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Employment Patterns and Income Generation of Farm Households in Integrated Farming of Bangladesh

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Abstract: This study focused on the patterns of farm and off-farm employment considering gender structure and the incomes earned from different sources. However, conventional farming has not been able to generate the needed employment opportunities. Therefore, it is crucial to continue absorbing the ever-growing labor force through integrated farming which is considered a good source of increased income. The study revealed that unemployment decreased with the increases in farm size and farmers practicing integrated farming had few family labors surplus compared to the conventional farmers. Primary data collected from personal interviews with farmers was used. It is found from the analysis that the number of enterprises was the most significant factor in integrated farming, whereas working hours per week on off-farm activities by males had significant effect in conventional farming. It also implies that integrated farming is important not only for employment creation, but also for promoting the overall economic condition.

Key words: Employment, income, farm households, integrated farming, Bangladesh

Introduction

A major portion of Bangladesh's population is based on rural areas and the labor force grows faster than the population. Although agriculture has been observed from the occupational distribution of employment as the primary occupation (62.8%), it alone cannot provide for household requirements. Consequently, most farm families try to derive their living from a wide range of both on-farm and off-farm activities. Rural women are also more or less directly involved in different farm and off-farm activities in addition to household work. Even though women constitute 47% of the total population, only 18% are economically involved in the total labor force.

A typical farmer in Bangladesh produces neither specialized crops nor rice crops, but combines other enterprises such as cattle, poultry and fish along with non-agricultural enterprises. These enterprises are interlinked and together constitute integrated farming. Integrated farming is a way to supply necessary commodities to households and to maximize farm income with the integration of crop and non-crop agricultural enterprises. By pursuing integrated farming, farmers use their family labor and recycle the resources among different agricultural enterprises to produce the necessities within the farm unit and thereby improve as well as stabilize their economic conditions.

To date, little research has been performed on the employment patterns and income generation of farm households. Juvancic and Erjavec (2005) provided an empirical insight into the determinants of employment choice behavior of farm holders and identified that low labor mobility reduces the efficiency of labor allocation on agricultural holdings in Slovenia. Rebecca (2002) concluded that social and cultural constraints to women's employment in Jordan persist despite increasing female labor force

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participation rates. Graziano da and Del Grossi (2001) suggested promotion of a real urbanization of the rural world to create better living and employment conditions in rural areas. Estudillo and Otsuka (1999) found that there has been a structural shift of household income away from land toward labor through the adoption of modern rice varieties. Simmons and Salinder (1997) argued that off-farm employment offers a considerable scope for both family and wage employment. However, no researcher has measured the employment patterns and income generation of farm households in integrated farming on the basis of farm size (i.e., landless, marginal, small, medium and large). Considering the above facts, this study is conducted with the following objectives: a) to analyze the employment patterns of farm households on the basis of gender structure, i.e., the male-female composition and b) to explore the determinants of income of farm households.

Materials and Methods

This study covered 18 villages in three districts (i.e., Mymensingh, Kishoregonj and Netrokona) in Bangladesh. The study areas were chosen on the basis of the availability of different categories of farmers and other characteristics including favorable climate and land topography suitable for production of crop and non-crop enterprises, better marketing facilities and communication for augmenting income from different types of farm and off-farm activities. A stratified random sampling was employed for this study. In total, 110 farmers were selected, of which 30 were landless (below 0.20 ha), 30 were marginal (0.21 to 0.60 ha), 20 were small (0.61 to 1.0 ha), 20 were medium (1.1 to 3.0 ha) and 10 were large (more than 3.0 ha). The study covered one year of employment and income from April 2002 to March 2003; however, this research was conducted in 2005 at Nagoya University. Data and other necessary information were collected through direct interviews. All the data collected from the field survey were grouped, summarized and presented in tabular forms. An attempt was made to explore the determinants of annual income of the farm households using a multiple regression model as follows:

$$\ln AHI = \ln a + b_1 \ln FS + b_2 \ln NL + b_3 \ln NE + b_4 \ln SY + b_5 \ln AM + b_6 \ln WFM$$
$$+ b_7 \ln WOFM + b_8 \ln WFF + b_9 \ln WOFF + b_{10} D + U_i$$

Where,

$\ln$ = Natural logarithm

AHI = Annual farm household income;

a = Constant or intercept of the function;

FS = Farm size (including pond and homestead areas);

NL = Number of family laborers (members aged 10 years and above);

NE = Number of enterprises;

SY = Schooling year;

AM = Age of adult members;

WFM = Working hours per week on farm activities by males;

$WOFM$ = Working hours per week on off-farm activities by males;

WFF = Working hours per week on farm activities by females;

$WOFF$ = Working hours per week on off-farm activities by females;

D = Dummy for farming type effect (1 for integrated farming, 0 otherwise)

$b_1, \ldots\ldots\ldots\ldots b_{10}$ = Coefficients of respective variables; and

U_i = Error terms.

The authors used relevant variables to determine the households' annual income. It was tested so that no multi-colinearity occurred among different independent variables. The above model was used separately for overall, integrated[1] and conventional farming[2].

Results

Family Size and Dependency Ratio

The average family size was found to be the biggest for marginal farmers, followed by landless, small, medium and large farmers (Table 1). The average size of selected farm families was bigger than the national average of 5.0. The dependency ratio expresses how many members of a family were dependent on a single, economically working/earning person. It was observed that the dependency ratio of landless farmers was higher than that of medium, small, marginal and large farmers. It is found from the equation[3] that the number of working persons had a more important effect on the dependency ratio.

Patterns of Farm Households' Employment

Employment patterns indicate the involvement of rural farm households from farm to non-farm avenues depending on physical strength, skill and the time effectively devoted. Rural households used to work on their farms and on the same day engaged in some off-farm activities such as petty trading, tailoring, carpentry, handicrafts, rickshaw pulling, etc., or migrate to other places during agricultural off-seasons. To identify the patterns of employment on farm and off-farm activities, the members of the sample farm households were classified on the basis of: (a) types of main occupations, (b) age, © education and (d) farm size.

Farm households were those in which all employed members were engaged in farm activities as their principal occupation (Table 2). In the contrary case, the family was considered a non-farm household. The incidence of off-farm time spent was lower among farm households than non-farm households. However, it can be pointed out that both types of households were dependent on farm and off-farm activities, implying that farm households not so far attained full specialization of one profession in respect to gender.

Most family members were primarily employed in the agricultural sector and also spent a good part of their productive time on non-agricultural activities (Table 3). It is evident that males and females aged 15-54 years spent about two-fifths and four-fifths of their working time, respectively, on farm activities. Some factors including higher income and potentially lower risk attract male members to non-farm employment. As many non-farm activities are tough jobs physically, female members' participation is low. Teenaged males worked more than 55-year olds because of their good physique, innovativeness, enthusiastic nature and social traditions. Older men and most women spent a higher proportion of their time on farm activities.

Regarding employment patterns on the basis of education, it is found that the participation of earning members in off-farm jobs was positively correlated with education levels (Table 4). Of note, weekly time spent on off-farm activities was roughly double for the male population that had primary and secondary education and three times higher for graduate members in comparison to illiterate males.

Table 5 shows that landless and marginal farm households spent about three-fifths of their working time on farm activities. In contrast, small and medium farmers used more than 60% of their time on farm activities, whereas large farmers allocated only 9% of their working time for farm activities. For males, the proportionate amount of time spent on off-farm activities by large farmers

Table 1: Family structure of farm households

Farm category	Family members (No.)			Working/Earning persons (No.)			Dependency ratio
	Male	Female	Total 1	Male	Female	Total 2	3 = 1÷2
Landless	3.1	3.7	6.8	1.8	0.6	2.4	2.8
Marginal	3.8	3.2	7	1.9	0.9	2.8	2.5
Small	3.7	2.7	6.4	2	0.5	2.5	2.6
Medium	3.1	2.8	5.9	1.6	0.6	2.2	2.7
Large	3	2.8	5.8	1.8	0.9	2.7	2.1

Source: Field survey, 2003

Table 2: Employment patterns by type of main occupation (hour basis by week)

Items	Male		Female	
	Farm households	Non-farm households	Farm households	Non-farm households
Farm activities	53.7	34.6	55.6	22.8
Off-farm activities	46.3	65.4	44.4	77.2
Total	100.0	100.0	100.0	100.0

Source: Field survey, 2003

Table 3: Weekly time spent by age (hour basis)

Items	Male			Female		
	10-14 years	15-54 years	Above 55 years	10-14 years	15-54 years	Above 55 years
Farm	11.8	28.5	5.7	2.8	12.3	4.7
Activities	(72.8)	(41.9)	(68.7)	(70.0)	(82.6)	(65.3)
Off-farm	4.4	39.6	2.6	1.2	2.6	2.5
Activities	(27.2)	(58.1)	(31.3)	(30.0)	(17.4)	(34.7)
Total	16.2	68.1	8.3	4.0	14.9	7.2
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

Source: Field survey, 2003; Note: Figures in parentheses indicate percentages

Table 4: Employment patterns by length of education (hour basis by week)

Items	Male				Female			
	Illiterate	Primary	Secondary	Graduation and above	Illiterate	Primary	Secondary	Graduation and above
Farm activities	35.1	23.0	20.7	8.0	13.1	9.2	2.5	0.4
	(73.0)	(54.0)	(45.0)	(16.7)	(86.2)	(78.0)	(30.9)	(6.6)
Off-farm activities	13.0	19.6	25.3	40.0	2.1	2.6	5.6	5.7
	(27.0)	(46.0)	(55.0)	(83.3)	(13.8)	(22.0)	(69.1)	(93.4)
Total	48.1	42.6	46.0	48.0	15.2	11.8	8.1	6.1
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

Source: Field survey, 2003; Note: Figures in parentheses indicate percentages

Table 5: Employment patterns by farm size (hour basis by week)

Items	Male					Female				
	Land less	Mar ginal	Small	Medium	Large	Land less	Mar ginal	Small	Medium	Large
Farm activities	26.1	27.8	31.5	20.8	4.1	8.3	7.9	14.2	4.5	0.8
	(50.3)	(55.7)	(58.7)	(45.1)	(9.2)	(70.9)	(51.3)	(74.7)	(76.3)	(7.9)
Off-farm activities	25.8	22.1	22.2	25.3	40.3	3.4	7.5	4.8	1.4	9.3
	(49.7)	(44.3)	(41.3)	(54.9)	(90.8)	(29.1)	(48.7)	(25.3)	(23.7)	(92.1)
Total	51.9	49.9	53.7	46.1	44.4	11.7	15.4	19.0	5.9	10.1
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

Source: Field survey, 2003; Note: Figures in parentheses indicate percentages

Table 6: Family labor supply and utilization (man-days/year)

Farmers' category	Labor supply 1	Farm activities 2	Off-farm activities 3	Disguised unemployment 4	Total labor utilization 5 = 2+3	Level of unemployment 6 = 1-5
Integrated farm family						
Landless	771	382 (49.5)	266 (34.5)	104 (13.5)	648 (84.0)	123 (16.0)
Marginal	761	426 (56.0)	233 (30.6)	95 (12.5)	659 (86.6)	102 (13.4)
Small	670	442 (66.0)	158 (23.6)	58 (8.7)	600 (89.6)	70 (10.4)
Medium	653	331 (50.7)	285 (43.6)	37 (5.7)	616 (94.3)	37 (5.7)
Large	660	188 (28.5)	448 (67.9)	9 (1.4)	636 (96.4)	24 (3.6)
Conventional farm family						
Landless	790	160 (20.3)	470 (59.5)	130 (16.5)	630 (79.7)	160 (20.3)
Marginal	753	212 (28.2)	415 (55.1)	108 (14.3)	627 (83.3)	126 (16.7)
Small	637	183 (28.7)	364 (57.1)	71 (11.2)	547 (85.9)	90 (14.1)
Medium	628	97 (15.4)	446 (71.0)	48 (7.6)	543 (86.5)	85 (13.5)
Large	604	66 (10.9)	480 (79.5)	30 (4.9)	546 (90.4)	58 (9.6)

Source: Field Survey, 2003; Note: Figures in parentheses indicate percentages

Table 7: Family labor usage by agricultural enterprise (man-days/year)

Gender	Farmers' category	Rice crops	Vegetables	Other crops	Homestead	Cattle	Poultry	Fish	Total on farm employment	Total enterprises (No.)
Male	Integrated farming									
	Landless	101	44	17	16	106	13	9	306	8
	Marginal	114	57	34	23	95	12	5	340	11
	Small	159	61	58	27	58	7	10	380	12
	Medium	121	73	12	19	29	13	13	280	10
	Large	30	41	20	14	15	35	35	170	8
	Conventional farming									
	Landless	83	0	0	24	0	0	0	107	4
	Marginal	139	0	0	25	0	0	0	164	3
	Small	127	0	0	20	0	0	0	147	4
	Medium	61	0	0	15	0	0	0	76	3
	Large	42	0	0	12	0	0	0	54	3
Female	Integrated farming									
	Landless	15	10	12	11	24	3	1	76	4
	Marginal	22	11	6	27	12	6	2	86	5
	Small	14	2	5	11	13	16	1	62	5
	Medium	5	12	2	8	14	10	0	51	2
	Large	0	0	0	12	0	6	0	18	2
	Conventional farming									
	Landless	39	0	0	14	0	0	0	53	2
	Marginal	32	0	0	16	0	0	0	48	2
	Small	24	0	0	12	0	0	0	36	1
	Medium	3	0	0	18	0	0	0	21	1
	Large	0	0	0	12	0	0	0	12	1

Source: Field Survey, 2003

was double than the time spent by landless, marginal and small farmers. Likewise, female members of landless, small and medium farmers spent less time on off-farm activities, whereas those of large farmers devoted maximum time to it.

Table 8: Annual income (Taka) and agricultural labor productivity (Taka/day)

Sources	Landless farmers		Marginal farmers		Small farmers		Medium farmers		Large farmers	
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
Integrated farming										
Farm activities	20810	57.8	38709	70.6	55023	79.7	118681	88.2	182846	91.1
Off-farm activities	15203	42.2	16151	29.4	14013	20.3	15929	11.8	17767	8.9
Total income	36013	100.0	54860	100.0	69036	100.0	134610	100.0	200613	100.0
Labor productivity	41		73		107		202		168	
Conventional farming										
Farm activities	16567	52.0	21983	53.3	35765	68.3	74770	58.2	109708	57.9
Off-farm activities	15319	48.0	19278	46.7	16605	31.7	53783	41.8	79752	42.1
Total income	31886	100.0	41261	100.0	52370	100.0	128553	100.0	189460	100.0
Labor productivity	32		65		101		191		132	
Total income differences										
Integrated over		4127***		13599***		16666***		6057*		11153*
conventional farming		(3.85)		(13.35)		(17.73)		(2.91)		(2.16)

Source: Calculated by the authors, 2003; Note: Figures in parentheses indicate t-values; *** Significant at 1 % level
* Significant at 10 % level

Supply and Utilization of Family Labor

Table 6 depicts that, with the exception of landless farmers, other categories of integrated farm families possessed more family labor than conventional farm families. Landless, marginal and small farmers utilized more amount of family labor for farm activities compared to medium and large farmers and unemployment (total labor supply minus total labor utilization) decreased with the increases in farm size in both integrated and conventional farm families. On the other hand, disguised unemployment[4] estimated on the basis of farmers' calculations was higher in conventional farming than integrated farming. In conclusion, farmers practicing integrated farming had less family labor surplus compared to farmers practicing conventional farming.

Family Labor Usage by Agricultural Enterprises

Labor usage largely depends on the number of enterprises produced (Table 7). In comparison to labor requirements for conventional farming, the total labor used for integrated farming was higher, which implies that conventional farming underutilized the existing labor supply from families. It can be deduced that integrated farming led not only to a use of underutilized family labor, but also to providing job opportunities for others during peak seasons. Apparently, the participation of females in both types of farming was lower compared to males because women were primarily involved in domestic household activities.

The present findings suggest that integrated farming makes a positive contribution to the overall levels of employment for all categories of farmers. This evens out employment patterns of farm family labor across peak and through seasons throughout the year. An overwhelming majority of all farmers reported that employment opportunities in integrated farming increased over the past years due to the adoption of labor-intensive enterprises.

Annual Income and Labor Productivity

Annual income was derived by the total earnings of family members from both farm and off-farm activities during a year. Table 8 indicates that income from integrated farming was higher for all categories of farmers compared to conventional farming. Labor productivity[5], a major determinant of farm income, was higher in integrated farming compared to conventional farming. The differences in

total income earned between integrated farming and conventional farming were statistically significant. The share of non-agricultural enterprises to total household income markedly decreased with the increase in farm size in integrated farming, whereas it differed for medium and large farmers in conventional farming. The income rise seems to be quite encouraging for landless, marginal and small farmers in integrated farming.

Significance of Integrated Farming

Estimated values of the coefficients and related statistics of the multiple regression model of farm households for different types of farming are presented as follows:

For overall farming:
$$\ln AHI = 2.33 + 0.34 \ln FS^* + 0.08 \ln NL + 0.17 \ln NE^{***} + 0.16 \ln SY^{**} - 0.14 \ln AM + 0.17 \ln WFM^*$$
$$(1.07) \quad (0.03) \quad\quad (0.08) \quad\quad (0.05) \quad\quad\quad (0.06) \quad\quad\quad (0.08) \quad\quad\quad (0.08)$$
$$+ 0.58 \ln WOFM^{***} + 0.01 \ln WFF + 0.20 \ln WOFF^{***} + 0.71 D^{***}$$
$$(0.20) \quad\quad\quad (0.06) \quad\quad (0.08) \quad\quad\quad (0.11)$$
$$R^2 = 0.95,\ F\text{-value} = 109.70^{***}$$

For integrated farming:
$$\ln AHI = 2.40 + 0.39 \ln FS^* + 0.04 \ln NL^* + 0.42 \ln NE^{***} + 0.18 \ln SY^{**} - 0.02 \ln AM$$
$$(1.02)\ (0.03) \quad\quad (0.06) \quad\quad\quad (0.20) \quad\quad\quad (0.05) \quad\quad\quad (0.09)$$
$$+ 0.08 \ln WFM^* + 0.35 \ln WOFM^* + 0.01 \ln WFF^* + 0.09 \ln WOFF$$
$$(0.03) \quad\quad\quad (0.05) \quad\quad\quad (0.07) \quad\quad\quad (0.06)$$
$$R^2 = 0.93,\ F\text{-value} = 101.76^{***}$$

For conventional farming:
$$\ln AHI = 1.96 + 0.32 \ln FS^* + 0.02 \ln NL + 0.11 \ln NE^* + 0.25 \ln SY^{**} - 0.53 \ln AM$$
$$(2.20)\ (0.09) \quad\quad (0.19) \quad\quad (0.01) \quad\quad (0.12) \quad\quad\quad (0.18)$$
$$+ 0.06 \ln WFM^* + 0.91 \ln WOFM^{***} + 0.09 \ln WFF + 0.21 \ln WOFF^{**}$$
$$(0.05) \quad\quad\quad (0.43) \quad\quad\quad\quad (0.09) \quad\quad\quad (0.10)$$
$$R^2 = 0.95,\ F\text{-value} = 42.87^{***}$$

Standard errors are in parentheses
***, ** and * indicate level of significance at 1, 5 and 10%, respectively.

The results revealed that the coefficient of the dummy was positive and statistically significant at the one percent level, implying that the change in farming type towards integrated farming will contribute positively to annual household income in overall farming. The number of enterprises was found to be the most significant factor in integrated farming, which meant that an increase in the one percent of the number of enterprises, keeping other factors constant, would lead to an increase in annual household income by 0.42%. On the other hand, working hours per week on off-farm activities by males had a significant effect at the one percent level in conventional farming. These results were reasonably influential for farm households' income generations, which suggest that the change in farming type towards integrated farming through the increase in the number of enterprises and working hours per week on off-farm activities by males, are the potential of integrated and conventional farming, respectively, as a possible pathway to remove the poverty in rural Bangladesh.

Discussion and Implications of the Results

This study looked at the employment behavior not only for operators and spouses as mentioned in the earlier studies, but also for all working-age household members that added some new ingredients.

It was observed that the incidence of off-farm time spent was lower among farm households than non-farm households. It was evident that males and females aged 15-54 years spent about two-fifths and four-fifths of their working time on farm activities, respectively. It was found that the participation of earning members in off-farm jobs was positively correlated with education levels which supports the findings of Appleton *et al.* (2002). It revealed that landless and marginal farm households spent about three-fifths of their working time on farm activities. It also identified the level of overt and disguised unemployment in farm families.

Farmers in integrated farming clearly earned more income compared to farmers in conventional farming. Integrated farming enhanced labor demand throughout the year. Farmers practicing this type of farming had a reduced amount of excess labor compared to conventional farming, which is different from the study of Varma and Kumar (1996). They noticed that rural non-farm has been contributing a rising share of employment. Janvry de and Sadoulet (2001) found that education plays a major role in accessing better-remunerated nonagricultural employment, but our study revealed that the key determinant of success in integrated farming is the number of enterprises, whereas it is the working hours per week on off-farm activities by males in conventional farming.

The farm families in integrated farming had the possibility for gainful employment throughout the year and thereby ensured good income and better standards of living. The implication of integrated farming revolved around better utilization of time, resources and family laborers in farm households. Therefore, it can be generalized that even farmers without land or capital can be involved in integrated farming with homestead, cattle, poultry and other non-farm enterprises if government or non-government organizations offer logistic support, such as credit amenities on easy terms and condition. Suitable agricultural technologies are, therefore, required to be developed for landless, marginal and small farmers for which integrated farming is proved better than conventional or specialized farming.

Policy intervention to generalize integrated farming is justified on a number of grounds. First, expansion of integrated farming promotes more equitable growth in income by providing employment to unskilled workers and other vulnerable groups. Second, by enhancing job opportunities in rural areas, integrated farming will stop the large scale migration from rural areas to cities in some extent. Third and the most important argument, integrated farming disproportionately benefit the rural women. This type of study that looks into the patterns of employment and income generation basing on farm size, farming type and gender structure has not been performed in the previously.

Conclusions

This study pointed up that farmers in integrated farming increase their income by practicing multiple agricultural enterprises compared to farmers in conventional farming. Less external input-based enterprises should be developed and incorporated into integrated farming, which enhance farm households' income and increase labor demands throughout the year. On the other hand, non-farm avenues should be increased to solve the problems of overt and disguised unemployment of conventional farm families. Therefore, policies should be directed towards providing incentives to households for participating in integrated farming, as well as increasing their capacity to take advantage of such opportunities. However, this would have to be verified by further empirical study.

Obviously, such an employment opportunity through integrated farming helps to improve the economic conditions of rural people, especially for the landless, marginal and small farmers, who are around 80% of the total farm households in Bangladesh. Even though spreading labor, re-utilizing resources and the possibility of minimizing both economic and biological risks are the advantageous points of integrated farming, it enforces farmers' attention to disperse to many enterprises which are

often obstructed due to the lack of farmers' skills and management. Considering the above facts, not all farmers follow exactly the same methods, as they differ in their modes, habits, preferences and production practices.

Notes

1). Sixty-five percent of the sampled farmers practiced integrated farming, i.e., multiple crops, cattle, poultry and fish, along with off-farm activities, where the interdependence of resources among different enterprises was existed.
2). Thirty-five percent of the sampled farmers practiced conventional farming, i.e., only rice monocropping and a small extent of homestead vegetables along with off-farm activities, where no resource interdependence was existed. Off-farm activities covered trading, service/remittances, rickshaw pulling, handicrafts and wage earning.
3). The regression equation of dependency ratio is DR= 3.81 + 0.43 FM*** - 2.45 WP***, where FM and WP stand for family members and number of working persons, respectively. R^2= 0.93, *** indicates the level of significance at one percent.
4). Disguised unemployment means that even with unchanged techniques of agriculture, a large part of the engaged population could be removed without reducing output.
5). Labor productivity was derived dividing the total income by the total number of labor days (family and hired).

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