Original Research Paper

Impact of Remittance on Agricultural Technology Adoption and Employment Generation in Lakshmipur District of Bangladesh

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Abstract: The study focused on the impact of remittance on agricultural technology adoption and income and employment generation of technology adopted farmers. The relevant data were collected from remittance receiving households of Lakshmipur district in Bangladesh. Farm households having at least a member in abroad who sent remittance to the respective family were selected for the study. A total of 60 households was selected as sample. The regression result shows that, estimated values of the relevant coefficients among the included explanatory variables, i.e., amount of remittance, savings, farm size and access to irrigation had positive and significant impact on the adoption of agricultural technology and the coefficient of number of active males was negatively significant. It was found from the study that remittance was mainly spent in three different items, i.e., food, non-food and durable goods. Family member of the maximum household went to Malaysia and highest average annual revenue was received from Kingdom of Saudi Arabia (KSA). Family member of technology adopted farmers spent more time in non-farm activities. This research will enable the policy makers to create a more dynamic economic environment for the remittance receiving households.

Keywords: Remittance, Agricultural Technology, Income, Employment

Introduction

Remittance is the transfer of money by an expatriate working abroad to his family living in home country. Bangladesh is the 8th largest remittance receiving country in the world (World Bank, 2016). The share of remittance in Gross National Income (GNI) is increasing day by day. In Bangladesh, most of the expatriates are from agricultural family living in the rural areas. Expatriates are working abroad and send remittance to the family. The official flow of remittances to Bangladesh has increased dramatically in the last 39 years. Most of the international remittances come to Bangladesh are from the Middle East countries. Saudi Arabia alone accounts for about 30 per cent of the official remittance inflow. Other remittance inflow countries are UAE, Kuwait accounts, Malaysia, Oman, Qatar, Bahrain, Singapore, Italy, South Korea, Australia, Canada, Germany, Hongkong, USA and UK. (BB, 2015; BMET, 2015). Remittance is an important source of liquidity for rural poor households in Bangladesh. It is used mainly for consumption,

education and health purpose in the remittance receiving household. Bangladesh uses remittance for investment on industrial development, improvement of educational facilities and health services. The money that is sent back to home country is beneficial to the families by helping in reducing poverty. World Bank (2012) said "Remittance has been a key driver of economic growth and poverty reduction in Bangladesh."

Bangladesh is a role model for the United Nations for its excellent development performance in the field of agriculture, contributing 16.77 percent to the Gross Domestic Product (GDP) (Dhar *et al.*, 2018a; BER, 2014). Bangladesh is one of the most densely populated countries of the world. It is losing 1% of its total arable land every year whereas the annual increase of population is 1.5% (BBS, 2011). To ensure adequate food is a great challenge for Bangladesh. Moreover agricultural labours have come down to 50 percent from 90 percent (BBS, 2013). Labour shortage becomes acute during sowing, planting and harvesting time. Moreover wage of agricultural labour is so high. The only way that we have to increase agricultural

production is to go for intensive agriculture which involves the introduction of improved technology into agriculture. Farmers use remittance to purchase technology and use it in farm to increase farm yield. However, farmers of Bangladesh face liquidity crisis to adopt and use agricultural technology. To reduce credit constraints, remittance can be used to purchase improved agricultural technologies (Zahonogo, 2011; Quinn, 2009). Agricultural technologies include new varieties, improved management practices, and agricultural tools and machineries that are used to support agricultural enterprise. For sustainable agricultural development, it needs financial and technical support, technology, new variety, innovate new strategy for management practices, cropping system and machinery (Dhar *et al.*, 2018b; Islam *et al.*, 2018).

Modalities of such impact have been described in a good number of literatures. A modest attempt has been made here to review the previous research studies which are: Jawaid and Raza (2014) carried out a research on International Organization for Migration (IOM) on the effect of workers' remittances and its volatility on economic growth of five South Asian countries and found a significant positive long run relationship between remittances and economic growth in India, Bangladesh, Sri Lanka and Nepal, but a significant negative relationship in Pakistan. A study was carried by Tshikala and Fonsah (2014) on the impact of migration and remittances on technology adoption in rural Senegal and revealed that internal and international migrations as well as international remittances had a positive impact on the adoption of new technologies. Choudhury, (2013) examined global financial crisis and its impact on remittance of Bangladesh and found that inflow of remittance has remained slayable in Bangladesh and if the recession continues some crisis would be discernable. Pandit *et al.* (2014) evaluated the effect of remittance on intensity of agricultural technology adoption in Nepal and specified the positive role of remittance payment on agricultural technology adoption. Paul and Das (2011) conducted a study on Bangladesh (from 1979 to 2009, a relatively liberalized regime) to examine the remittance-GDP interaction in both the long run and short run, and found a long run positive relationship between remittances and GDP. Munshi (2015) carried a research on socio-economic impact of remittance on households in Khulna, Bangladesh and found households receiving remittances spend heavily on various investment activities like land purchase, building construction and other investment activities. There was no study conducted on technology adoption through remittance in Bangladesh. In the light of this situation, this study will contribute to a better understanding of remittance

that influences the adoption of agricultural technology of remittance receiving farm household of Bangladesh. The specific objectives were:

i. To document the socioeconomic characteristics of the selected remittance receiving farm household in the study area
ii. To identify the use of remittance in the remittance receiving household
iii. To analyze the impact of remittance on income and employment generation of technology adopted and non-adopted farmers
iv. To estimate the impact of remittance on agricultural technology adoption

Materials and Methods

Keeping in view the objectives, the study was conducted in three unions under Lakshmipur district where remittance receiving farmers were available. The three unions were Hajirpara, Mandari and Dattapara upazila which were selected purposively as study areas. A total of 60 farmers was selected as sample who were having remittance from household's member and involved in farming activities. Among them 30 farmers were spending part of remittance on agricultural technology adoption and other 30 farmers were not spending part of remittance on agricultural technology adoption. Farmers were interviewed using structured questionnaire for collection of data and information. Face-to-face interview method was conducted by the researcher.

Analytical Techniques

Descriptive statistics (i.e., sum, average, percentages, ratios, etc.) were used to examine the remittance receiving household's social and economic status, use of remittance and impact of remittance on income and employment generation in the study areas.

Logit Model

In order to investigate the extent of influence of the determinants on the decision making status of adopting agricultural technology, logistic regression analysis (i.e., logit model) was used. In the present research, the following logit model was used to identify the level of influence of the factors influencing adoption of agricultural technology by the farmers:

$$Zi = \ln\left[Pi \div (1 - Pi)\right] = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 D_1 + U$$

Where:
Pi = Is the probability of adoption and non-adoption of agricultural technology
$Pi = 1$ = Indicates adoption
Pi = 0 indicates non-adoption

Dependent variable:

Zi = Probability of adoption of agricultural technology

Independent variables:

X_1 = Amount of remittance (TK.)
X_2 = Active males in the household (No.)
X_3 = Age of the household head (Years)
X_4 = Annual household revenue (TK.)
X_5 = Level of education of the expatriate (Years of schooling)
X_6 = Farm size (ha.)
D_1 = Extension contact ((Pi = 1) indicates having extension contact and (Pi = 0) indicates having no extension contact)
a = Intercept
b_1 to b_7 = Regression coefficients of the dependent variables
U = Error term

The marginal probabilities of the key determinants of adopting conservation agriculture practice by the farmers was estimated based on expressions derived from the marginal effect of the logit model was as follows:

$$dZ / dQ = \beta i \{ Pi(1 - Pi) \}$$

Where,
βi = Estimated logit regression coefficient with respect to the ith factor
Pi = Estimated probability of farmers' adoption status

Results and Discussion

Socioeconomic Characteristics of Remittance Receiving Household

The survey was conducted among the remittance receiving households of which 53% was male and 47% was female. Most of the persons were belonging to 15-55 years (58.44%). In the educational level, twelve years of schooling was highest (26.59%) among the households. The average family size of remittance receiving household was 6.016 in number. In the remittance receiving household, on an average, 20.6% was engaged in agriculture, 5.4 and 3.6% was involved in small business and labour as main occupation. Average land holding was 0.673 hectare. The average crop area was 0.42 hectare. On an average, a farmer owned 3.83 number of large animal and 24.04 number of small animal as well as 0.01 ha, 0.84 ha and 13.4 no. of fisheries, homestead and agro forestry respectively (Table 1).

From Table 2, it was found that out of 60 farm household, family member of 17 household went to Malaysia which is highest among the household following KSA (12), UAE (8) and other countries from 2014 to 2016. It was also found that highest average annual remittance received came from KSA and lowest average annual remittance received came from Japan in the household at the same time (Table 2).

Use of Remittance in the Remittance Receiving Household

Table 3 explains the average expenditure from remittance by different categories. Average household expenditure from remittance was accounted Tk. 178922 of which Tk. 51973 was spent for food, Tk. 49474 for non-food and Tk. 77475 for durable and others (savings and investment). The largest share of non-food spending was used to repay the loan taken to finance the related expenses of migration. About 59% of the total share of spending on durable items was used to purchase land. They kept their savings in banks in different forms such as savings account and permanent deposit. Besides they provided money to friends and others who repaid them on later and they also saved at home. Apart of remittances was invested in own business of households. These households resided with a well decorated house (Table 3).

Table 1: Sex, age, education level, family size, occupational status, land holding and area of agricultural enterprisesof the remittance receiving household

Particulars			Remittance receiving household
Sex (%)	Male		53.000
	Female		47.000
Age (15-55 years) (%)			58.440
Educational level (Twelve years of schooling)			26.590
Family size (no.)			6.016
Occupational status(%)	Agriculture		20.600
	Small business		5.400
	Wage labour		3.600
Land holding (ha)	Average		0.673
Agricultural enterprises	Crop area (ha)		0.420
	Livestock (no.)	Large animal	3.830
		Small animal	24.050
	Fisheries (ha)		0.010
	Homestead (ha)		0.840
	Agroforestry (no.)		13.400

Source: Field survey, 2016

Table 2: Number of household and average annual remittance received by the farm household from different countries from 2014 to 2016

Country	No. of household	Average annual remittance received (Tk.)
KSA (Kingdom of Saudi Arabia)	12	336000
UAE (United Arab Emirates)	8	276000
Kuwait	5	288000
Oman	2	252000
Qatar	3	264000
Bahrain	4	300000
Malaysia	17	288000
Singapore	3	276000
S. Korea	3	240000
UK	1	216000
Italy	1	228000
Japan	1	180000
Total	60	3144000

Source: Field survey, 2016

Table 3: Distribution of average expenditure of remittance receiving household from remittance

Category of Expenditure	Amount of remittance (Tk.)	Percentage (%)
Food	51973	12.3898341
Non-food	49474	11.7940979
Durable	77475	18.4692513
Savings	155503	37.0703320
Investment	85056	20.2764850

Source: Field survey, 2016

Impact of Remittance on Income and Employment Generation

Out of 60 remittance receiving farmers 30 farmers adopted agricultural technology. The technology used by those farmers was hybrid seed (90%), new variety (83.33%), tractor (93.33%), water pump (73.33%) and chemical spray (60%) which were purchased by the remittance to increase production of agriculture and income of the farm (Table 4).

Impact on Income Generation

The income from crop cultivation was higher than other income sources for both technology adopted (9463.9 Tk.) and technology non-adopted farmers (5854.8 tk).The mean difference of income from crop cultivation between technology adopted and technology non-adopted farmers was 3609.1 tk. which was significant at 5 percent level. The income from other sources which was vegetable production, fruits, livestock, fish farming and bamboo selling was higher for technology adopted farmers compared to the income from the same sources for technology non-adopted farmers. The mean difference of income from livestock was 339.5 tk. which was significant at 10 percent level and the mean difference of total farm income was 12854.7 tk. which was significant at 1 percent level (Table 5).

Employment Pattern on Yearly Basis for Remittance Receiving Households

For the technology adopted farmer the average labour hour spent by men, women, children and hired labour in crop, livestock, fish and homestead farming was 1.53, 1.25, 0.85 and 0.26 h/day respectively (Table 6 and 7); and 2.24, 1.82, 1.25 and 0.98 hours/day respectively for technology non-adopted farmer(Table 6 and 7). The average labour hour spent by technology adopted farmer was lower for adoption of technology than the average labour hour spent by technology non-adopted farmer.

The highest average employment duration for male was 97.43 man-days/year for the technology adopted farmer and for technology non-adopted farmer, it was 113.25 man-days/year. Female spent average duration was 55.6man-days/year for technology adopted farmer and 65.69 man-days/year for the technology non-adopted farmer. The children spent average duration was 43.1 man-days/year and 51.22 man-days/year for technology adopted farmer and technology non-adopted farmer respectively. The hired labour spent average duration was 11.42 man-days/year and 23.62 man-days/year for technology adopted farmer and non-adopted farmer respectively. The average employment duration for male, female, children and hired labourfor technology adopted farmerwas lower than the non-adopted farmer because use of technology in farm reduces the labour hour for technology adopted farmers (Table 6 and 7).

Table 4: Agricultural technology used by farmers in the study areas

	Technology adopted farmers		
Agricultural technology	No. of adopters	Total sample	Percentage of total sample (%)
Hybrid seed	27	30	90.00
New variety	25		83.33
Tractor	28		93.33
Water pump	22		73.33
Chemical spray	18		60.00

Source: Field survey, 2016

Table 5: Annual average farm income of technology adopted and non-adopted farmers

	Technology adopted farmers		Technology non-adopted farmers		Mean difference (Tk.)	Standard error	t-value
Income source	Amount (Tk.)	Percentage (%)	Amount (Tk.)	Percentage (%)			
Crop cultivation	9463.9	29.21	5854.80	29.96	3609.1**	1209.00	2.340
Vegetables production	8721.2	26.92	3893.40	19.92	4827.8	924.00	0.760
Fruits	5344.7	16.49	2573.20	13.17	2771.5	493.00	0.039
Livestock (cattle, goat, etc.)	2792.3	8.62	2452.80	12.55	339.5*	382.00	1.870
Fish farming	2346.4	7.24	2341.20	11.98	5.2	265.00	0.940
Bamboo selling	3723.7	11.49	2421.40	12.39	1302.3	321.00	0.059
Total farm income	32389.2	100.00	19534.50	100.00	12854.7***	1296.85	5.750
Remittance	117000.5	-	68000.04	-	49000.46	13831.64	7.350
Total family income	149389.7	-	87534.54	-			

Source: Author's estimation based on field survey, 2016
Note: ***significant at 1% level, **significant at 5% level and *significant at 10% level

Table 6: Employment pattern on yearly basis for technology adopted farmer

	Working hours/day				Duration (man-days/year)				Wage/day			
Farming systems	Male	Female	Children	Hired labour	Male	Female	Children	Hired labour	Male	Female	Children	Hired labour
Technology adopter												
Crop farming	3.23	0.80	2.10	1.07	147.3000	32.6	59.5	45.700	270	200.0	200.0	300
Livestock rearing	1.50	2.10	0.80	0.00	125.9000	57.9	47.3	0.000	230	150.0	190.0	0
Fish farming	0.50	0.20	0.01	0.00	70.6000	12.6	19.8	0.000	220	150.0	150.0	0
Homestead farming	0.90	1.90	0.50	0.00	45.9500	119.3	45.8	0.000	180	150.0	150.0	0
Total	6.13	5.00	3.41	1.07	389.7500	222.4	172.4	45.700	900	650.0	690.0	300
Average	1.53	1.25	0.85	0.26	97.4375	55.6	43.1	11.425	225	162.5	172.5	75

Source: Field survey, 2016

Table 7: Employment pattern on yearly basis for technology non- adopted farmer

	Working hours/ day				Duration (man-days/year)				Wage/day			
Farming systems	Male	Female	Children	Hired labour	Male	Female	Children	Hired labour	Male	Female	Children	Hired labour
Technology non adopter												
Crop farming	5.560	1.900	3.50	2.56	178.50	53.8000	71.600	94.500	270	200.0	200.0	300
Livestock rearing	2.400	2.800	0.90	0.89	133.80	69.4000	56.800	0.000	230	150.0	190.0	0
Fish farming	0.000	0.000	0.00	0.00	82.90	14.7000	23.600	0.000	220	150.0	150.0	0
Homestead farming	1.020	2.600	0.60	0.50	57.80	124.8700	52.900	0.000	180	150.0	150.0	0
Total	8.980	7.300	5.00	3.95	453.00	262.7700	204.900	94.500	900	650.0	690.0	300
Average	2.245	1.825	1.25	0.98	113.25	65.6925	51.225	23.625	225	162.5	172.5	75

Source: Field survey, 2016

It can be said that remittance receiving household who are adopting agricultural technology got more time to spend in non-farm activities like wage labour, teaching, service, shopkeeping, worker, small business, garments and rickshaw/van pulling compared to remittance receiving household who are not adopting agricultural technology. Thus, remittance creates employment opportunity in the study areas and also increases the farm income.

Impact of Remittance on Agricultural Technology Adoption

The estimates of the logit model show that amount of remittance, active males in the household, level of education of the expatriate, farm size and extension contact have positive impact; and age of the household head and annual household revenue have negative impact on adoption of agricultural technology.

Table 8: Estimates of logistic regression and marginal effect of determinants adopting agricultural technology

Variables	Estimates of coefficient			Estimates of marginal effects	
	Coefficients	Standard error	P>|z|	dZ/dQ	Q
Constant	-2.399	3.315	0.469	-	-
Amount of remittance (X_1)	0.001**	0.001	0.046	0.001	8766.670
Active males in the household (X_2)	1.011*	0.569	0.075	0.253	1.650
Age of the household head (X_3)	-0.145***	0.047	0.002	-0.036	47.633
Annual household revenue (X_4)	-0.001	0.001	0.704	-0.001	88366.700
Level of education of the expatriate (X_5)	0.083	0.122	0.494	0.021	3.983
Farm size (X_6)	0.142	0.144	0.323	0.036	9.533
Extension contact (D_1)	1.668**	0.742	0.025	0.394	0.500

Source: Author's estimation based on field survey, 2016
Note: ***significant at 1% level, **significant at 5% level and *significant at 10% level

The significant variables found in this case were amount of remittance, active males in the household, age of the household head, extension contact (significant at 5, 1, 10 and 5% probability level, respectively). The significant results indicate that farmers having higher amount of remittance, active males in the household, extension contact have higher probability of adopting agricultural technology than other; higher age of the household head has lower probability of adopting agricultural technology than other (Table 8).

Amount of remittance, active males in the household, level of education of the expatriate, farm size and extension contact had positive value of dZ/dQ which were 0.001, 0.253, 0.021, 0.036, 0.394; and age of the household head and annual household revenue had negative value which were 0.036 and 0.001. It meant that if any of the explanatory variable i.e., amount of remittance, active males in the household, level of education of the expatriate, farm size and extension contact is increased by 1 unit, the probability of adopting agricultural technology will be increased by 0.001, 0.253, 0.021, 0.036 and 0.394 times respectively; and age of the household head and annual household revenue is increased by 1 unit, the probability of adopting agricultural technology will be decreased by 0.036 and 0.001times respectively(Table 8).

The result of Pandit *et al.* (2014) is that landholding size and number of animals have a positive impact on technology adoption. The study also found an increase in the household's income from remittances increased the number of agricultural technologies adopted. Tshikala and Fonsah (2014) found that international remittances have a positive impact on the adoption of new technologies.

Conclusion

The study concludes that remittance played a great role to adopt and use agricultural technology in the farm household. The result of logit model showed that there was scope for increasing adoption of agricultural technology by increasing remittance, active male in the household and extension contact; and reducing the age of the household head since the coefficients of these parameters were significant. Farmers used different agricultural technology i.e.hybrid seed, new variety, tractor, water pump, chemical spray to increase production of agriculture in the study areas. A large portion of remittance goes to investment on business and purchase of land and agricultural machineries. The intervention of remittance on agriculture has positive and significant impact on farmers' employment creation and income generation by increasing farm income and reducing labour hour in farming for adopting agricultural technology purchased by remittance helped to invest more time on other non-farm activities. As remittance has contributed great to the agriculture, government should increase the number of expatriate working abroad to increase amount of remittance. Reduction of high cost of going abroad, access to education and training of the expatriate, providing high wage, removing exploitation by the middleman and longer duration of job can be very effective measurement to smooth the process of going abroad which ultimately will increase flow of remittance to the farm households.

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Author's Contributions

Fardous Ara Happy: Designed, collected and checked the analyzed data; prepared the draft manuscript and approved the final manuscript.

Ismat Ara Begum: Coordinated the study, analyzed the data and supervised the draft manuscript.

Aurup Ratan Dhar: Contributed in model specification and data interpretation, and reviewed the draft manuscript.

Ethics

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues involved.

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