Causes of transformation of agriculture from rice cultivation to mango farming and its impact on farming community in the northwestern Bangladesh

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Abstract: Transformation of agriculture in the northwestern Bangladesh, especially from rice cultivation to mango farming, has been going on for more than a decade. This change is influencing the very basic characteristics of socioeconomic as well as livelihood system of the farming community. Ganguria union of Porsha *upazila* under Naogaon district was selected purposively for the study. Information on land ownership pattern, irrigation coverage, and transformation of paddy field into mango farming were collected from the relevant offices under the *upazila*. Focus group discussions were also conducted to understand the impact of the transformation, and to cross-check the data. A total of 27 group interviews were conducted in 27 *mouzas* of the union. The respondents were farmers (large, medium, small), landless and agricultural laborers including union *parishad* chairman and members, and local elites. Findings show that about 58% of total arable land has already been transformed into mango orchards in the Gaguria union, and the rate of transformation is too high to reach 80% within a next five years. The transformation of paddy field into mango orchards has been taken a rapid form in almost all the villages of the union especially after the year 2000. Most of the large landholders are absentees in the study area. Only a small number of large landowners (who are locally called *Sahoo*) occupy majority of the total arable land of the union. The factors influencing such a rapid transformation are mixed, complex and interconnect. For instances, Baharul is a village where *Sahoo*s own more than ninety % of arable land. The area is basically single cropped and has limited irrigation facility. It has the highest transformation rate (nearly 90%) of paddy land to mango farming. In contrast and most interestingly, the *Sahoo*s own no land in Michira village, and this is the only village of the union where the *Sahoo* have no power exercise also. Despite the area has very limited irrigation coverage, the %age of transformation is low (40%) in comparison to that of other areas. On the other hand, in the Dahuki village, about 50% of the arable land is owned by the local people and has about 33% of total arable land under irrigation coverage. Mango farming covers almost 21% of the total arable land which is much lower than the other parts. In contrast Paschim Daulia has maximum irrigation facility (about 47%) but the rate of mango farming is very high (60%). The majority of the land of this village is owned by *Sahoo*s, and most of the people living here have no homestead land. Therefore, the study reveals that the causes of transformation are not uniformed, rather have different dimensions. The findings from the field study shows that the monetary return from mango farming is one of the most important factors influencing the rapid transformation. Landowner can get more than double profit than that of rice cultivation. If we consider single cultivation of rice per year then the return is almost 6.25 times in case of own mango farming and the age of orchard is in between 3 to 5 years. The profit rises with the rise of the age of the orchards. All villages, with a few exceptions, having less access to irrigation coverage are highly prone to transfer their paddy land to mango farming. Villages having less than 30% of irrigation coverage already have experienced 60 to 80% of transformation. The tendency of transformation is very high among the large landowners in any case. For the large owners whether the land is under irrigation or not, it does not make much difference in taking the decision of transformation. The small and marginal farmers are more interested in their food supply from the small landholdings rather to transform it into mango orchards. The transformation in this area is changing the agriculture structure significantly. Evidence is mixed and context-specific regarding the gains and losses to transformation of agriculture as it does not have an equal effect on different livelihood groups. This will have a serious implication on the poor people's livelihood strategy in many forms, but medium and large landowners would make a substantial profit. The vulnerability of the poor will be increased for a considerable period of time until the process of transformation completes and the people adjusted in the changed circumstances. Therefore, there is a need for public intervention to help people cope with the impact of transformation at least for the time being so that the situation of the poor and most vulnerable should not get worse.

Key words: transformation of agriculture, livelihood, coping.

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1. Background of the study

Bangladesh is still recognized as predominantly agrarian country despite a precipitous fall of the contribution of agriculture to the gross domestic product (GDP). Among the various agricultural products, rice is the main crop as well as the staple food of the country. About three-forth of the total arable land and more than eighty % of the total irrigated land is under rice cultivation. Almost all of the fourteen million farm families of the country grow rice. It meets about two-thirds of total calorie supply as well as food security. Rice cultivation is not only about food production or employment generation. The importance is embedded in the culture and total livelihood system of the country. As an important social and economic group, farmers are in the center of the agricultural production system. This agricultural labor force is also the poorest and most vulnerable section of the country.

There are a lot of inherent factors associated with their poverty and livelihood vulnerability. Such vulnerability arises mainly from the unemployment, income deficit, and instability of agricultural production. These people have less ability to recover from any shocks as they always suffer from lack of resources. Since half of the total farmers' livelihood depends on agriculture, any change in agricultural sector has substantial impact on their income and employment situation. The northwestern part of the country is witnessing a rapid agricultural transformation during the last two decades.

Agricultural transformation is the process by which individual farms shift from highly diversified, subsistence-oriented production towards more specialized production oriented towards the market or other systems of exchange (e.g., long-term contracts). In this study, transformation of agriculture is perceived as the conversion of farmland from rice cultivation to mango farming. The study intends to identify the causes and consequence of transformation of agriculture from paddy cultivation to mango farming, and its impact on farming community.

2. Methodology and study area

The Gnaguria union of Porsha *upazila*[1] of Naogaon district was taken purposively as the study area. Degree of transformation of paddy lands to mango orchards, irrigation facility, and land ownership pattern were considered as major indicators for selecting the study area. A total of 27 focus group discussions (FGDs) were conducted in 27 *mouza*s[2] of the union to distinguish the rate and nature of mango farming, and to assess the impact of transformation on different group of people. Semi-structured questionnaire was used to understand the impact of transformation of agriculture on different farming groups. It also helped to identify the distinctive nature of land ownership pattern, irrigation facility, and socioeconomic vulnerability of the study area. %age of mango farming was calculated based on the secondary information collected from the union *parishad* and *upazila* office respectively. Data was analyzed in Microsoft excel and by using descriptive statistics. Belonging to *Barind* tract, this area is highly prone to drought. The land distribution pattern is highly imbalanced, and the tenancy relationship is also typical than the other parts of the country. A very few landlords of Porsha (locally called *Sahoo*) actually own almost all the arable land of the union. They regulate here a feudal production system and control the cropping pattern, sharing of crops, and wage of labor. The majority of the people of this area are living under poverty line.

[1] Upazila formerly called thana, is a geographical region in Bangladesh used for administrative purposes. They function as sub-units of districts.
[2] Mouza is the lowest revenue collection unit.

3. The nature and causes of transformation

The Ganguria union is witnessing a rapid transformation in the agriculture sector. About 58 % of total arable land (3539 hectare) has already been transformed to mango farming. The gradual increase of mango farming in Ganguria union is shown in figure 01. According to the figure, the percentage of mango orchards was only 3% at the very beginning of 21st century. But, it shot up to nearly 22% in the next five years, and almost doubled in the following five years.

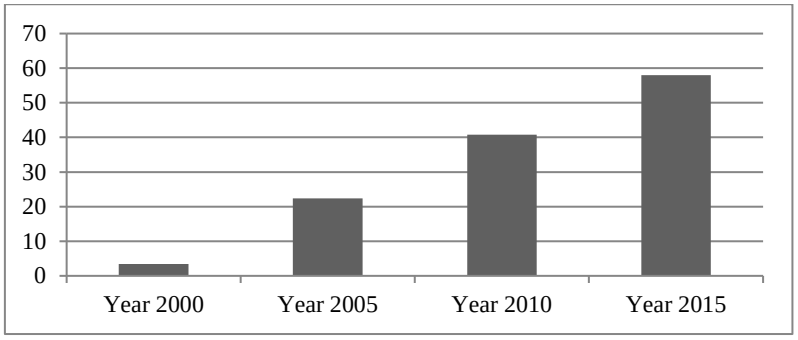

Figure 01: Gradual expansion of mango farming in Ganguria union

The graph 02 depicts that the transformation of paddy field into mango orchards has been taken a rapid form in almost all the villages of the union especially after the year 2000. The factors influencing such a rapid transformation are mixed, complex and interconnect. Baharul is a village (*mouza* 1) where the *Sahoo*s own more than ninety % of arable land. The area is basically single cropped and has limited irrigation facility. It is very adjacent to Porsha *upazila*, and has the highest transformation rate (90%). In contrast and most interestingly, the *Sahoo*s own no land in Michira village (*mouza* 15), and this is the only village of the union where the *Sahoo* have no power exercise also. Despite the area has very limited irrigation coverage, the %age of transformation is low (40%) in comparison to that of other areas. On the other hand, in the Dahuki village (*mouza* 24), about 50% of the arable land is owned by the local people and has about 33% of total arable land under irrigation coverage. Mango farming covers almost 21% of the total arable land which is much lower than the other parts. In contrast Paschim Daulia (*mouza* 4) has maximum irrigation facility (about 47%) but the rate of mango farming is very high (60%). The majority of the land of this village is owned by *Sahoo*s, and most of the people living here have no homestead land.

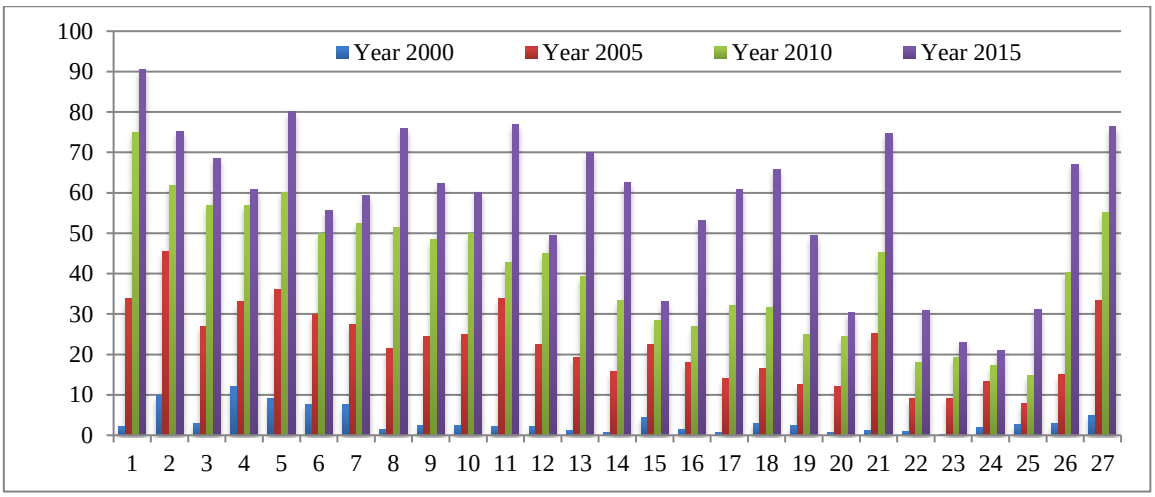

Figure 02: The nature of transformation in Ganguria union in 27 *mouza*s

Therefore, the study reveals that the causes of transformation are not uniformed, rather have different dimensions. Most important factors are described in the following sections.

3.1 Economic return and its impact on transformation: The findings from the field study shows that the monetary return from mango farming is one of the most important factors influencing the rapid transformation. A comparison of return from rice cultivation and mango farming is shown in the table 01. This is to be noted here that the return is been considered for the landowners only. Besides, there are wide varieties of paddy and mangoes, and prices differ from one variety to others. Keeping this in mind, only the minimum average prices are considered so that these estimations do not reach to a misleading conclusion. The agricultural income was calculated by deducting the operational cost of cultivation from the gross value of agricultural output as of 2015. The operational cost covers items like cost of preparing field, wages paid for hired labor, cost of machinery, irrigation, fertilizers, seeds, etc. There are also other factors which are generally translated into monetary terms, such as cost of management and value of family labor. In this calculation, both were excluded. To avoid any other complexity normal production year is assumed for both of rice and mango farming.

In general, the table 01 shows that the mango farming is more profitable than that of rice cultivation in any case. Landowners can get a total of 1,78,685.00 taka it the land has irrigation coverage, and is cultivated three times a year. Keeping in mind that the most of the land of the union does not have access to irrigation, and they are used only for rain-fed *aman* production. So, the return is typically 64,310.00 taka per hectare per year. If the land is used for share-cropping then the return is reduced to half.

In contrast, landowner can get more than double profit than that of three times rice cultivation in a year. If we consider single crop area then the return is almost 6.25 times in case of own mango farming and the age of orchard is in between 3 to 5 years. Since mango orchards take at least 3 years to give output, the farmers will get no return from mango farming in the initial years.

However, they can cultivate both mango and rice at this period. Interestingly, during first 5 years the owner of the land will also get paddy from the planted land which is about 30-50% less than the usual production. So, ultimately the return from mango orchard stands a little higher than shown in the table. The production of mango becomes almost double and the return becomes 4.3 times higher than that of rice production (if irrigated) after 10 years. If we compare the return with that of rain-fed *aman* only, then it becomes about 12 times higher. However, the return varies considerably if the landowners rented out mango orchards. But, still it is much higher than that of rice cultivation.

Table01: Return from rice and mango farming per hectare

Type of farming			Return (in BDT)
Rice cultivation		Single crop (*aman*)	64,310.00
		Double crop (*aman and boro*)	75,125.00
		Treble crop (*aman, boro and aus*)	39,250.00
		Total	1,78,685.00
Mango farming	Own farming	3-5 years old mango orchard	4,02,000.00
		10 years-plus orchards	7,73,750.00
	Contractual	3-5 years old mango orchard	3,00,000.00
		10 years-plus orchards	5,00,000.00

Source: author's calculation (field study 2015)

3.2 Access to irrigation and control over land, and their impact on transformation: All villages, with a few exceptions, having less access to irrigation coverage are highly prone to transfer their paddy land to mango farming (figure 03). The union has only 15% of irrigation coverage. The graph shows that *mouza* number 1, 2, 3, 5, 11, 13, 14, 15, 16, 17, 18, 19, 21, 26 and 27 have less irrigation facility (less than 30% of total arable land). Eventually the transformation reached up to 60 to 80 % in these *mouza*s except Michira village (*mouza*

15). The village has only 15% land under irrigation coverage, but the farmers have transformed only 33% of their arable land to mango orchards. The main factor is the landownership pattern. This is the only village where *Sahoo*s have no landownership. In contrast the total land transformed into mango orchard is only 23% in the Magrail village (*mouza* 23) as it has nearly 60% irrigation coverage. Again, Paschim Daulia (*mouza* 4) and Pashcim Haripur (*mouza* 12) are two other villages that have nearly 50% of irrigation facility, but experiencing 60% and 50% of transformation respectively. The *Sahoo*s own most of the land of these villages, and most of the villagers do sharecropping. So control over land is very important aspect.

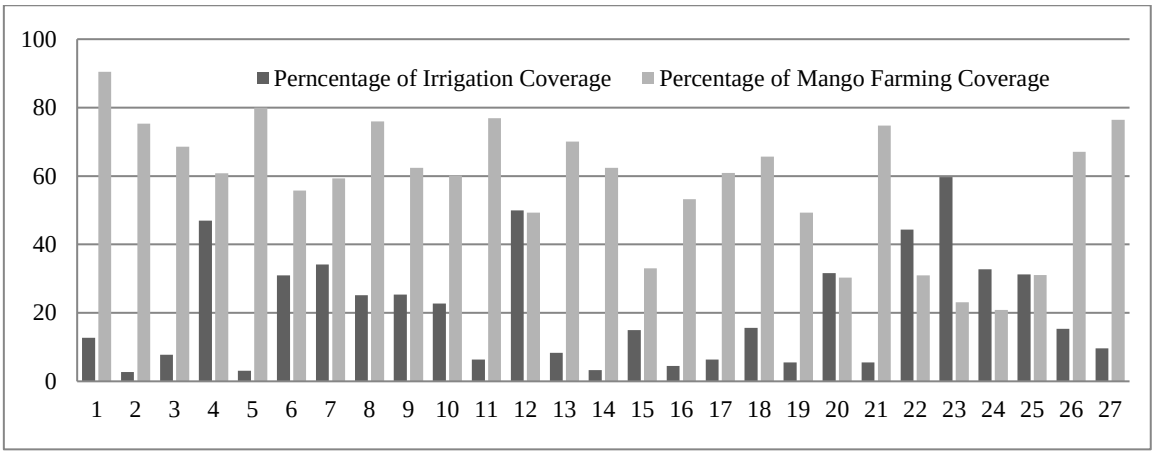

Figure 03: Comparison between access to irrigation and transformation of agriculture in 27 *mouzas* of Ganguria union

The findings from the FGDs show the summary of the nature and trend of transformation of rice fields into mango orchards (table 02). It represents that the tendency of transformation is very high among the large and medium land owners than that of the small and medium farmers. The small and marginal farmers are more interested in their food supply from the small landholdings rather to transform it into mango orchards. From the category of land the tendency is very high for the land without irrigation facilities. But when we combine the ownership and availability of irrigation facilities, still ownership influence is stronger than the irrigation facilities issue as the tendency of transformation among the large landowners is very high. If we add the form of tenancy with two other criteria, namely land ownership and availability of irrigation facilities then the final picture shows that the tendency of transformation is still very high among the largest owners because in case of return calculation; tenancy has a negative relation with return. So, for the large owners whether the land is under irrigation or not, it does not make much difference in taking the decision of transformation. Once the transformation started, the difference of return between mango and rice is visible. This demonstration effect is playing very strong role in decision making here.

Table 02: tendency for transformation among different landowner groups

Table 02: tendency of transformation among different landowners considering availability of irrigation, and tenancy arrangement

Types of land ownership	Water availability	Tenancy arrangement	Tendency for transformation
Sahoo (Large farmer)	Rain fed	Sharecropping	Very high
	Irrigated	Fixed rent	Very high
Medium farmer	Rain fed	Own cultivated	high
		Rented	Very high
	Irrigated	Own cultivated	Very low
		Rented	Low
	Rain fed	Own cultivated	High

Types of land ownership	Water availability	Tenancy arrangement	Tendency for transformation
Small and marginal farmer		Rented	High
	Irrigated	Own cultivated	Very low
		Rented	low

Source: field study, 2015

So, the land ownership is the determining factor in decision making. The land owners have got the motivation and it is moving faster. The respondents reported that within the next five to ten year, more than 80 % of total cultivable land in Ganguria will be transformed into mango orchards. Small and marginal farmers are risk-averse and they prefer to stay on their traditional way of life. The small and marginal land owners who are generally cultivators of their own land can engage themselves in fields all around the year. So they are less willing to transform land into mango orchard. In some exceptional cases they are compelled to do it because when adjacent plots are transformed, then productivity decreases due to shade and other negative impacts on the paddy production. So in case of small and marginal farmers where irrigation facilities are available the tendency of transformation is very low.

A significant number of the total respondents considered legislative factor about land ceiling as one of the key elements behind the transformation of agriculture. Government of the Peoples Republic of Bangladesh issued a notification with an objective to limit the agricultural land holding up to 100 standard *bighas* (about 12.15 hectares) per family. This notification is known as President's Order No. 98 of 1972 "Bangladesh Land Holding (Limitation) Order, 1972". Since then the large landowners are under pressure of confiscation of land in excess of 100 *bighas*. But there is a clause in this notification that the order about ceiling may be relaxed for "land used for cultivation of tea, rubber or coffee [or covered by orchards]". So to avoid confiscation; the large land owners are changing the status of land through transforming rice fields into mango orchards. This issue of land ownership was found one of the very sensitive issues where the respondents from large land owners' category were not very comfortable to answer. Some of the large land owners avoided answering this question. But one of the *Sahoo* was spontaneous and identified it as one of the major reasons behind the transformation. He also mentioned that though it is important but the economic factor is the key behind the transformation.

3.3 Other factors influencing transformation: There are other climatic and social factors factors influencing the transformation of paddy field to mango orchards. Losing production of rice due to drought or uneven rainfall was the major cited problem for the farmers. During the FGD with the villagers, farmers estimated about 30% of losses in recent years rice production due to uneven and uncertainty of rainfall. They also said that moderate drought occurs around every three years and each time they experience 40-50% of production loss. This climate variability is also pushing landowners to convert their paddy land into mango orchards. On the hand, most of the large landowners are now live in big cities. The management of resources is an important issue here. From management point of view mango orchards have several advantages over rice cultivation. So it is preferable to all the absentee landlords to transform their land into mango cultivation. Historically, the Rajshahi region, especially the Chapainababgang district (adjacent district of the study area), is very much famous for mango. So, question may arise what motivates people to transform their paddy land to mango orchards so rapidly, especially after the year 2000. Followings are the two other very important factors that have influenced the change such as (a) The construction of Jamuna bridge (the largest bridge of the country) in 1997 has opened the door for the businessmen to transport mango to different part of the country very quickly, and (b) The gradual economic growth of the country has increased the purchasing power of the people.

4. Impact of transformation of agriculture on farming community

The transformation in this area is changing the agriculture structure of the study area significantly. Evidence is mixed and context-specific regarding the gains and losses to transformation of agriculture as it does not have an equal effect on different livelihood groups. At present, about 58% of paddy field of the union has already gone under mango farming. According to the local people it will be 80% within next 5 to 10 years. So the rice based agriculture which is employing the 75% of the local people, will be soon out of rice cultivation. This will have a serious implication on the poor people's livelihood strategy in many forms. The sharecroppers and marginal farmers will lose their paddy field and consequently will lose their income opportunity from rice cultivation. Low labor–intensive mango farming may result in a huge unemployment for the local landless labor forces as well. The immediate impact of transformation would be reduction in the number of working days. This fall in working day will happen gradually with the increase in size of the mango trees. The field study findings show that 123 labor-day per hectare is required for the *aman* paddy to carry out all the activities in a season, whereas mango farming requires only 42 labor-day per hectare per year. If we assume that after 5 years 80% arable land of Ganguria union will go under mango farming, which means about 2,800 hectares of land will go out of rice cultivation. At the existing situation by ignoring all the secondary impacts, within 5 to 10 years, about 1500 to 2000 households would be unemployed[3]. This implies that about the same number of families would fall in great trouble as most of the households are dependent on single breadwinner. All these will lead to poor people to leave this place or have to change their occupation. Opportunity and security for both cases are very limited. Furthermore, since the majority of the homestead land of the sharecroppers is owned by the *Sahoos*, there will be a great threat of losing their shelters too. These will expose poor people in a more vulnerable condition, and may weaken their adaptive capacity. However, the large and middle farmers are typically able to make profit from mango farming. Such transformation contributes positively to income sustainability for the rich because it reduces proneness to stress and shocks. The winners in this competitive agricultural transformation will normally have better position to maintain improved standard of living and obtain a strengthen position in society resulting an increased impoverishment for the large number of agricultural wage-earners. On the one hand, the income of the poor is going to fall significantly; on the other hand, income of the rich is going to increase considerably. So, there will be an increase in income inequality in the coming years in this area. If we consider the impact on different livelihood groups the large landowners will the most beneficiary and the worst affected will be the tenants and landless agricultural laborers.

5. Conclusion

The process of agricultural transformation is changing the basic agricultural and socioeconomic structure of the Ganguria union. The large landowners would be benefited from financial, management and risks points of view, whereas the tenants and laborers would be severely affected through loss in employment and income which would ultimately threaten their adaptive capacity. Hence, the study urge for a more systematic investigation for identifying the ways so that the negatively affected communities of this region can cope with the new challenges successfully.

[3] Total average number of working days is 220 per person per year. This figure is obtained from the field survey in Ganguria and is used for the calculation of employment and unemployment figures.