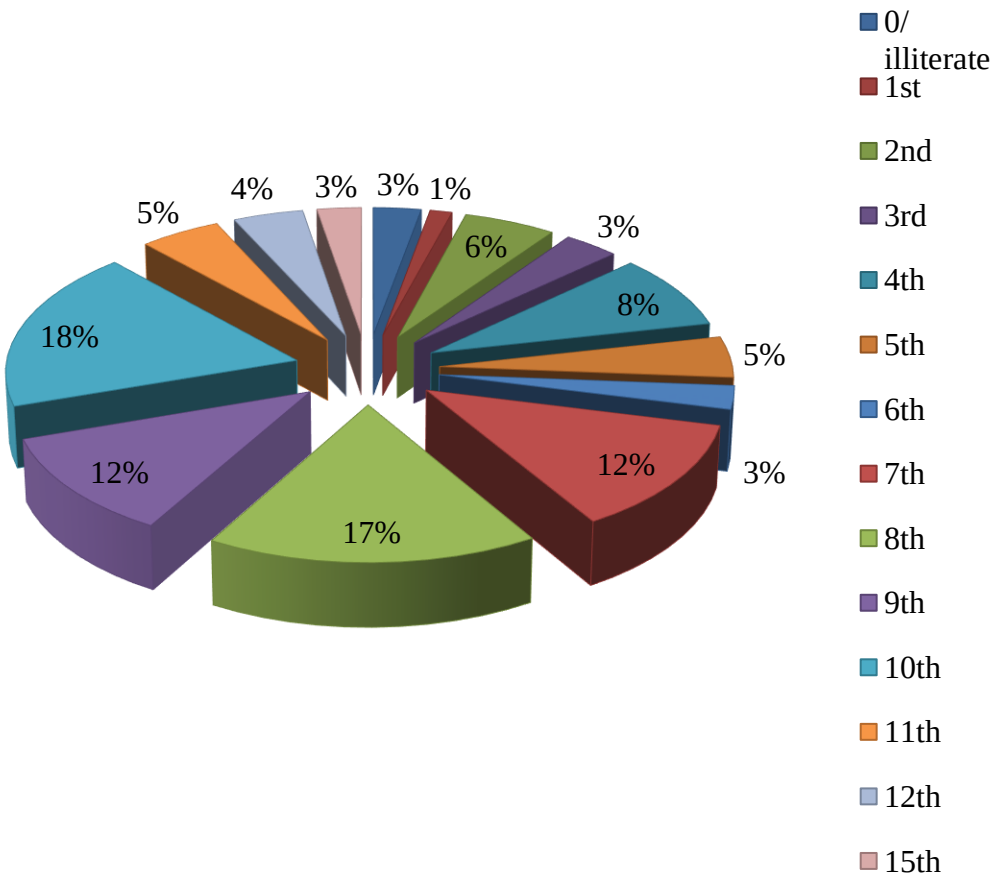
Table- 4.28
Level of schooling of the farmers in Barak Valley

Class standard	Number of farmers	Percentage
0/ illiterate	13	3%
1st	6	1%
2nd	25	6%
3rd	15	3%
4th	38	8%
5th	21	5%
6th	12	3%
7th	56	12%
8th	76	17%
9th	52	12%
10th	83	18%
11th	22	5%
12th	19	4%
15th	12	3%
Total	450	100

Source: Calculated by author.

Chart- IV.13

Distribution of farmers according to level of schooling



4.1.9 Education Index in Barak Valley

The mean education index of 0.616 indicates moderate level of performance in this regard. The year of schooling is an important determinant of human development while in Barak Valley, as we know that infrastructural bottlenecks hinder the education to rise. The EDI ranges in between 1 to 0 throughout all ADOs under the study. There is wide disparity among the

farmers regarding child enrolment and schooling as indicated by the value of standard deviation.

Table- 4.29

Descriptive statistics for Education Index

Statistics	Value
Maximum	1.0
Minimum	0.0
Mean	0.616
Standard Deviation	0.255

Source: Calculated by author

Table-4.30

Beta Distribution for Education Index

Beta Regularized [z, a, b] Function Evaluation	Beta Regularized [z, a, b] Function Evaluation	Beta Regularized [z, a, b] Function Evaluation
$I_{0.25}(1.62571,\ 1.01343) \approx$ 0.106659	$I_{0.5}(1.62571,\ 1.01343) \approx$ 0.328191	$I_{0.75}(1.62571,\ 1.01343) \approx$ 0.631885

http://functions.wolfram.com/webMathematica/FunctionEvaluation.jsp?name=BetaRegularized

After calculating beta distribution parameters the c.d.f. for class intervals have been calculated with the help of above web service provider.

Table- 4.31

Distribution of farmers according to score in Education index

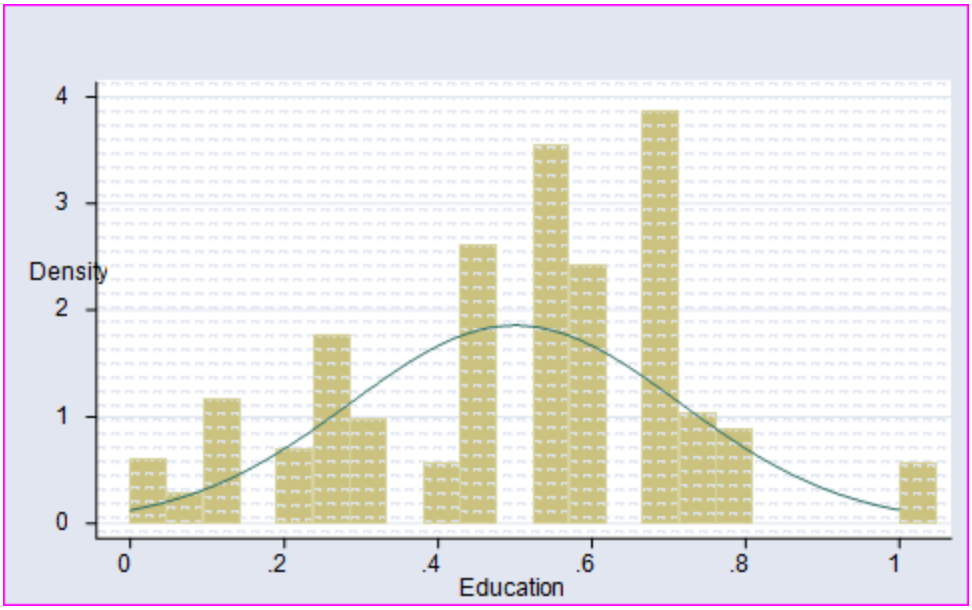
Indicator	Number of farmers	% of farmers
High (>0.631885)	294	65.3%
Medium (0.328191-0.631885)	65	14.4%
Low (0.106659 -0.328191)	68	15.1%
Very low/Negligible (<0.106659)	23	5.1%
Total	450	100

Source: Calculated by the author.

There is wide range of distribution as is revealed from table 4.31. The different perfromance categories have been classified by beta distribution. The diagram below also depicts that the education index is highly dispersed in Barak Valley.

Chart- IV.14

Distribution of Education Index in Barak Valley



The important findings are:

1. The peformance in Education Index of Barak Valley is 0.294 for farmers or 65% have performed in the high category. It indicates that these farmers have better schooling and they have also sent their children to schools. These farmers have understood the need and importance of education in life and are eager to see their children with better life with education.
2. The medium level performers have constituted 14.4% of the sample farmers. They have lower level of schooling and many of them have sent their children to schools. About 15.1% of the farmers are low level performers, they have faults in both enrolment and literacy.
3. The last group of farmers have failed in both enrolment and literay level. The illiteracy also exists in this category.

4.1.10 Health Index in Barak Valley

Health is also one of the most important aspect of quality of life or human development. Health index in Barak Valley has been prepared with the help of two dimensios- Body Mass Index and Child Mortality. Child mortality is a measure of mortality and BMI indicates nutrional achievement or the level of body fitness. However since both variables should move in the same direction, mortality scores have been reciprocated to avoid methodological problems. Both the dimensions have been given equal weights and household level health index has been made for 450 sample households in Barak Valley. The important findings as revealed from the data presented in table 4.32 are:

Table- 4.32

Descriptive statistics for Health Index

Statistics	Value
Maximum	0.980
Minimum	0.08
Mean	0.771
Standard Deviation	0.191

Source: Calculated by the author

The mean education index of 0.717 indicates moderate level of performance in this regard. BMI and child mortality are important determinants of human development while in Barak Valley, as we know that health infrastructure hinders the entire development. The health index ranges in between 0.980 to 0.08 throughout all the ADOs under the study. There is wide disparity among the farmers regarding health index as indicated by the value of of standard deviation.

Table-4.33

Beta Distribution for Health Index

Beta Regularized [z, a, b] Function Evaluation $I_{0.25}(2.90811, 0.863757) \approx$ 0.0140800	Beta Regularized [z, a, b] Function Evaluation $I_{0.5}(2.90811, 0.863757) \approx$ 0.376401	Beta Regularized [z, a, b] Function Evaluation $I_{0.75}(2.90811, 0.863757)$ $\approx$ 0.7981961

http://functions.wolfram.com/webMathematica/FunctionEvaluation.jsp?name=BetaRegularized

After calculating beta distribution parameters the c.d.f. for class intervals have been calculated with the help of above web service provider.

Table- 4.34

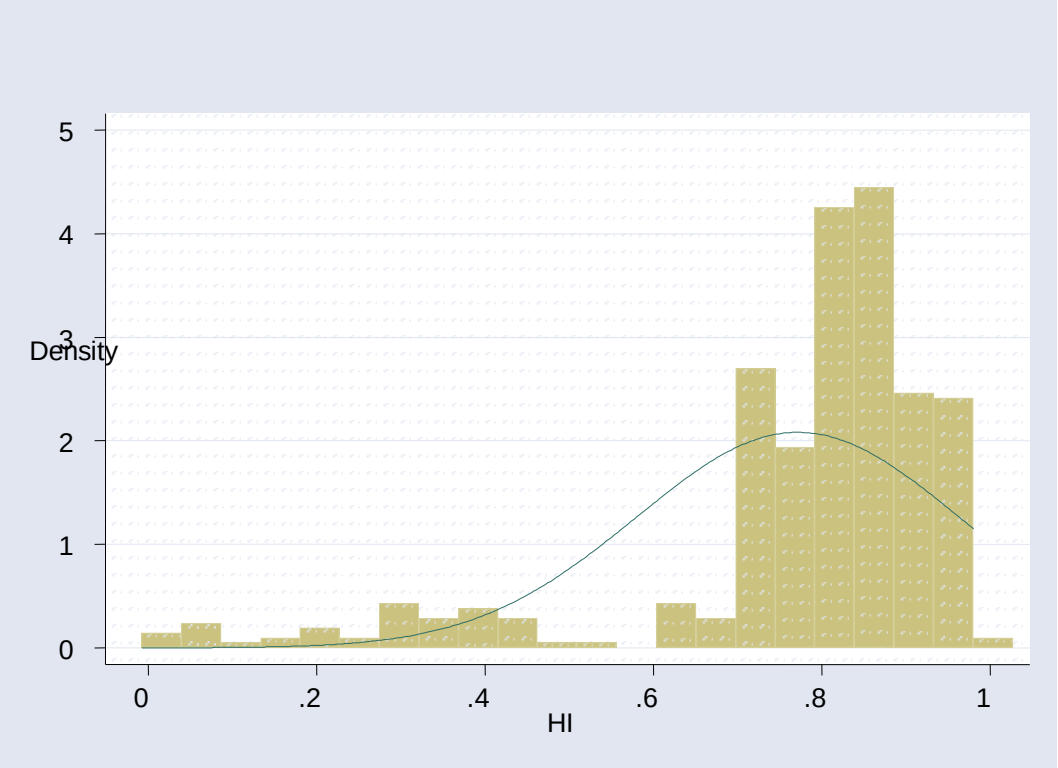
Distribution of farmers according to score in health index

Indicator	Number of farmers	% of farmers
High (>0.7981961)	264	58.6%
Medium (0.376401-0.7981961)	151	33.5%
Lower (0.0140800 -0.376401)	33	7.33%
Very low/Negligible (<0.0140800)	3	0.66%
Total	450	100

Source: Calculated by the author

Chart- IV.15

Distribution of Health Index in Barak Valley



The important findings as revealed from table 4.34 and Chart IV.15 are:

1. The mean performance index of 0.771 denotes moderate achievement in health. The distribution of farmers in Barak Valley shows that 58% farmers are there in safe zone which is indicative of better Body Mass Index and no Child Mortality. These group of samples are health conscious and scored more than 0.798 index value.
2. There is 33.5% farmers belonging to the medium category and are vulnerable section. They are deprived at least in one of the parameter either child mortality or malnutrition exists.
3. The lower and very low level performers belong to high risk zone and they are deprived in both the indicators and scored below 0.376 index value.

4.1.11 Nutritional status in Barak Valley

Nutrition is an important parameter of human development as without proper nutrition work efficiency will decline. In Barak Valley the nutrional status of the farmers have been taken in body mass index which is measured with their hight and weight. Adults are considered malnourished if their BMI is below 18.5 kg/m^2. Whereas BMI = weight (kg) / height (m)².

Table- 4.35

Descriptive statistics for BMI

Statistics	Value
Maximum	34.4
Minimum	14.4
Mean	21.05
Standard Deviation	4.5

Source: Calculated by the author

The mean BMI value of 21 indicates moderate level of performance in this regard. The nutrition is an important determinant of human development while in Barak Valley, the nutritional element in the food has been declining due to the erratic application of fertilizer and pesticides, lack of resources, lack of health awareness etc. More over the prices of nutritious vegetables and fruits are very high in the local markets, thus affecting their health and nutrition.

Table- 4.36

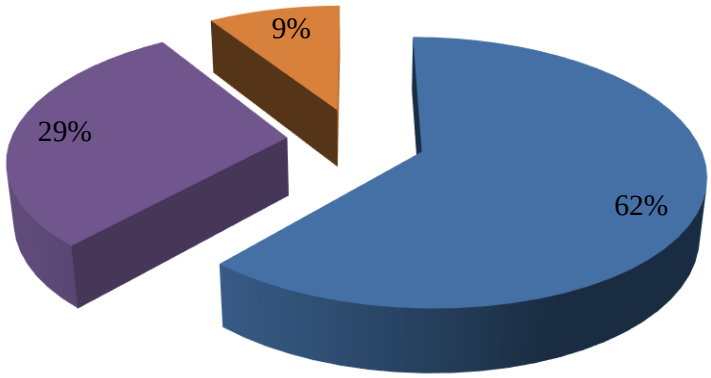
Distribution of farmers according to BMI score

Indicator	BMI	Indicator	Number of farmers	% of farmers
Mean observation	21.053	Properly Nourished (18.5 kg/m^2 - 25.5 kg/m^2)	277	62%
Max. observation	38.42	Mal Nourished (< 18.5 kg/m^2)	132	29%
Min. observation	14.39	Over weight (>25.5 kg/m^2))	41	9%
		Total	450	100

Source: Calculated by the author

Chart- IV.16

Distribution of farmers according to BMI score



The important findings from table 4.36 and Chart IV.16 are:

1. The mean value of Body Mass Index is 21.05 in Barak Valley which is normal. The maximum value shows the one who is highly overwight with BMI of 38 and the lowest or the most underweight is 14.39. The achievement in nutritional status of Barak Valley shows that Body Mass Index of 62% of the sampes are in proper zone. They have achieved the safe level of BMI of 18.5 kg/m^2 -25.5 kg/m^2. This zone is referred as normal BMI zone.
2. The mal nourished constituted 29% of the samples or 132 in number. Their BMI is below 18.5 kg/m^2. The lack of nutrition affects the work capacity of the farmers, especially those who work in the field.
3. The number of overweight people is 41 or 9% of the total in my study area. Their BMI is more than that of the normal range of 18.5 kg/m^2 -25.5 kg/m^2.

4.1.12 Quality of Life Index in Barak Valley

Performance in human development has been measured by achievement in quality of life/standard of living. A composite index has been formed to measure the progress in quality of life by 28 indicators of household- housing characteristics, quality of sanitation, electricity, drinking water, cooking fuel, a bunch of electronic goods, essential goods, vehicles etc. Moreover education index made of literacy level and enrolment, health index made of BMI-Body Mass Index and child mortality have been prepared. Quality of life index is a composite measure of all three dimension indices having equal weights.

Table- 4.37

Descriptive statistics of Quality of Life Index

Statistics	Value
Maximum	0.944
Minimum	0.143
Mean	0.643
Standard Deviation	0.141

Source: Calculated by the author

The mean quality of life index is 0.643 in Barak Valley which is moderate. It ranges between 0.143 to 0.944. There is wide disparity in the distrbution of performance indices, the value of standard deviation is 0.141. The acievement in human development is determined by achievement in a lot of factors. Broadly it can be devided in to three dimension indices i.e. variation in education, health, and wealth have determined the variation in QLI.

Table-4.38

Beta Distribution for Quality of Life Index

Beta Regularized [z, a, b] Function Evaluation	Beta Regularized [z, a, b] Function Evaluation	Beta Regularized [z, a, b] Function Evaluation
$I_{0.25}(6.73706, 3.74049) \approx$	$I_{0.5}(6.73706, 3.74049) \approx$	$I_{0.75}(6.73706, 3.74049) \approx$
0.00371401	0.165610	0.754335

http://functions.wolfram.com/webMathematica/FunctionEvaluation.jsp?name=BetaRegularized

After calculating beta distribution parameters the c.d.f. for class intervals have been calculated with the help of above web service provider.

Table- 4.39

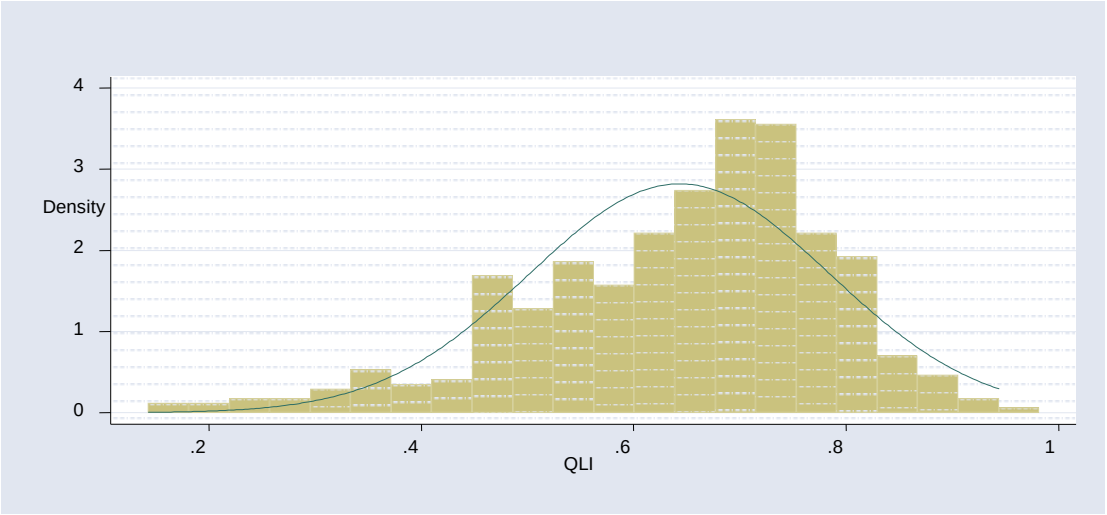
Distribution of farmers according to score in Quality of Life Index

Indicator	Number of farmers	% of farmers
High (>0.754335)	94	21%
Medium (0.165610-0.754335)	353	78.4%
Low (0.00371401-0.165610)	3	0.6%
Very low/Negligible (<0.00371401)	0	0
Total	450	100

Source: Calculated by the author

Chart- IV.17

Distribution of Quality of Life Index in Barak Valley



The important findings from the data presented in table 4.39 and Chart IV.17 are:

1. The result shows that there is heavy concentration in medium zone of performance category but it is noticed that the class interval has a wide range of data from 0.165 to 0. 754. Thus it cannot be concluded that the index value of 0.2 or 0.3 and 0.5 or 0.6 depicts the same picture. The farmers with index value between 0.2 to 0.4 belongs to lower medium category while index value 0.5 to 0.7 indicates higher medium performer. Those who have scored more than 0.754 belongs to the high category.
2. The farmers with index value ranging from 0.754 and above have performed well in almost all the dimensions i.e. education, enroment, nutrition, wealth etc. those with index value ranging from 0.5 to 0.7 performed well but failed any one or two dimensions. Those with index value below 0.4 have performed badly in at least two or three dimensions.

India Human Development Report (2011) mentioned 'The ***raison d'être*** of development is to improve the quality of people's lives by creating an environment for them to engage in a wider range of activities, to be healthy and well nourished, to be knowledgeable, and to be able to participate in community life'. Sen (1985 & 1987) calls these 'basic functionings'. Quality

of life of the farmers on the basis of wealth, education and health endeavours to fulfill these precondtions.

4.2 Agriculture and Poverty Interface

Rural development is a process that aims at reducing poverty and improving living standards through sustainable and broad based growth and investment in the people who reside in the countryside. For economies whose mainstay is agriculture, efforts directed at sustainable rural development contribute to poverty reduction. Agriculture can play a substantial role in reducing poverty especially in those areas where agriculture is the most important source of living. In Barak Valley Multidimensional Poverty Index has been prepared to assess the poverty. The methodology has been borrowed from Sabina Alkire and Maria Emma Santos (2010). MPI uses the household as a unit of analysis. Moreover four Millenium Development Goals have been connected with it. They are- MDG1 is to Eradicate Extreme Poverty and Hunger; MDG2 is to Achieve Universal Primary Education; MDG4 is to Reduce Child Mortality; MDG7 is to Ensure Environmental Sustainability.

There are three dimensions and ten indicators. Dimensions are deprivation in Education, deprivation in Health and deprivation in Living Standard. Education has two indicators a) Years of schooling and b) Child school attendance. They are defined as- he/she is deprived if a) No household member has completed five years of schooling and b) Any school-aged child is not attending school up to class 8. They are related to MDG2. Health has also two indicators- a) Child mortality and b) Nutrition. Anyone will be deprived if a) Any child has died in the family and b) Any adult for whom nutritional information is malnourished or their BMI is less than 18.5 kg/m^2. They are related to MDG4 and MDG.

The dimension is Living standard and the indicators are measured as, anyone is deprived if:

a) The household has no electricity, b) The household's sanitation facility is not improved (according to MDG guidelines), or it is improved but shared with other households, c) The household does not have access to safe drinking water

(according to MDG guidelines) or safe drinking water is more than a 30-minute walk from home roundtrip, d) The household has a dirt, sand or dung floor, e) The household cooks with dung, wood or charcoal, f) The household does not own more than one radio, TV, telephone, bike, motorbike or refrigerator and does not own a car or truck. They are linked with MDG7.

4.2.1 Multidimensional Poverty Index in Barak Valley

The Multidimensional Poverty Index has been estimated from the sample data. The important findings as revealed from table 4.40 are:

Table- 4.40

Descriptive statistics of Multidimensional Poverty Index

Statistics	Value
Maximum	0.886
Minimum	0.00
Mean	0.250
Standard Deviation	0.195

Source: Calculated by author

The value of mean multidimensional poverty index is 0.250 in Barak Valley. It ranges between 0.0 to 0.886. There is wide disparity in the distrbution of performance index, the value of std. deviation is 0.195. The achievement in poverty reduction is determined by achievement in a lot of factors.

Table- 4.41

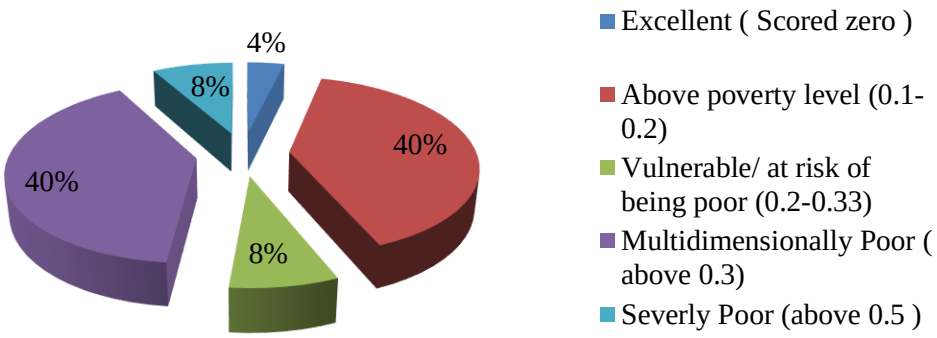
Distribution of farmers according to score in MPI

Indicator	Number of farmers	Percentage of farmers
Excellent (Scored zero)	17	4%
Above poverty level (0.1-0.2)	180	40%
Vulnerable/ at risk of being poor (0.2-0.33)	35	8%
Multidimensionally Poor (above 0.3)	181	40%
Severly Poor (above 0.5)	37	8%
Total	450	100

Source: Calculated by scholar.

Chart- IV.18

Distribution of farmers according to score in MPI



The distribution of farmers according to the score in MPI as shown in table 4.41 and Chart IV.18 are:

1. Multidimensional poverty endeavours to include deprivation in all aspects of human life. The adoption of MPI in Barak Valley by the given guidelines show that the mean performance is below the cut-off level. But it does not mean that the size of poverty striken people are low rather the result shows that a huge portion of the people are poor. There are 218 (48%) farmers found multidimensionally poor.
2. The mean performance of Barak Valley is 0.250 MPI while the maximum or the worst performer is -0.338 with the index of 0.886 and the minimum or the best performer has achieved 0.00. The farmers who have scored zero or index value of 0.00 mean no deprivation at all. They have qualified in all ten indicators of deprivation. They are 17 in number or only 4% of the total samples under study. The best performer are mostly rich people, having big land holdings or better performer in wealth index, education and health index etc.

3. Those farmers who have scored in between 0.100 to 0.200 are regarded as safe or above poverty line. They are sizable number in Barak Valley as 180 farmers or 40% of the total farmers. These farmers are well-off and they have deprivation in some of the indicators but qualified in most of the others. However it is clear that these 40% farmers are neither deprived in both the health indicators nor deprived in both the education indicators. Out of six indicators of living standard, hardly they may be deprived in 2 to 3 indicators.
4. Those farmers who have scored between values of 0.200 to 0.33 are vulnerable. Though they are not referred as poor yet deprivation score is such that they are close to risk. They constitute 8% of the farmers in my study area or 35 in all.
5. The farmers who are multi dimensionally poor scored more than index of 0.33. This cut-off has been set by experts earlier (HDR, 2011). In Barak Valley the performance is really alarming. They are 181 in number which is huge or 40% of the total samples. If 40% of the farmers are found multi dimensionally poor by the international standards out of 450, what could be the actual situation if the methodology is applied for entire population? All government claim about poverty reduction and schemes will be put before question.

   There are farmers found during field survey that they are heavily affected by poverty. By MPI methods they scored more than 0.500 index value and thus fall in the category of 'severely poor'. They constitute 8% of the total farmers under study or 37 in number.

4.2.2 Deprivation- Indicator Wise

The number of farmers deprived in different indicators is shown in table 4.42 and Chart IV.19:

Table- 4.42

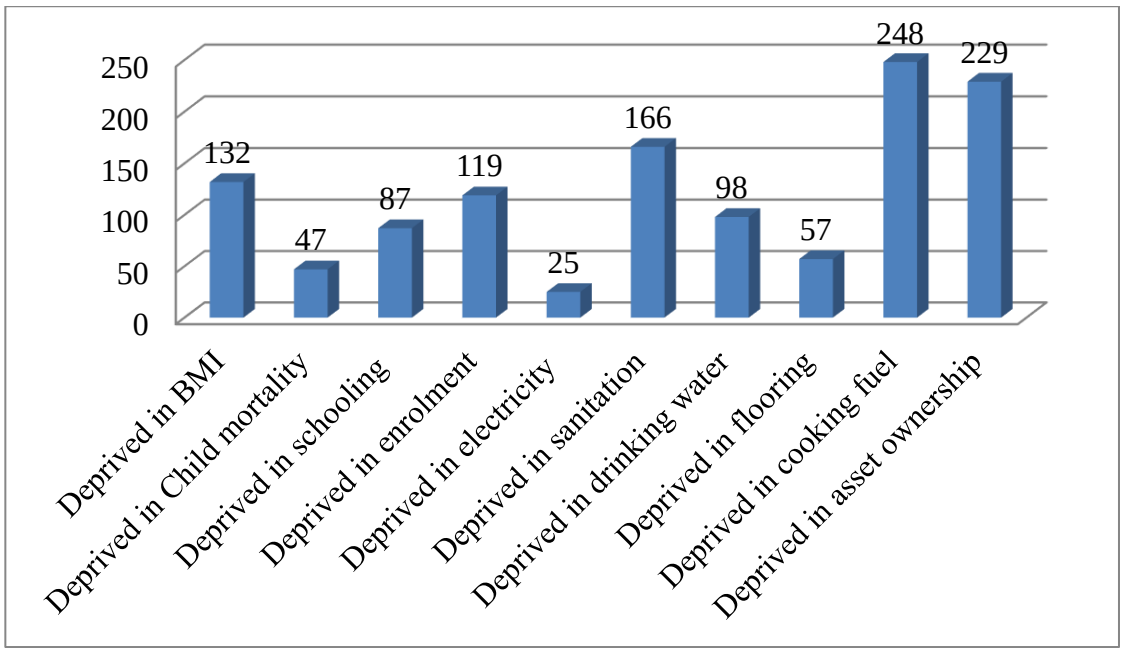
Number of farmers deprived in various indicators

Indicator	Number of farmers	% of farmers
Deprived in BMI	132	29%
Deprived in Child mortality	47	10.4%
Deprived in schooling	87	21%
Deprived in enrolment	119	26.4%
Deprived in electricity	25	5.5%
Deprived in sanitation	166	36.88%
Deprived in drinking water	98	21.77%
Deprived in flooring	57	12.66%
Deprived in cooking fuel	248	55.11%
Deprived in asset ownership	229	50.88%

Source: Calculated by the author

Chart- IV.19

Number of Farmers- Indicator wise



The important findings are**:**

1. The number of farmers deprived in different indicators of poverty show that there is large variation in the performance in facets of muldimensional poverty index in Barak Valley for the sample farmers. The Body Mass Index is an important indicator of nutritional status of the people. If BMI is found below the cut-off level of 18.5 kg/m^2, they are regarded as poor. The number of farmers deprived in BMI is 132 or 29% of the total farmers which shows an alarming level of nutritional intake of the farmers. Certainly it reduces the productivity of the labour and output in Barak Valley.
2. Those famers who experienced child mortality in their family are 47 in number. Child mortality is found to decline if compared with the state. About 10.4% of the farm household is deprived in this indicator. 21% of the farmers are deprived in schooling by the MDG guideline or 87 in total out of 450 farmers. The farmers' family in which no one has completed 5 years of schooling is 87. The number of farmers deprived in school enrolment is 119 or 26.4% of the total sample households. The criterion is that any school aged child who is not attending school up to class 8.
3. The number farm households found to be deprived in electricity is 25 or 5.5% of the total. The number of farm family deprived in sanitation is very high with 166 or 36.88% of the total. According to MDG guideline, a household is considered to have access to improved sanitation if it has some type of flush toilet or latrine, or ventilated improved pit or composting toilet, provided that they are not shared.
4. The number of farmers deprived in access to safe drinking water is 21.77% of the total or 98 in number. The criteria of safe drinking water according to MDG is- a household has access to clean drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring or rainwater, and it is within a distance of 30 minutes' walk (roundtrip).
5. The number of farmers deprived in flooring of the house is 57 or 12.66% of the total. Someone is poor in flooring if the household has a dirt, sand

or dung floor. The poor household is one which cooks with dung, wood or charcoal and the number of farmers deprived in cooking fuel is really alarming as the figure is 248 out of 450 farmers or 55.11%. Thus access to cooking fuel is still in deplorable condition is this Valley.

6. The number of farmers deprived in asset ownership is 229 or 50.88% of the total which shows the level of asset poverty for the farmers. The criterion is- a deprived household does not own more than one radio, TV, telephone, bike, motorbike or refrigerator and does not own a car or truck.

4.3 ADO Circle Wise Performance

Production performance is analysed with help of crop production, productivity etc. Output of different agricultural crops in Barak Valley show that though many types of paddy i.e. the staple crop of the Valley is produced yet the Sali paddy occupies the most important position. Auose is also produced but the gap between Sali and Auose is huge while Boro paddy is also produced in the Valley but exclusively in low lands or water logged areas locally called 'Beel' or 'Haoor'. Since the sample villages do not belong to water logged areas agriculture is confined to Sali and Aouse paddy, moreover the production of Boro rice is only 6%-6.5% of the total paddy production. Among vegetables, potato is produced by almost every farmer but it is not sufficient to fulfill the local demand. Sugarcane is an important cash crop for the farmers and almost all farmers are engaged in producing sugarcane rarn income out of that. Summer vegetables is produced by most of the farmers but on subsistence scale and a few of them produce for commercial purposes. Winter vegetables is more appreciable to the farmers as many of them produce commercially, however it remained in subsistence level for a large section.

4.3.1 Land Under Cultivation in ADOs

The land under under different crops for the sample farmers is shown in the table 4.43 and Chart- IV.20 and Chart- IV.21. Sali paddy is the major crop of Barak Valley which covers most of the land under cultivation. But there is enough gap between the distribution of land under HYV seeds and traditional

seeds. For Dullabcherra ADO circle, HYV seed covers 78.652 hectares of land or 71.33% of the total of 110.27 hectares of land while traditional seed covers 31.6 hectares of land or 28.67%. In Sadarashi ADO circle, 64.46% or 73.47 hectares out of 114.13 hectares is under HYV seeds and 40.56 hectares under traditional seeds. Similarly all other ADOs have got more than 60%-65% of their land sown by HYV seeds.

In all ADOs of Barak Valley taken under study have largest distribution for Sali paddy and the lowest distribution for summer vegetables. The second large distribution is for Auose land and the third rank is for sugarcane. The fourth rank is for winter vegetables and fifth position for potato. The share of Sali is higher and other crop is lower due to very low diversification and commercialisation of agriculture.

Table- 4.43

Cropping Pattern in Different ADOs (In hectares)

Crop	Dullabcherra	Sadarashi	Arunachal	Sonai	Motinagar	Hailakandi
Sali (HYV)	78.6 (71.33%)	73.56 (64.46%)	80.87 (64.6%)	76.92 (63.33%)	72.56 (66.33%)	72.36 (72.66%)
Sali (Traditional)	31.6 (28.67%)	40.56 (35.54%)	44.32 (35.4%)	44.5 (36.67%)	36.8 (33.67%)	27.2 (27.34%)
Total Sali	110.26	114.13	125.2	121.4	109.4	99.6
Auose (HYV)	21.4 (70.7%)	23.12 (68%)	22.8 (63.5%)	19.8 (65%)	16.9 (67.22%)	15.5 (69%)
Auose (Traditional)	8.8(29.3%)	10.8 (32%)	13.11 (36.5%)	10.6 (35%)	8.2 (32.78%)	6.9 (31%)
Total Auose	38.3	34	36	30.5	25.2	22.4
Potato	12.13	9.6	10.8	8.5	9.03	6.7
Sugarcane	31	34	36	31	25.2	22.4
Summer Vegetables	12.13	9.6	10.7	8.5	9	6.7
Winter Vegetables	32.2	34.13	36	31	27.6	24.7
Total	228	235.6	254	230.2	205.6	182.6

Source: Calculated by the author

Chart- IV.20

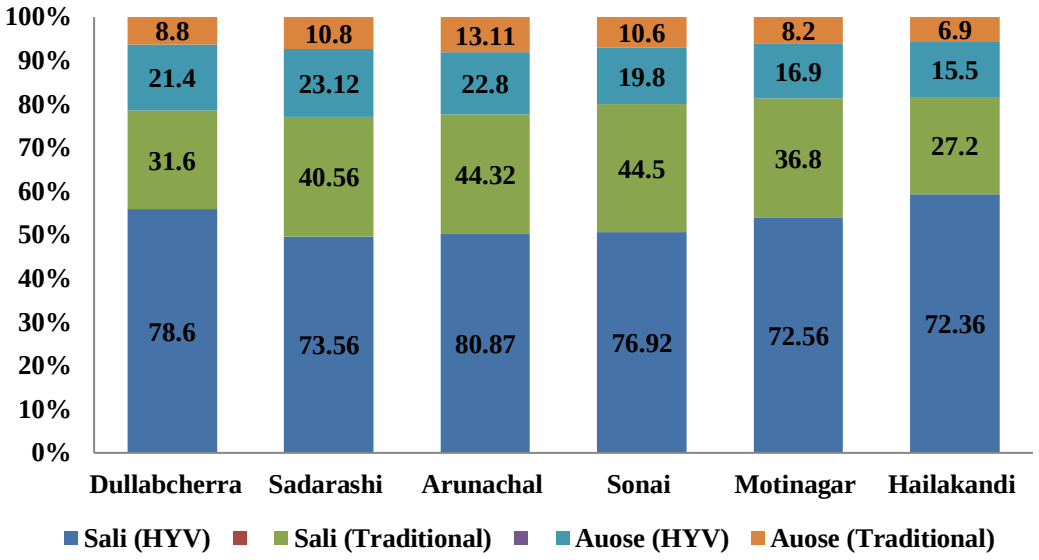
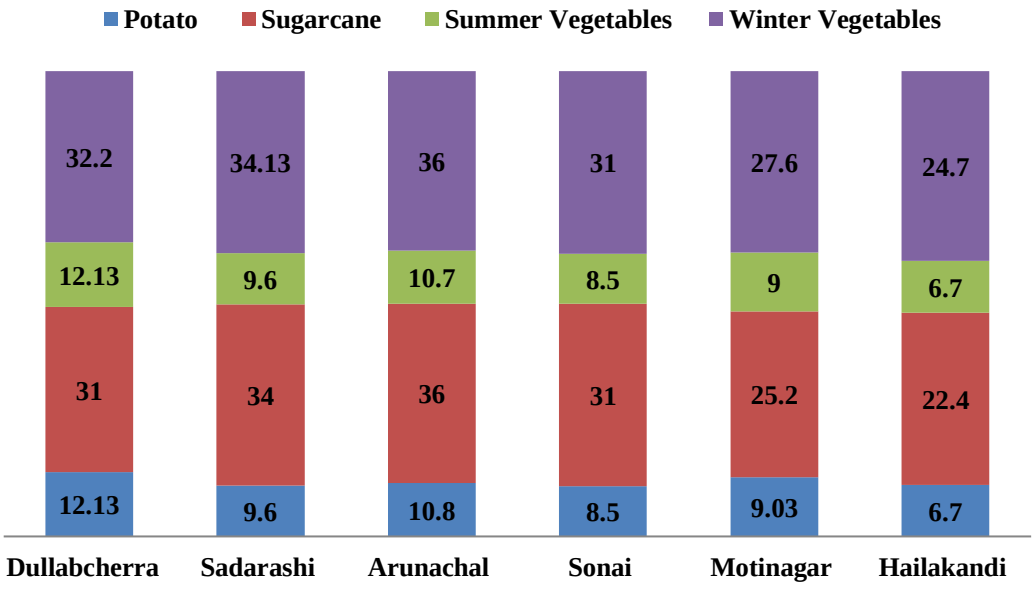


Chart- IV.21



1.3.2 Production in ADOs

In table 4.44 and Chart- IV.22, the mean production of Sali paddy is 49.92 quintals in Dullabcherra ADO circle, 52.08 quintals in Sadarashi, 57.45 quintals in Arunachal which is the highest, 54.88 quintals in Sonai, 52.65 quintals in Motinagar, 47.38 quintals in Hailakandi ADO. The Auose production is the

highest in Arunachal with 17.19 quintals, 15.27 quintals in Sadarashi, 14 quintals in Dullabcherra and 14.37 quintals in Sonai ADO circle. The lower production is found in Motinagar and Hailakandi ADO circle. However the mean production of potato is the highest in Dullabcherra with 6.5 quintals and the lowest in Hailakandi ADO with 3.6 quintals while in other ADOs it ranges around 5 quintals. The mean production of sugarcane is the highest in Arunachal ADO with 18.3 quintals, 17.1 quintals in Sadarashi, 15.8 quintals in Dullabcherra, 15.7 quintals in Sonai, 13 quintals in Motinagar and 11.1 quintals in Hailakandi ADO. The mean output of summer vegetables is around 1 quintals in all ADOs which shows deplorable condition while winter vegetables is around 4/5 quintals in all ADOs.The details estimates are depicted in table 4.44.

Table- 4.44

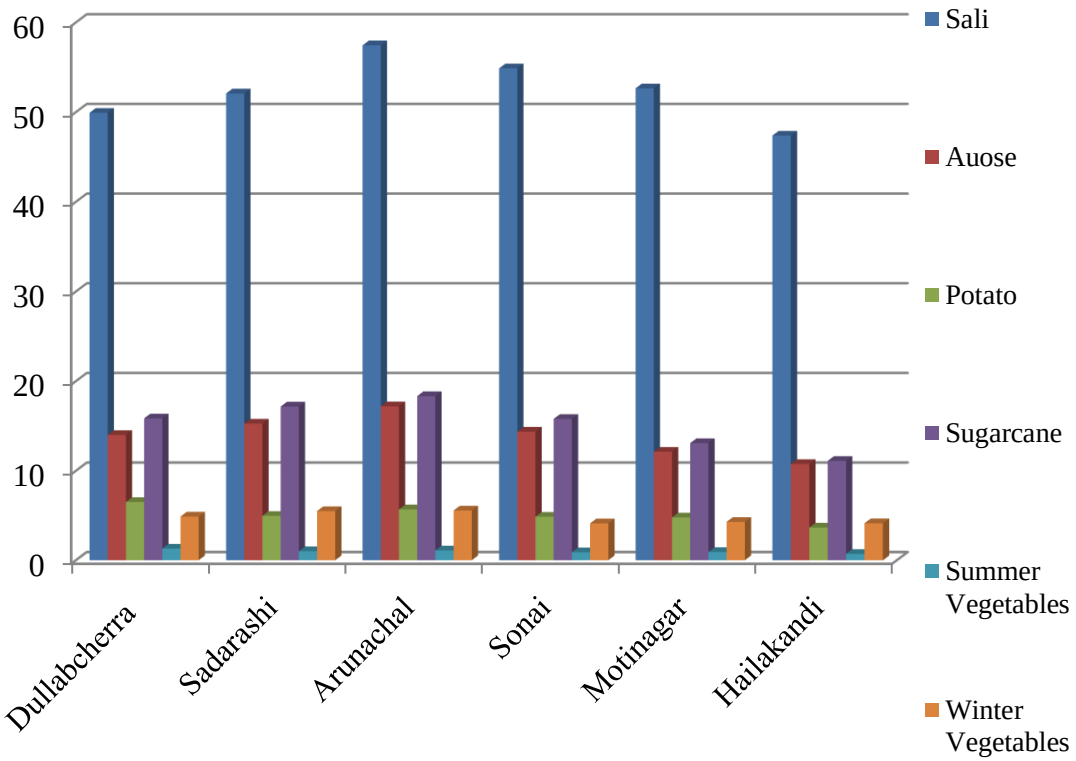
Output in ADOs (In Quintals) [Mean output of 75 samples from each ADO]

Crops	Dullabcherra	Sadarashi	Arunachal	Sonai	Motinagar	Hailakandi
Sali	49.923	52.08	57.453	54.88	52.653	47.381
Auose	14	15.273	17.193	14.373	12.127	10.76
Potato	6.507	4.957	5.687	4.867	4.787	3.653
Sugarcane	15.849	17.175	18.328	15.79	13.086	11.108
Summer Vegetables	1.298	1.015	1.096	0.898	0.924	0.711
Winter Vegetables	4.881	5.493	5.563	4.119	4.284	4.131

Source: Calculated by the author.

Chart- IV.22

Mean Output of Different Crops



4.3.3 Productivity in ADOs

The productivity in different sample ADOs in Barak Valley is shown in table 4.45.

Table- 4.45

Productivity in ADOs (In Quintals)

Indicator		Dullabcherra	Sadarashi	Arunachal	Sonai	Motinagar	Hailakandi
Total Output	Mean	92.458	95.993	104.888	94.92	87.860	77.744
	Std. Dev.	70.7	71.2	76.3	72.5	69.2	56.1
	Min	13.9	21.5	24.0	24.6	18.1	17.7
	Max	438.0	305.2	371.2	450.2	421.5	377.2
Area under Production (In hectare)	Mean	3.04	3.14	3.3	3.07	2.74	2.43
	Std. Dev.	1.8	2.1	1.7	1.9	1.2	1.1
	Min	0.6	0.8	0.8	0.8	0.6	0.6
	Max	14	10.2	12	14.6	12.6	11.7
Workers Applied	Mean	1.960	2.013	2.267	2.213	2.187	2.120
	Std. Dev.	1.3	1.7	1.5	1.8	1.4	1.5
	Min	1.0	1.0	1.0	1.0	1.0	1.0
	Max	5.0	5.0	6.0	6.0	6.0	6.0
Output per hectare	Mean	29.78	30.03	30.51	30.45	31.38	31.5
		2.8	3.1	3.7	3.3	3.8	4.1
	Min	23.25	22.5	21.75	25.5	22.5	26.25
	Max	36	39	35.2	37.5	36	37.5
Output per Worker	Mean	45.156	44.889	45.147	41.46	37.471	34.168
	Std. Dev.	16.2	15.7	16.2	13.8	11.5	10.3
	Min	8.9	21.5	24.0	24.6	18.1	17.6
	Max	120.6	76.3	72.3	75.0	70.3	62.9

Source: Calculated by the author

The important findings are:

Dullabcherra

1. Total crop is calculated by taking in to account output of all products. The mean output 92.4 quintal is not at all bad. The highest producer is the sample farmer no.56 who is the only large scale farmer taken from Dullabcherra ADO. The most poor one produces only 13.9quintal. The mean area under cultivation in Dullabcherra ADO is 3.04 hectare. From the table we know that most of the farmers belong to the class of small, marginal and semi medium farmers while medium and large farmers are a

few. The workers used in the production varies in between 1 to 3 for the small farmers and 3 to 5 for the medium and large farmers. The mean observation is 2 and a maximum of 5 has been used in the land.

2. The most important parameter to understand the productivity is output per worker and output per hectare i.e. labour productivity and fertility of the land. The output per hectare varies between 22.5 to 37.5 quintal paddy per hectare. The mean value is 30 quintal and the maximum is 36 quintal while the minimum is 23.2 quintal per hectare. The labour productivity varies largely from 8.9quintal to 101quintal. The mean productivity is 44.5quintal per worker. Actually it is largely determined by the size of land.

Sadarashi

1. The mean output 95.9quintal is moderate. The highest producer produces 305.2 who is the only large scale farmer taken from Sadarashi ADO. The poorest one produces only 21.5quintal. The mean area under cultivation in Sadarashi ADO is 3.1 hectare. From land holding pattern we know that most of the farmers belong to the class of small, marginal and semi medium category while medium and large farmers are a few. The workers used in the production varies in between 1 to 3 for the small farmers and 3to 5 for the medium and large farmers. The mean observation is 2 and a maximum of 5 has been used in the land.
2. The output per hectare varies in between 22.5 to 37.5 quintal paddy per hectare. The mean value is 30 quintal and the maximum is 39 quintal while the minimum is 22.5 quintal per hectare. The labour productivity varies largely from 21.5quintal to 76.3quintal. The data in the table depicts the mean productivity is 44.8quintal per worker. Actually it is largely determined by the size of land.

Arunachal

1. The mean productivity is 105.32quintal and the highest producer produces 371.15quintal who is the only large scale farmer taken from Arunachal ADO. The most poor produces only 24.01quintal. The mean area under cultivation in Arunachal ADO is 3.3 hectare. Most of the farmers belong to the class of small, marginal and semi medium farmers while medium and large farmers are a few. The workers applied in the production varies in between 1 to 3 for the small farmers and 3 to 5 for the medium and large farmers. The mean observation is 2 and a maximum of 6 has been used in the land.
2. The output per hectare varies in between 22.5 to 37.5 quintal paddy per hectare. The mean value is 430 quintal and the maximum is 35.2 quintal while the minimum is 21.7 quintal per hectare. The labour productivity varies largely from 24 quintal to 72.3 quintal per worker. The data in the table depicts that mean productivity is 45.14quintal per worker. Actually it is largely determined by the size of land.

Sonai

1. In Sonai ADO the mean productivity is estimated at 94.9 quintal while the highest producer produces 450.2 quintal. The most poor one produces only 24.6 quintal. The mean area under cultivation in Sonai ADO is 3.06 per hectare. Most of the farmers belong to the class of small, marginal and semi medium farmers while medium and large farmers are a few. The workers applied in the production varies in between 1 to 3 for the small farmers and 3 to 5 for the medium and large farmers. The mean observation is 2 and a maximum of 6 has been used in the land.
2. The output per hectare varies in between 22.5/30/37.5q paddy per hectare. The mean value is 4.06q and the maximum one is 37.5q while the minimum one is 22.5 per hectare. The labour productivity varies largely from 24.6q to 75q per worker. The table 4.45 depicts the mean productivity as 41.4q per worker. Actually it is largely determined by the size of land.

Motinagar

1. The mean volume is 87.8q which is not at all bad. The highest producer produces 421.5 who is the only large scale farmer taken from Motinagar ADO. The poorest one produces only 18.1q. The mean area under cultivation in Motinagar ADO is 2.7 hectare. From land holding table we know that most of the farmers belong to the class of small, marginal and semi medium farmers while medium and large farmers are a few. The workers applied in the production varies in between 1/2/3 for the small farmers and 3/4/5 for the medium and large farmers. The mean observation is 2 and a maximum of 6 has been used in the land.
2. The mean value is 31.3q and the maximum one is 36q while the minimum one is 22.5q per hectare. The labour productivity varies largely from 18.1q to 70.3q per worker. As the table depicts the mean productivity is 37.4q per worker. Actually it is largely determined by the size of land.

Hailakandi

1. The mean volume is 77.7q and the highest producer produces 377.2q who is the only large scale farmer taken from Hailakandi ADO. The most poor one produces only 18.1q. The mean area under cultivation in Hailakandi ADO is 2.4 hectare. From land holding table we know that most of the farmers belong to the class of small, marginal and semi medium farmers while medium and large farmers are a few. The workers applied in the production varies in between 1/2/3 for the small farmers and 3/4/5 for the medium and large farmers. The mean observation is 2 and a maximum of 6 has been used in the land.
2. The mean value is 31.5q and the maximum one is 37.5q while the minimum one is 26.2q per hectare. The labour productivity varies largely from 17.6q to 62.9q per worker. As the table depicts the mean productivity is 34.1q per worker. Actually it is largely determined by the size of land

1.3.3 Marketing Performance in ADOs

The table 4.46 shows that the mean output sold in ADOs is the highest in Arunachal with 74 quintals, the 2nd highest is the Sadarashi ADO with 64 quintals and Soani just below with 63 quintals. The Dullabcherra and Motinagar ADOs have sold 59.7 quintals and 57 quintals repectively while Hailakandi has sold the lowest with the value of 47 quintals. The maximum values show the highest sellers of the respective ADOs in the table. The minimum amount sold is 0 quintal in all ADOs since the zero value indicate the subsistence farmers who sold nothing. The percentage of output sold is the highest in Arunachal once again and the other results are same as that of mean values of the ADOs. The table shows that almost 90% of the output is getting sold by the farmers in all ADOs.

Table- 4.46
Agricultural Produce Sold in the Market in Different ADOs

Indicator		Dullabcherra	Sadarashi	Arunachal	Sonai	Motinagar	Hailakandi
Amount Sold	Mean	59.7q	64q	74q	63q	57q	47q
	Std. Dev.	31.4	33.2	38.1	32.5	30.7	27.4
	Min	0q	0q	0q	0q	0q	0q
	Max	275q	273q	339q	418q	390q	345q
% of Output Sold	Mean	49.8	51.11	55.19	52.81	45.12	40.24
	Std. Dev.	28.1	29.7	30.3	29.4	26.3	21.8
	Min	0.0	0.0	0.0	0.0	0.0	0.0
	Max	89.6	89.52	91.38	92.89	92.41	91.52

Source: Calculated by the author

1.3.4 Agricultural Performance Index in ADOs

The Agricultural Performance Index in Barak Valley is 0.468. The API in ADOs is 0.495, the highest in Arunachal and 0.441, the lowest in Hailakandi. However all ADOs have performed moderately in API. The 2nd is 0.481 in Sadarashi, 0.478 in Dullabcherra, 0.463 in Sonai and 0.450 in Motinagar ADO circle. The mean Land Fertility Index in all ADOs is almost moderate. The LFI is very close to each other in Hailakandi with 0.569, in Motinagar with 0.559, 0.507 in Arunachal and 0.506 in Sonai ADO. The value is a little lower in Sadarashi with 0.476 and 0.465 in Dullabcherra ADO. But in Market Index Arunachal is the highest with 0.593 and the next is 0.567 in Sonai, 0.549 in Sadarashi and 0.531 in Dullabcherra ADO circle. Hailakandi with value 0.432 and Motinagar with 0.478 have performed at the top in LFI but in market index they are at the bottom since though fertility is higher but subsistence farming is more while in other ADOs commercialisation is better. The Technology Achievement Index ranges between 0.593, in Arunachal, to 0.493 in Motinagar, thus performing moderate. The Labour Productivity Index ranges in between 0.325 in Dullabcherra to 0.226 in Hailakandi. Almost all ADOs have performed below the average in LPI. The correlation between API and LFI ranges in moderate zone in all ADOs while very high value for API-Market Index in all ADOs. The API-TAI is very high for all and also for LPI-API.

Table- 4.47

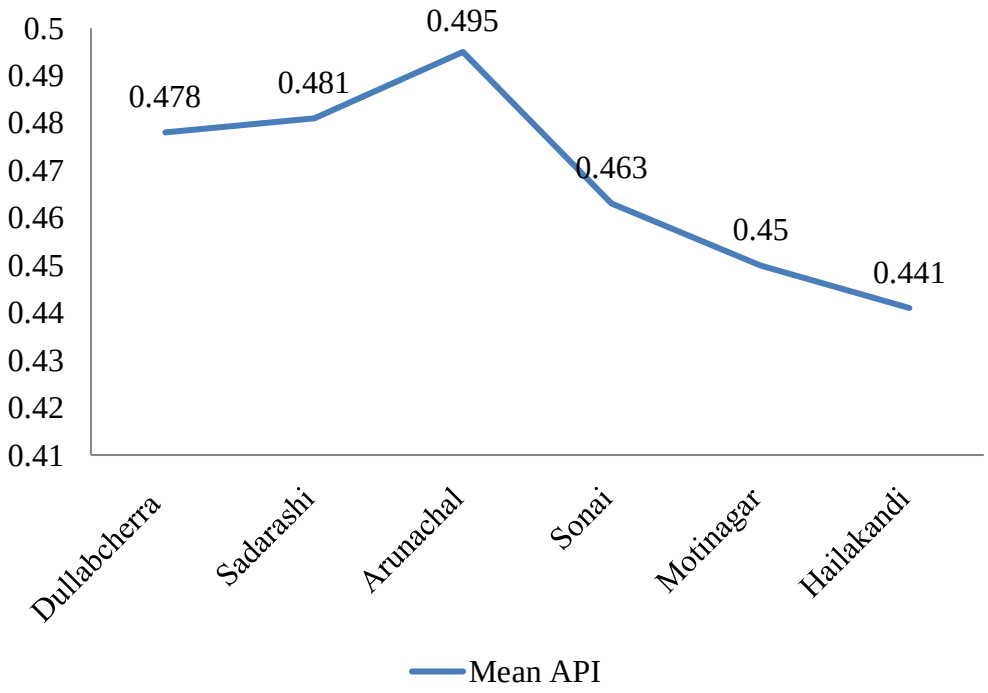
Agricultural Performance in Different ADOs

Indicator	Dullabcherra	Sadarashi	Arunachal	Sonai	Motinagar	Hailakandi
Mean API	0.478	0.481	0.495	0.463	0.450	0.441
Mean LFI	0.465	0.476	0.507	0.506	0.559	0.569
Mean MI	0.531	0.549	0.593	0.567	0.478	0.432
Mean TAI	0.593	0.579	0.557	0.496	0.493	0.538
Mean LPI	0.325	0.322	0.324	0.291	0.255	0.226

Source: Calculated by the author

Chart- IV.23

Agricultural Performance Index in Different ADOs



4.3.6 Human Development Performance in ADOs

The Quality of Life Index in Barak Valley is 0.643 which is moderate and in all ADOs it has also been found that the it is moderate with score ranging between, 0.660, the highest in Hailakandi , to 0.622, the lowest in Dullabcherra. The QLI is 0.657 in Motinagar, 0.647 in Sonai, 0.639 in Arunachal and 0.634 in Sadarashi ADO circle. The Wealth Index showing richness of the people in 28 socio-economic factors ranges in between 0.593 in Dullabcherra to 0.536 in Hailakandi which is average. There is moderate performance in Education Index ranging in between 0.676 to 0.515. The Health Index ranges in between the highest value of 0.786 to 0.762, thus indicating little variation among the ADOs. The mean BMI is also normal around 20/21 in all ADOs. The mean Multidimensional Poverty Index varies in between 0.339 to 0.229. The human development performance is not much varied in ADOs of Barak Valley taken under consideration (refer Table 4.48)

Table- 4.48

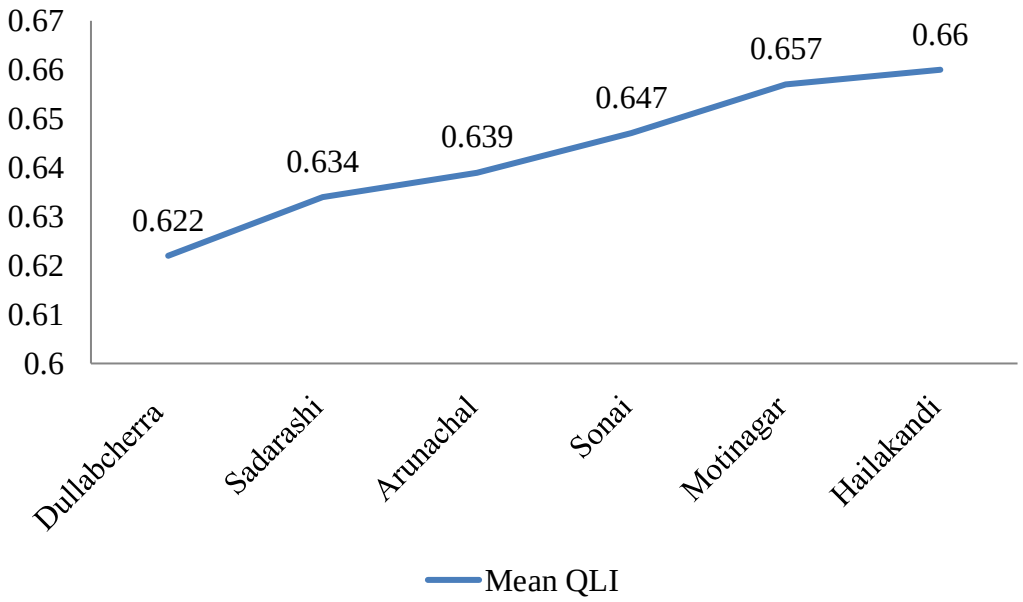
Human Development Performance in Different ADOs

Indicator	Dullabcherra	Sadarashi	Arunachal	Sonai	Motinagar	Hailakandi
Mean QLI	0.622	0.634	0.639	0.647	0.657	0.660
Mean WI	0.593	0.572	0.548	0.556	0.554	0.536
Mean EI	0.515	0.586	0.621	0.633	0.668	0.676
Mean HI	0.771	0.762	0.767	0.770	0.765	0.786
Mean BMI	21.2	20.72	21.05	20.6	21.3	21.4
Mean MPI	0.339	0.267	0.246	0.189	0.231	0.229

Source: Calculated by the author

Chart- IV.24

Quality of Life Index in Different ADOs



Summary

In this chapter we have analyzed the sample data in the concerned ADOs of the Barak Valley region of Assam. We can summarize the major features which have been observed in this chapter:

1. The land holding pattern in the ADOs of Barak valley shows that 9.34% of the farmers are marginal land holders having 0-1 hectare of land. The number of small and semi medium farmers is highly concentrated in Barak Valley in Assam as almost 70% of the sample farmer fall within these two categories. The small farmers have land holding 1-2 hectares and semi-medium farmers have 2-4 hectares. The medium farmers have land holding of 4-10 hectares and constitute 18.6%. If the sample farmers while large scale farmers are only a few constituting only 1.5% of the total samples.
2. The mean land fertility index of 0.514 indicates moderate level of performance in this regard. The natural fertility of the soil is an important determinant of agricultural productivity while in Barak Valley, as we know that infrastructural bottlenecks hinder the output per hectare to rise. The result shows that the LFI is highly concentrated around the mean value of the 6 ADOs.
3. The market index as showing the level of commercialization of farm produce is highly skewed. The performance of farmers in all categories i.e. low, medium and high contain large number of farmers, even there are 13% farmers who are totally at subsistence level i.e. have sold nothing. The mean performance is 0.526 in Barak Valley which indicates medium level performance. The technology achievement index is 0.542 which is moderate and the labour productivity in Barak valley region has been found very low.
4. Human development as measured by three indices of education, health and wealth shows moderate performance in all three indices and the composite index of quality of life. The year of schooling is increasing among the farmers and now they have developed the attitude of sending

their children to school and adopting modern health practices. The problem is that they have low level of resource to avail them. Moreover government service to make these amenities available to them is really very poor. The education and wealth differ largely in Barak Valley and the farmers having higher land holdings are found to have more access to socio-economic benefits than those farmers having lower land holdings. Thus land holding is a parameter of richness in Barak Valley. The housing characteristics and possession of gadgets are also highly skewed among the farmers.

5. The poverty in the valley as measured by Multidimensional Poverty Index shows that most of the farmers maintain a low level of living. 48% of the farmers suffer from multidimensional poverty. This also reduces the performance level of the farmers while it is found that agricultural performance plays a vital role in reducing poverty and enhancing the standard of living.
6. Access to basic amenities of life like electricity, drinking water, cooking fuel, and standard toilet facility as per MDG guideline differ widely. Moreover possession of essential commodities and electronic gadgets as per guideline of National Family Health Survey shows that they are highly varied in Barak Valley. The standard of living is much lower than the other parts of the country.

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