

IMPACT OF FARMING SYSTEM RESEARCH ON FARMERS' INCOME AND LIVELIHOOD AT DEKAR HAOR OF SUNAMGANJ

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Abstract

The study was conducted to evaluate the impact of farming system research on farmers' income and livelihood status in Dekar *haor* of Sunamganj district. A total of 120 farmers (i.e., 60 project and 60 non-project) were selected as the sample of the study. Data were collected through direct interviewing and were analyzed with a combination of descriptive and econometric analyses. The average farm size was about 2.44 acre and 2.00 acre for project farmers and non-project farmers in the study areas, respectively. The average annual income was Tk. 51530 and Tk. 39936 for the project and non-project farmers, respectively. Based on paired *t* test, the average annual income of project farmer was increased by Tk. 48570 to Tk. 51530 per year which is statistically significant at 5% level. On the other hand, the income of non-project farmer was decreased. The access on natural capital, financial capital, human capital, social capital and physical capital for project farmers was increased by 25.53%, 43.33%, 68.87%, 52.5% and 33.35%, respectively due to the involvement with this farming system research which is not satisfactory in case of non-project farmers. Institutional credit is not available to the farmers of the study area due to complex process. Different commercial bank should make the credit system to the farmers of *haor* area. If these problems could be solved within a reasonable time, farmers could earn more monetary income which might help them to change their livelihood status ultimately.

Keywords: Farming system research, income, livelihood, *haor*.

Introduction

With a population of over 159.9 million living in an area of 147,570 square kilometers', Bangladesh is one of the most densely populated countries in the world. About 80% of the population lives in rural areas and is mainly engaged in agriculture and related non-farm activities. More than two thirds of the rural population is landless or functionally landless (owning less than 0.2 hectares of land), 44% are below the national poverty line and 29% are classified as very poor (BER, 2016).

The *haor* Basin in north-eastern Bangladesh is subject to very peculiar conditions and suffers from extensive annual flooding. This makes livelihoods extremely vulnerable and limits the potential for agriculture production and rural enterprise growth. For 6 to 7 months of the year, the cropped land is completely inundated. Rural poor households have to depend upon fisheries and off-farm labor. The communication infrastructure is poorly developed with submersible rural roads providing some connectivity during the dry season and boats being the main source of communication during the flood season. The poor communication network limits the incentives for increasing production, discourages rural growth, limits access to markets and off-farm employment opportunities and limits access to existing social services particularly health and education. Strong wave action adds to the vulnerability as it can potentially wash away the land and poses a major threat to many villages in the *haor*. Protection of villages against flood action, proper management of the fishery resources and securing existing livelihoods such as crop and animal production are critically needs for the poor rural households living in the *haor* region (Rashid, 2013). It is often argued that the future development of Bangladesh depends particularly on the agriculture sector which is the mainstay of the economy and also considered as the prominent source of employment for the incremental labor force. However, farmers' are engaged in producing field crops and homestead farming like vegetables and fruit production, fish culture, livestock and poultry rearing along with some other non-farm activities. These activities are interlinked and together they constitute integrated farming. Different institutions of Bangladesh have worked on Farming Systems Research and Development for more than three decades, however there is a clear dearth of information and including publications. To understand Farming Systems of Bangladesh is important for overall agricultural development (Uddin *et al.*, 2015)

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Most of the farmers' of *haor* are poor, landless and disorganized, with low social status and exploited by the rich and powerful. Farmer's access to resource is limited because of their poverty, lack of organization and capacity. They also do not have more access to institutional credit due to inability to provide collateral and consequently they are dependent on private sources of credit at higher rates of interest - about 10 times the rate of institutional credit. In recent years they are getting financial and social support from NGOs. Government policies have provision for fisher's access to resources and credit, but in reality they do not get these because of their poverty and lack of organized forum. A major constraint in farmer communities is their lack of financial and social empowerment. There has been a recent move towards community based farmer management approaches aimed at social and financial empowerment of farmer communities with public sector's support. By getting support from farming system research (FSR), the income of farmer increases which also have effect on livelihood improvement of farmer. While this has shown some positive changes locally the long-term sustainability of such institutions.

Modalities of such study are portrayed in a number of literatures which are: Islam *et al.* (2013) conducted a research on competency assessment of the farmers on the application of 'one house one farm' approach and indicated that majority of the respondents (94 percent) had medium competency compared to 2 percent of them having high competency. Jahan *et al.* (2013) conducted a research on impact of homestead agroforestry on sustaining livelihoods of rural poor in Mymensingh district of Bangladesh and revealed that homestead agroforestry had positive impact on improving the status of rural households and women empowerment. Ullah (2011) carried out a research on farmers' perception towards 'one house one farm' approach in Mymensingh district which revealed that 47% of the farmers had moderate favorable perception, 28% had less favorable perception and 25% had favourable perception. Ali *et al.* (2010) conducted a research on livelihood status of the fish farmer in some selected areas of Tarakanda upazila of Mymensingh district and found that average annual income of the farmers was estimated at BDT 42500 and 90% of the farmers used their own money for farming, while 10% received loan. Mamun *et al.* (2010) conducted a study on homestead vegetables cultivation at Raichow village under Comilla district and argued that home is a good source of additional income for the household through the sale of garden produce after family consumption.

The observation from review of literature is that different studies have been done either on profitability or present status of different farming system research. Some studies addressed the competency, perception, etc. of different farming system research. But there is little study which attempted to analyze the impact of farming system research on farmers' livelihood in *haor* area. In this context, this study will explore the socioeconomic condition of *haor* households. This research will also measure the impact of farming system research on farmers' income generation and livelihood pattern. The specific objectives of the study are: i) to identify the socioeconomic characteristics of FSR supported farm household; and ii) to evaluate the impact of FSR on income generation and livelihood pattern.

Materials and Methods

Selection of study area and sample

The locations for the present study were selected purposively in Dekar *haor* at *Dakshin* Sunamganj upazila under Sunamganj district. The topography, soil, climatic condition and communication facilities were good in the study areas. A list of project beneficiary was prepared with the help of FSR associate. A total of 120 farmers (i.e., 60 beneficiaries and 60 non-beneficiaries) were selected for the present study. Data were collected from the farmers through personal interviews using structured questionnaire. Secondary data sources relevant to the study were also considered.

Analysis of Data

A combination of descriptive and statistical technique was used to achieve the objectives and to get meaningful results.

Socioeconomic characteristics of farm household

Descriptive statistics (i.e., sum, average, percentages, ratios, etc.) were used to examine the farmers' social and economic status in the study area.

To evaluate the impact of FSR on farmers' income generation and livelihood pattern

Impact is the change in outcomes. Descriptive statistics (i.e. sum, average, percentages, etc.) were used to examine the contribution of different enterprises in farmers' income. Descriptive statistics (i.e. sum, average, percentages, etc.) were used to examine the livelihood pattern of farmers. To evaluate the impact on income generation pair t-test was used. A paired t-test was used to compare two population means where there were two samples in which observations in one sample can be paired with observations in the other sample (McDonald, 2014). The formula of paired t-test is,

$$t = \frac{\sum d}{\sqrt{\frac{n(\sum d^2) - (\sum d)^2}{n-1}}}$$

Where,

$\sum d$ = Sum of differences.

Sustainable livelihood framework

Livelihood status will be measured by presenting the assets in an asset pentagon framework which is composed of five types of capitals namely human capital, social capital, natural capital, physical capital and financial capital (DFID, 2000).

Results and Discussion

Socioeconomic characteristics of FSR Supported Farm Household

The resolution of this section was to identify the demographic characteristics of the sample farmers. Demographic characteristics mainly illustrated the wide ranges of interrelated social attributes of the farmers and their family members which largely influenced their economic activities, living condition and decision making process. Basic characteristics of the farmers' were sex distribution, age composition, level of education, land ownership, income level, sources of income of the family members, training exposure, etc.

Age of the household head

In the study area, about 80% household head was between 16-49 and 20% household head age is 50 or above for the project farmers. It was also same for respondents of non-project farmers (Table 1).

Table 1. Age of the household head in the study area

Age of the household head	Project		Non-project	
	No of respondent	Percentage	No of respondent	Percentage
15-29	2	3.3	2	3.3
30-64	57	95	58	96.7
65 and above	1	1.7	0	0
Total	60	100.0	60	100.0

Source: Field survey, 2017.

Family Size

In this study the family size of the farmer was divided into three categories on the basis of number of family member. The result showed that 26.7% families are small for the project farmer while it was 23.3% for non-project farmers. The result also showed that 56.7% families were medium and 16.7% families were large for the project farmer while it was 61.7% and 15.0% for the non-project farmer, respectively (Fig.1). The average family size of the project and non-project farmers were 6 and 5 which was higher than the national average of 4.06 (HIES, 2016).

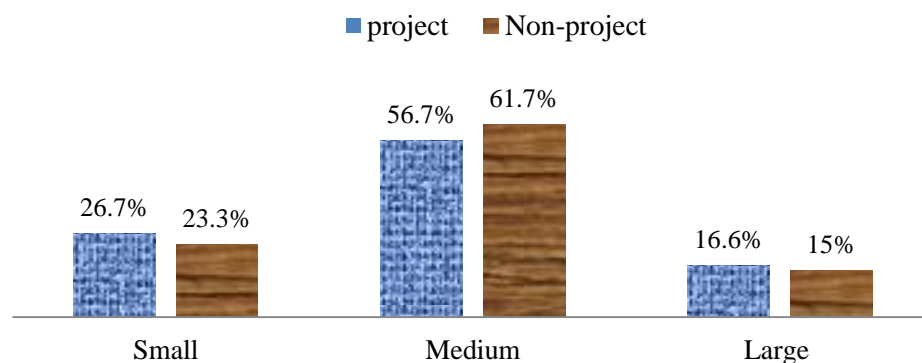


Fig. 1. Family size of the farmer in the study area

Family type

In rural Bangladesh, normally families are classified into two types such as (1) nuclear family and (2) joint family. Figure 2 demonstrates that 8.3% families were nuclear for the non-project farmer while it was 15.0% for project farmers. The result also showed that 85.0% families were joint for the project farmer while it was 91.7% for non-project farmers.

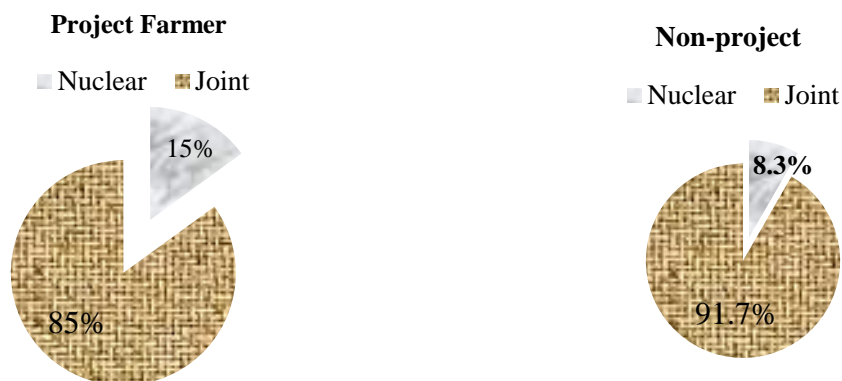


Fig. 2. Family type of the farmer in the study area

Literacy level

Literacy is important in life because it gives people the skill and tools they need to navigate the world. Literacy is very important for every person. In the study area, it was found those 31.7% farmers were illiterate means they cannot read and write while it was 15.0% for the non-project farmers. 43.3% farmers can sign only for the project farmers while it was 35% for non-project farmers. The percentage of the farmer who can read only is 1.7% for the projects and non-project farmers. The percentage of literate farmer who can read and write only but not enough educated is 23.3% for the non-project farmer while it was 23.3% for project farmer (Fig. 3).

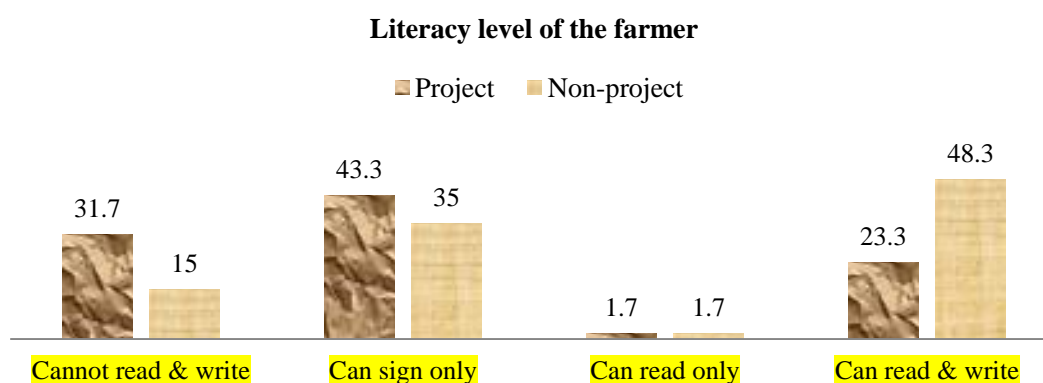


Fig. 3. Literacy level of the farmer in the study area

Occupation of the household head

Occupation of the head of farm household is one of the determining factors of their status. The distribution of principal occupation is fascinating because it varies greatly depending on how much they are involved in and what level of income is earned from the present occupation. Farmers in the *haor* region were engaged in various types of occupations. Table 2 shows that 33.3%, 50%, 15% respondents were fishermen, farmer and agricultural labor, respectively for the project farmers while it was 23.3%, 38.3% and 35% for the non-project farmers.

Table 2. Occupation of the household head

Occupation of the household head	Project		Non-project	
	No. of respondent	Percentage	No. of respondent	Percentage
Fisherman	20	33.3	14	23.3
Farmer	30	50.0	23	38.3
Agricultural labor	9	15.0	21	35.0
Housewife	0	0.0	1	1.7
Jobless	1	1.7	1	1.7
Total	60	100.0	60	100

Source: Field survey, 2017.

Farm size

Farm size is estimated as the total farm land owned by the household measure in acre. Farm size was measured using the following formula (Dhar, 2016):

Average land holding = Homestead area + Owned cultivable land + Rented / mortgage / leased-in land – Rented / mortgage / leased-out land + Area under pond + Fallow / waste land

From the field survey, 73.3% project farmer were small farmer, 25% were medium and 1.7% large farmer, respectively for the project farmers while there was no large farmer among the 60 respondent of non-project farmer. For the non-project farmer, 81.7% farmers were small while 18.3% farmers were medium (Fig. 4).

It is revealed from Table 3 that average land holding of project and non-project farmers was 2.40 and 2.00 ha, respectively. Rented / mortgaged / leased-in land contained the maximum portion of the total land holding (0.97 and 0.81 acre for project and non-project farmers, respectively) which was followed by owned cultivable land (0.89 and 0.70 acre for project and non-project farmers, respectively) in the study areas.

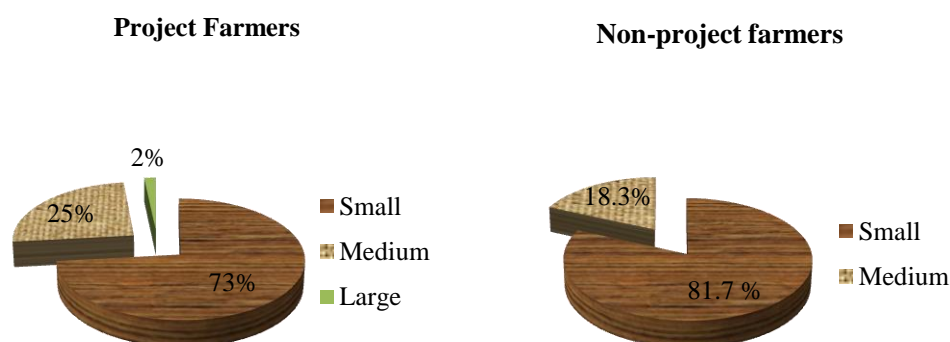


Fig. 4. Average farm size of the farmer

Table 3. Average land holding of the farmers

(in acre)

Types of land	Project	Non-project
Homestead area	0.57	0.45
Owned cultivable land	0.89	0.70
Rented/mortgaged/leased-in	0.97	0.81
Rented/mortgaged/leased-out	0.39	0.46
Area under pond	0.20	0.3
Fallow land	0.16	0.2
Total	2.40	2.00

Source: Field survey, 2017.

Housing condition

In the study area, the housing condition of farmer was divided into five categories: (1) straw wall, straw roof (2) bamboo wall, straw roof (3) bamboo wall, tin roof (4) tin wall, tin roof (5) brick wall, tin roof. Table 4 represents that 3.3% farmer own straw wall, straw roof house, 3.3% farmer own bamboo wall, straw roof house, 8.3% farmer own bamboo wall, tin roof house, 78.3% farmer own tin wall, tin roof house and 6.7% farmer own brick wall, tin roof house for the project farmer. On the other hand, 20% farmer own straw wall, straw roof house, 13.3% farmer own bamboo wall, straw roof house, 8.3% farmer own bamboo wall, tin roof house, 55% farmer own tin wall, tin roof house and 3.3% farmer own brick wall, tin roof house for the non-project farmer.

Table 4. Housing condition of the farmer in the study area

Housing condition	Project		Non-project	
	No. of respondent	Percentage	No. of respondent	Percentage
Straw wall, straw roof	2	3.3	12	20.0
Bamboo wall, straw roof	2	3.3	8	13.3
Bamboo wall, tin roof	5	8.3	5	8.3
Tin wall, tin roof	47	78.3	33	55.0
Brick wall, tin roof	4	6.7	2	3.3
Total	60	100.0	60	100.0

Source: Field survey, 2017.

Sanitary facilities

Sanitation is one of the major causes to prevent disease. In the study area, it was observed that sanitary conditions of farmer were good. The result showed that, 86.7% project farmer had sanitary facility while 65% of non-project farmer had sanitary facility. 1.7% farmer had earthen while 10% farmer had hung latrine for the project farmer. 30% non-project farmer use hung latrine while 1.7% non-project farmer had earthen and bush (Table 5).

Table 5. Sanitary facilities of the farmer in the study area

Sanitary facilities	Project		Non-project	
	No. of respondent	Percentage	No. of respondent	Percentage
Sanitary/ ring slab	52	86.7	39	65.0
Earthen	1	1.7	1	1.7
Bush	0	0	1	1.7
Hung latrine	6	10.0	18	30.0
Open field	1	1.7	1	1.7
Total	60	100.0	60	100.0

Source: Field survey, 2017.

Solar electricity

In the study area, 68.3% project farmers had solar electricity facility while it was only 28.9% for the non-project farmers (Fig. 5).

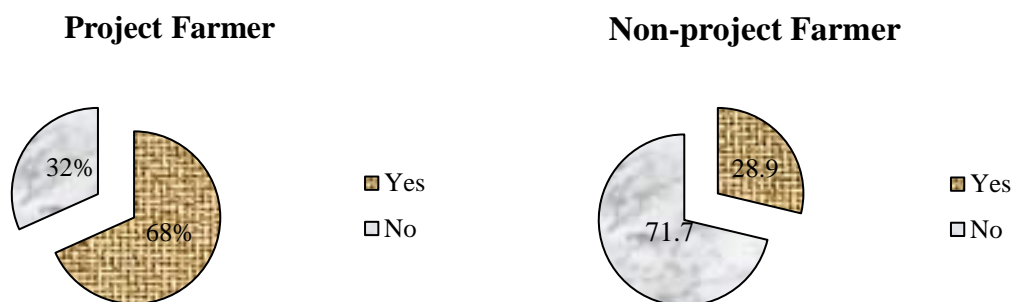


Fig. 5. Solar electricity facilities

Impact of farming system research on income generation and livelihood pattern

Income generation and livelihood patterns are important factors, for any relative study, to estimate overall economic condition. Income is an important indicator for any analysis. Income may be of two types i.e., farm income and non-farm income. According to Chambers and Conway (1991), a livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. It is sustainable when it can cope with and recover from stress and shocks, and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base. However, the purpose of this section is to assess the impacts of FSR on farmers' income and livelihood pattern for both categories of farmers.

Impact on income generation

An analysis of income sources adds further insight into the income generation process. There were two sources of income for project and non-project farmers: farm income source and non-farm income source. The major farm income sources were crop, livestock, fisheries and vegetable farming. Table 6 clearly indicated that after engaging in this farming system research, a considerable portion of total income from almost all sources had been increased for the project farmers. The major non-farm income sources were agricultural labor, driving, services, homestead work etc. Table 6 clearly shows that, for the project farmer livestock was the major income source while the major income source of non-project farmer was agricultural labor. The income of project farmer was increased because they get support such as seed, livestock, fingerlings, training and suggestion from this farming system research.

During the reference year 2016, the average annual total income of project farmer was Tk. 51530 and total income of non-project farmer was Tk. 39936. The average annual farm income for project farmer was Tk. 39632 and the average annual farm income for non-project farmer was Tk. 22661. The average annual farm income of project farmers was 16.38%, 31.96%, 18.13% and 10.44% from crop cultivation, livestock rearing, fisheries/fishing, vegetable cultivation, respectively. The average annual farm income of non-project farmers was 16.63%, 14.96%, 18.31% and 6.83% from crop cultivation, livestock rearing, fisheries/fishing, vegetable cultivation, respectively. The average annual non-farm income for the project farmer was Tk. 11898. The average annual non-farm income of non-project farmer was Tk. 17275. The average annual non-farm income of project farmers was 7.03%, 6.53%, 4.48%, 2.96% and 2.09% from agricultural labor, driving, shop keeper, service (shop) and other non-farm activities, respectively. The average annual non-farm income of non-project farmers was 26.22%, 4.80%, 3.61%, 5.34% and 3.30% from agricultural labor, driving, shop keeper, service (shop) and other non-farm activities, respectively (Table 6).

From Table 6, about 76.91% income came from the farm activity of project farmer while it was 56.73% for non-project farmer. Livestock rearing (31.96%) contributed highest in the farm income of project farmer. Fisheries (18.31%) contributed highest in the farm income of non-project farmer. The income estimated from crop cultivation, livestock rearing, fishing/fisheries and vegetable cultivation were 16.38%, 31.96%, 18.13% and 10.44%, respectively for the project farmers. The income estimated from crop cultivation, livestock rearing, fishing/fisheries and vegetable cultivation were 16.63%, 14.96%, 18.31% and 6.83%, respectively for the non-project farmers. The income estimated from agricultural labor, driving, shop keeper, service (shop) and other non-farm activities were 7.03%, 6.53%, 4.48%, 2.96% and 2.09%, respectively for the project farmers. The income estimated from agricultural labor, driving, shop keeper, service (shop) and other non-farm activities were 26.22%, 4.80%, 3.61%, 5.34% and 3.30%, respectively for the non-project farmer.

Table 6. Average annual income for sample farmer

Sources of income	Project farmer		Non-project farmer	
	Amount (Tk.)	Percentage	Amount (Tk.)	Percentage
Farm income				
Crop Cultivation	8442	16.38	6645	16.63
Livestock Rearing	16468	31.96	5975	14.96
Fishing/Fisheries	9342	18.13	7313	18.31
Vegetable Cultivation	5380	10.44	2728	6.83
Total farm income	39632	76.91	22661	56.73
Non-farm income				
Agricultural Labor	3623	7.03	10475	26.22
Driving	3367	6.53	1917	4.80
Shop keeper	2305	4.48	1439	3.61
Service (Shop)	1523	2.96	2127	5.34
Other non-farm activities	1080	2.09	1317	3.30
Total non-farm income	11898	23.09	17275	43.27
Total Income	51530	100	39936	100

Source: Authors' estimation, 2017.

To test the consistency of the results, paired t-test method was also used to evaluate the impact of farming system research on income generation. Table 7 showed that the income of project farmers was increased which was statistically significant at 5% level. On the other hand, the income of non-project farmers was decreased which was also statistically significant at 1% level which indicated that farming system research had positive impact on the income of project farmers. Uddin and Dhar (2016) also found a positive and statistically significant change on average annual income and expenditure of the farmers after adoption of conservation agriculture.

Table 7. Annual income of project farmer

Item	Amount of money		t-value
	Income before	Income after	
Project farmer	48570	51530	2.549**
Non-project farmer	42992	39936	-4.265*

Source: Authors' estimation, 2017.

Note: ** and * indicates 1% and 5% level of significance, respectively.

Impact on livelihood pattern

Livelihood pattern was measured by presenting the assets in a framework which is known as asset pentagon. Asset pentagon is composed of five types of capitals namely natural capital, financial capital, human capital, social capital and physical capital (DFID, 2000). A sustainable livelihood is the outcome of inter and intra relationship between the components of these capitals. Changes in the asset position during one year were discussed as the transformation and improvement of the livelihoods of the respondents.

Natural capital

Natural capital is the term used for the natural resources stocks from which resource flows and services useful for livelihood are derived. There is a wide variation in the resources that make up natural capital, from intangible public goods such as the atmosphere and biodiversity to divisible assets used directly for production. Here information about production, land ownership, pond ownership as the natural capital of sample farmer. From Table 8 it was found that, 45% project farmers responded that their production was increased while 38.3% and 16.7% responded for decreased and remained constant, respectively. 26.7% non-project farmer responded that their production was increased where 63% responded as decreased. Majority of the project farmers (51.7%) and non-project farmers (53.3%) responded that their land ownership remained constant. In case of pond ownership, 66.7% and 65% project and non-project farmers responded that their pond ownership remained constant, respectively.

Financial capital

Financial capital denotes the financial resources that people use to achieve their livelihood objectives. The definition used here is not economically robust in that it includes flows as well as stocks and it can contribute to consumption as well as production. 58.3% project farmer reported that their income was increased because they get support from this

farming system research while only 36.7% non-project farmer reported that their income was increased. Majority of the non-project farmers' (55%) income decreased while it was 38.3% for project farmer. About 63.3% project farmer reported that their savings was decreased. 45% and 53.3% non-project farmers reported that their savings was decreased and remained constant, respectively. Credit access increased for project farmer. But the farmers could not access more in institutional credit because of complex process. About 65% project farmers reported to increase credit access when 40% and 41.7% non-project farmer reported that credit access was increased and remained constant, respectively (Table 8).

Human capital

At a household level, human capital is a factor of the amount and quality of labor available; this varies according to household size, skill levels, leadership, potential, health status etc. Human capital appears in the generic framework as a livelihood asset, that is, as a building block or means of achieving livelihood outcomes. Development of human capital is one of the pre-requirements for successful attainment of other types of assets. It is evident from Table 8 that training, education and medical care increased, reported by 58.3%, 78.3% and 70% project farmers, respectively. Training, education and medical care increased, reported by 36.7%, 80% and 85% non-project farmers, respectively.

Social capital

In the context of the sustainable livelihoods framework, it is taken to mean the social resources upon which people draw in pursuit of their livelihood objectives. The components of social capital are involvement in social group, political involvement, self-managerial capability, women empowerment and social access etc. Involvement in social group was increased, reported by 48.3% project farmers while 36.7% reported that involvement in social group was decreased. It was a good sign in *haor* area that, women empowerment was increased day by day. 56.7% project farmers and 65% non-project farmers reported that women empowerment increased (Table 8).

Table 8. Livelihood status of farm households

Item	Project Farmer			Non-project farmer		
	Increased	Decreased	Constant	Increased	Decreased	Constant
Natural Capital						
Production	45	38.3	16.7	26.7	63.3	10
Land						
Ownership	13.3	35	51.7	16.7	30	53.3
Pond						
Ownership	18.3	15	66.7	16.7	18.3	65
Financial Capital						
Income	58.3	38.3	3.3	36.7	55	8.3
Savings	6.7	63.3	30	1.7	45	53.3
Credit						
Access	65	3.3	31.7	40	18.3	41.7
Human Capital						
Training	58.3	3.3	38.3	36.7	5	58.3
Education	78.3	3.3	18.3	80	-	20
Medical Care	70	5	25	85	3.3	11.7
Social Capital						
Involve in social group	48.3	15	36.7	53.3	11.7	35
Women involvement in income activity	56.7	10	33.3	65	8.3	26.7
Physical Capital						
Furniture	16.7	3.3	80	6.7	6.7	86.4
Agril. Equipment	36.7	11.7	51.6	16.7	15	68.3
Mobile Phone	30	11.7	58.3	35	16.7	48.3
Toilet	50	2.7	48.3	50	-	50

Source: Field survey, 2017.

Physical capital

Physical capital comprises the basic infrastructure and producer goods needed to support livelihoods. Infrastructure consists of changes to the physical environment that help people to meet their basic needs and to be more productive. Producer goods are the tools and equipment that people use to function more productively. Majority of the project farmers (80%) and non-project farmers (86.4%) reported that their furniture was remaining constant while only 16.7% project farmers and 6.7% non-project farmers reported that their furniture was increased (Table 8). For agricultural equipment, mobile phone and toilet, majority of project and non-project farmers reported that these items remained constant. 36.7%. 30%, 50% project farmer reported that agricultural equipment, mobile phone and toilet were increased, respectively.

The pentagon was used to enable probable information about farmers' assets to be presented visually, thereby bringing to life important inter-relationships between the various assets. The shape of pentagon displayed schematically the variation in farmers' access to assets. Table 9 and Fig. 6, 7 and 8 showed that significant improvement took place in farmers' livelihoods who are engaged in this farming system research. The findings are quite similar with Uddin and Dhar (2018) where the authors indicated that poverty in terms of deprivation of health education, employment, housing, mobility and income was decreased; and overall livelihood circumstances was improved through government input support on *Aus* rice production.

Table 9. Distribution of livelihood capital of the sample farmer

Asset category	Increased		Decreased		Constant	
	Project	Non-project	Project	Non-project	Project	Non-project
Natural capital	25.53	20.03	29.43	37.2	45.03	42.77
Financial capital	43.33	26.13	34.97	39.43	21.67	34.43
Human capital	68.87	67.23	3.87	4.15	27.2	30.0
Social capital	52.5	59.15	12.5	0.0	35	30.85
Physical capital	33.35	27.1	7.35	12.8	59.55	63.25

Source: Authors' estimation, 2017.

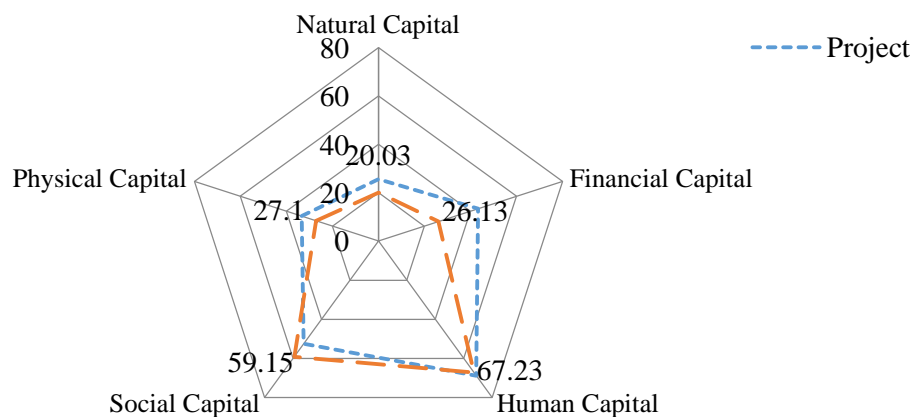


Fig. 6. Asset pentagon (increased situation) for project and non-project farmers

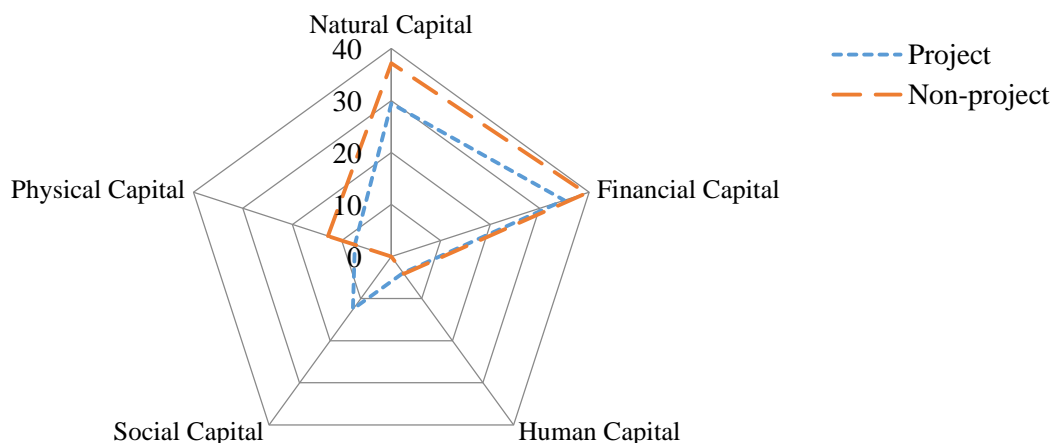


Fig. 7. Asset pentagon (decreased situation) for project and non-project farmers

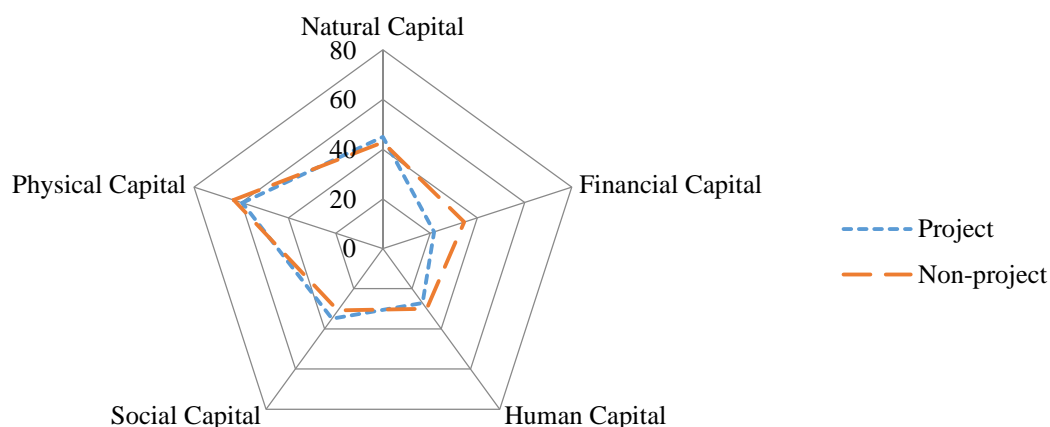


Fig. 8. Asset pentagon (constant situation) for project and non-project farmers

Conclusion and Recommendations

The study concluded that the average socio-economic condition of the project farmer is better than the average socio-economic condition of non-project farmer. Most of the project farmers' housing condition and sanitary facility was better than non-project farmers. In case of using solar electricity, project farmers were in better position than non-project farmers. Most of the farmers were within small category according to their farm size. The overall situation of income and livelihood status was improved in case project farmers. The income of project farmers was comparatively higher than the non-project farmers. This farming system research helped the project farmers by providing different types of support such as seed of different vegetable, poultry, livestock, fingerlings of fish, suggestion on different scientific process of production, vaccination of livestock and poultry which had a great positive impact on improving the income and livelihood pattern of project farmer. On the basis of the findings of the study, the following recommendation for policy implication are made: government should give more emphasis on the *haor* area to improve the living condition of the *haor* people; the extension activities need to be strengthened to give support to the farmers; sometimes the farmers sell their product at a lower price than their production cost, so, necessary steps should be taken so that they can get the reasonable price.

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References

- Ali H, Azad M A K, Anisuzzaman M, Chowdhury M M R, Hoque M and Sharful M I. 2009. Livelihood Status of the Fish Farmers in Some Selected Areas of Tarakanda Upazila of Mymensingh District. *J. Agrofor. Environ.* 3(2):85-89.
- BER. 2016. Bangladesh Economic Review, Economic Advisors Wing of Finance Division, Ministry of Finance, Government of the Peoples' Republic of Bangladesh.
- Chambers R and Conway G. 1991. Sustainable rural livelihoods: Practical concepts for the 21st century. Available at <http://www.smallstock.info/reference/IDS/dp296.pdf> (accessed on 06-08-2016).
- DFID. 2000. Enterprise Development Strategy. London.
- Dhar A R. 2016. Enhancing farmers' livelihood through adoption of conservation agriculture: A socioeconomic study. MS Thesis, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh-2202.
- Jahan N, Rashid M H A, Jinan T and Islam S. 2013. Impact of Homestead Agro-Forestry on Sustaining Livelihoods of Rural Poor in Mymensingh District of Bangladesh. *Journal of Progressive Agriculture*. 19(1):169-178.
- Harun-ur-Rashid A K M. 2013. LGED: Activities of haor infrastructure and livelihood improvement project, The Guardian. Available at <http://www.theguardianbd.com/lged-activities-of-haor-infrastructure-and-livelihood-improvement-project>.
- HIES. 2016. Preliminary report on household income and expenditure survey, Bureau of Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.
- Islam I, Haque M J, Miah M A M and Sheheli S. 2013. Competency Assessment of the Farmers on the Application of One House One Farm Approach. *Journal of Progressive Agriculture*. 24(1):291-299.
- Mamun M H A, Bashar H M K, Islam M S, Howlader M H K and Hasan M S. 2010. A Case Study on Homestead Vegetables Cultivation: Food Security and Income. *Int. J. Sustain. Crop Prod.* 5(1):5-10.
- McDonald, J.H. 2014. Handbook of Biological Statistics (3rd ed.). Sparky House Publishing, Baltimore, Maryland.
- Uddin M T and Dhar A R. 2018. Government input support on *Aus* rice production in Bangladesh: Impact on farmers' food security and poverty situation. *Agriculture & Food Security*. 7:1-15.
- Uddin M T, Khan M A, Islam M M. 2015. Integrated Farming and its Impact on Farmers' Livelihood in Bangladesh, *SAARC J. Agri.* 13(2):61-79.
- Uddin M T and Dhar A R. 2016. Conservation agriculture practice and its impact on farmer's livelihood status in Bangladesh. *SAARC Journal of Agriculture*. 14(1):119-140.
- Ullah S M A. 2011. Farmers' Perception of One House One Farm Approach. MS Thesis, Dept. of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.