



## CAUSES AND CONSEQUENCES OF TRANSFORMATION OF RICE CULTIVATION INTO MANGO ORCHARDS: A CASE OF NORTH-WESTERN BANGLADESH

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### ABSTRACT

Agriculture of Bangladesh is predominated by rice production as almost all fourteen million farm families grow it in three-fourth of the total arable land of the country. Apart from contributing to food security, labor-intensive rice production also provides employment to the majority of rural households. Since farmers immensely depend on rice production, any change in crop selection may reshape their livelihood. Hence, the study aims to investigate the causes and consequences of transformation of rice cultivation into mango orchards. Ganguria union of Porsha upazila under Naogaon district was selected for the study. Mixed research methods approach was applied to collect and analyze data. Findings show that the rate of transformation has already covered 58 percent of total arable land of the study area by 2015. The net return from mango farming, lack of irrigation facility and landownership pattern are the most important factors influencing the process. The large and medium farmers are benefited substantially while the transformation process is profoundly altering the nature of smallholder farmers' and agricultural laborers' livelihood. The vulnerability of the group tends to be extended for a considerable period of time till the process of transformation completes, and individuals adjust with the modified circumstances.

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### INTRODUCTION

Agriculture and its associated industries are the primary sources of employment in almost all developing economies (Sivakumar and Hansen, 2007) including Bangladesh. The country is predominantly an agricultural country. The cropping pattern of the country has a great influence on generating livelihood of farmers. Historically, rice is the staple food and the government of Bangladesh had emphasized on intensification of rice production to feed the increasing population, and to attain self-reliance in the long-run since 1990's (Mandal and Bezbaruah, 2013). As a result, the country had made noteworthy progress in producing this cereal crops, and is close to food self-sufficient in recent past (Thomas *et al.*, 2013). By the end of 2008, about three-fourth of the total arable land and more than eighty percent of the total irrigated land became under rice cultivation (Chowdhury, 2009). Nearly all the farm families of the country grow rice that accounts about 70 percent of the value of crop output, and meets about

two-thirds of total calorie supply (Awali and Siddique, 2011). Hence, rice cultivation is not all about economic growth and food security, but its importance is embedded into employment generation and the way of life especially of the rural cultivators (Gumma *et al.*, 2014). Mandal and Bezbaruah (2013), however, shows that the country is experiencing a departure from 'rice-led' growth to 'non-rice crops' production due to a number of causes including to generate better income and to protect agro-ecological conditions. Studies show that socioeconomic progress in association with disaster risk averse and profit-oriented agricultural strategies also play an important role in selecting different crop other than rice (Ghosh, 2011; Puri and Misra, 2015; Morgan and Munton, 1971). Providing examples from Indian societies, Ray (2007) and Misra and Bhat (1994) identified that changes in cropping pattern helps farmers to minimize risk involved in agriculture sector and maximize their farm income. Comparing net-profit between rice and non-rice crops, Dorosh and Shahabuddin (2002) showed that non-cereal crops were more profitable than that of rice. Alam and Abedin (1996), in contrast, argued for availability of technology over output price for determining the choice of crop. According to Mandal and Bezbaruah (2013),

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rice cultivation is becoming less profitable to many of the farmers because of market irregularities, seasonality and loss of production due to disaster and climate variability, and an increase of input price including labor cost. The research findings stated here shows that price risk due to market failure and production loss due to climate variability or disaster are the major causes behind the process of transformation of agriculture or changing of cropping pattern. But, tenancy arrangement, management of farming, economic growth of the country and legislative factors may also have influences on transformation of agriculture. The literature also depicts that transformation of cereal crop into non-cereal helps farmers to gain significant profit and to minimize their risks to different socioeconomic and environmental risks. But, they did not consider that the change of cropping pattern does not percolate income opportunities to different groups in similar fashion. For instance, the north-western part of Bangladesh had been experiencing a rapid transformation of rice cultivation into mango orchards in recent past (Noman, 2004). Noman and Joarder (2011) showed that transformation of labor-intensive rice cultivation into mango orchards in this region had potential negative impact on smallholder farmers' livelihood. Mango, as a seasonal business crop, escalates income of the rich farmers considerably by the cost of substantial unemployment of the smallholders and agricultural laborers. It broadens up the income gaps between rich and poor farmers. Most of the cases, large landowners gain substantial profit whereas smallholder farmers find themselves in more susceptible position as they largely depend on the previous group for sharecropping and employment. Since smallholder farmers face extreme forms of subordination and oppression in society (Singharoy, 2004; Schüren, 2003) because of their lower strata and position in the social, political and economic hierarchy (Borras, 2009; Vorley, 2002; Freedman, 1999; Beteille, 1974; Shanin, 1971; Wolf, 1966), they hardly can take advantage of any change in agriculture sector. So, their livelihood is subject to modification if any change or transformation takes place in their traditional agricultural arrangements. Therefore, the aim of the study is to explore the causes of the transformation of rice cultivation into mango orchards, and its impact on different rural livelihood groups.

## MATERIALS AND METHODS

The study was first conducted in 2010 and revisited in 2016. In the first stage, Gnaguria union under Porsha upazila (sub-district) of Naogaon district was selected purposively for the study after conducting five key informant interviews with the concerned agriculture officials. There are six unions under Porsha upazila but Ganguria union stands differently because of its unique nature of degree of transformation of paddy lands to mango orchards, access to irrigation facility, and land ownership pattern. Belonging to *Barind* tract, this area is highly prone to drought (Shahid and Behrawan, 2008). 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 *Shahoos*) own majority of the arable land of the union (Noman and Joarder, 2011). They control the total production system including cropping pattern, sharing of crops, and wage of labor of the area. In the second stage, 27 small group discussions with opinion leaders (i.e., members of the union council, school teachers and agricultural block supervisors) were conducted in each of the *mouzas* (a definite land area and the lowest revenue unit in Bangladesh. Under a single *mouza* there may have one

or more settlements) of the union to understand the different dimensions of causes and consequences of mango farming, landownership pattern, access to irrigation service and tenancy arrangement. In the next stage, four villages from the union were selected for in-depth study considering different dimensions that include land distribution pattern, tenancy relationship, availability of irrigation facility, and rate and nature of transformation of paddy land to mango orchards. For instance, irrigation facility in the Baharul village is very limited, and *Shahoos* own more than ninety percent of the arable land. In contrast, Michira is the only village of the union where the *Shahoos* have no landownership and power exercise as well. Landownership is fairly shared equally among the local inhabitants and absentee *Shahoos* in Dahuki village. Paschim Daulia village, however, has maximum irrigation facility, but the majority of the people has no ownership over farmland and homestead land. Finally, a total of 60 smallholding farmers/sharecroppers experiencing displacement due to the transformation of rice-field to mango-orchards were interviewed purposively from the selected four villages. The study classified smallholder sharecroppers who were cultivating less than 0.5 hectare (ha) of farmland. Individuals interviews were also conducted with four landlords who were closely associated with the livelihood systems of the poor since a long. A total of eight focus group discussions in the selected four villages were conducted to explore the nature and leading reasons of the transformation process. A secondary purpose of the discussions was to understand the extent of different socioeconomic vulnerabilities of the smallholder farmers as well. Representative members from different groups such as smallholder farmers, wage earners, and agricultural block supervisors were present in the discussions.

Transformation of agriculture means in this paper as transformation of rice or paddy field into mango-orchards. Percentage of mango farming was calculated based on the secondary information collected from the union council and *upazila* offices respectively. The information was cross checked with the result of small group discussions conducted in each of the *mouzas* of the union. In calculating the return from rice cultivation and mango farming, few issues were carefully considered. For instance, the return was considered only for the farmers who owned farmlands. Besides, there are wide varieties of paddy and mangoes, and the price differs from one variety to another. Keeping this in mind, only the minimum average prices were considered so that the estimations did 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 covered items like cost of preparing field, wages paid for hired laborers, cost of machinery, irrigation, fertilizers, seeds, etc. There were 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. Both quantitative and qualitative techniques were applied to analyze the field data. At first data were processed with SPSS software by using simple statistical techniques. Then, the quantitative data were analyzed through frequency distribution tables. Different descriptive statistics such as frequency analysis, cross tabulation and graphical presentations were applied to analyze data. Qualitative data collected through group discussions and key informant interviews by using 'qualitative analysis'

technique in which data are examined and interpreted non-numerically through a narrative approach and analytic description.

## RESULTS

### The nature of transformation

The Ganguria union is witnessing a rapid transformation as about 58 percent of the total arable land (3,539 hectare) has already been transformed into mango farming (Fig. 1). The figure also shows that the percentage of mango orchards was only 3 percent at the very beginning of the 21st century. But, it shot up to nearly 21 percent in the next five years, and almost 1.8 times in the following five years. The Fig. 2 demonstrates overall views and trends of transformation of paddy field into mango orchards of the study area. The village Baharul (*mouza 1*) stands highest with more than ninety percent of arable land transformed into mango orchards whereas the *mouza* numbers 2, 5, 8, 11, 13, 21 and 27 have more than 70 percent of land under mango farming. In contrast, among the 27 *mouzas* only five (*mouza* no. 15, 22, 23, 24 and 25) have less than 35 percent of arable land converted into mango farming. All the *mouzas*, except number 4, had less than 10 percent of farmland under mango farming at the beginning of 2000. But once the process started, it climbed up to 6 to 7 times higher in the next 10 to 15 years. For example, the rate of transformation in *mouzas* 21, 26 and 27 from the year 2010 to 2015 is 4 to 6 times higher than that of previous years. 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.

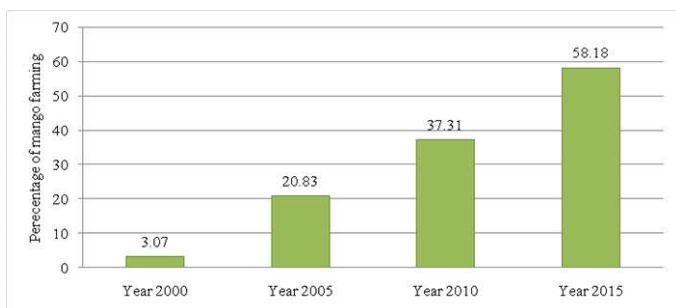


Figure 1. Gradual expansion of mango farming in Ganguria union

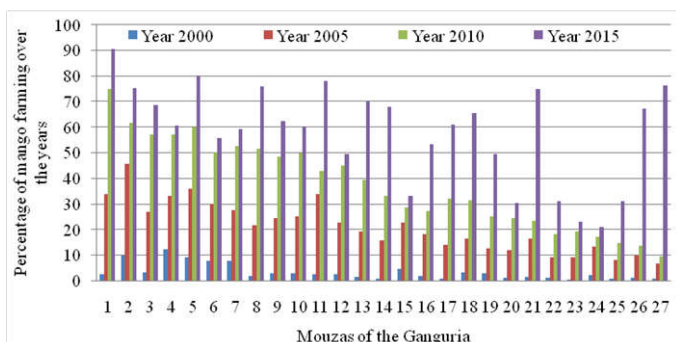


Figure 2. The nature of transformation in 27 mouzas of Ganguria

### Causes of transformation of rice-cultivation into mango orchards

**Financial return and its impact on transformation:** The study shows that the monetary return from mango farming is one of the most important factors influencing the

transformation process. A comparison of return from rice cultivation and mango farming is shown in the Table 1. In general, the mango farming is more profitable than that of rice cultivation in any case. Landowners can get USD 2,235.00 from one hectare of land if it has full irrigation coverage, and is cultivated three times a year. The most of the land of the union, however, does not have access to irrigation, and only the rain-fed rice production is possible there. So, the return is typically USD 804.00 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. In case of single crop area and the age of orchard is in between 3 to 5 years, then the orchard owners get 6.25 times higher return than that of rice cultivation. 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. During the first 5 years, the owner of the land will also get paddy from the planted land which is about 30-50 percent 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 compared 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.

**Access to irrigation and control over land, and their impact on transformation:** Access to irrigation facility has potential association with the trend of transformation process.

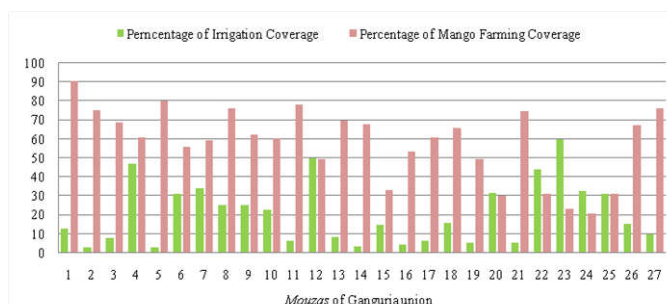


Figure 3. Comparison between percentage of arable land under irrigation coverage and mango farming in Ganguria

The Fig. 3 shows that all *mouzas* but three having less access to irrigation coverage are highly prone to transfer their paddy land to mango orchard. The union has only 15 percent 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 than 30 percent of total arable land under irrigation facility. Eventually the transformation reached up to 60 to 80 percent in those *mouzas* except in *mouza* 15 (Michira). The *mouza* has only 15 percent of land under irrigation coverage, but the farmers have transformed 33 percent of their arable land to mango orchards. The *Shahoos* owned no farmland in this *mouza* is the leading cause behind this disparity. About 50 percent of farmlands are owned by the local people in Dahuki *mouza* (24), and has nearly 33 percent of total land under irrigation. The transformation rate is only 21 percent which is much lower than the other parts. On the other hand, the total land converted into mango orchard is only 23 percent in Magrail *mouza* (23) as it has nearly 60 percent of farmland under irrigation.

**Table 1. A comparison between net-return from rice cultivation and mango orchards per hectare**

Type of farming		Return (in USD, 1 USD = 80.00 BDT)	
Rice cultivation		Single crop ( <i>aman</i> )	804.00
		Double crop ( <i>aman and boro</i> )	940.00
		Treble crop ( <i>aman, boro and aus</i> )	491.00
		Total	2,235.00
Mango farming	Own farming	3-5 years old mango orchard	5,025.00
		10 years-plus orchards	9,672.00
	Contractual	3-5 years old mango orchard	3,750.00
		10 years-plus orchards	6,250.00

Source: author's calculation based on the findings from the field study, 2016

**Table 2. Tendency of transformation among different landowners considering availability of irrigation, and tenancy arrangement**

Type of landowners	Water availability	Tenancy arrangement	Tendency for transformation
Large farmers ( <i>Shahoos</i> )	Rain fed	Sharecropping	Very high
	Irrigated	Fixed rent	Very high
Medium farmers	Rain fed	Own cultivated	High
		Rented	Very high
	Irrigated	Own cultivated	Very low
		Rented	Low
Smallholder farmers	Rain fed	Own cultivated	High
		Rented	High
	Irrigated	Own cultivated	Very low
		Rented	Low

Source: FGDs conducted under the study, 2016

**Table 3. Impact of transformation of agriculture on different farming clusters**

Livelihood groups	Details of the impact of transformation	Nature of impact
Large land owner	Low risk in investment; low risk of production loss; easy to manage; easy to holding the land over the ceiling; and substantial revenue.	Affirmative
Medium land owner	Gross economic benefit; low risk of production loss; easy management; opportunity for alternative investment	Affirmative
Smallholder farmers	Gradual loss of rice production but no benefit from the mango business; threat of eviction from homestead; limited opportunity to diversify income; forced non-paid labor in rearing mango orchards	Negative

Source: Source: FGDs conducted under the study, 2016

**Table 4. Coping status of the smallholders and agricultural laborers compared to a decade ago**

Coping strategies	Whether the transformation process is worsening the 'avoidant coping' status compared to a decade ago (Total respondents 60; percentage in bracket)	
	Yes	No
Experiencing seasonal unemployment	55 (91.67)	5 (8.33)
Selling labor in advance	34 (56.67)	26 (53.33)
Taking loans	29 (48.33)	31(51.67)
Cutting down food intake	26 (43.33)	34 (56.67)
Accepting low wage during lean period	32 (53.33)	28 (46.67)
Selling household productive and non-productive assets	23 (38.33)	37 (61.67)

Source: field study, 2016

Again, Paschim Daulia (*mouza* 4) and Pashcim Haripur (*mouza* 12) are two other villages that have nearly 50 percent of irrigation facility, but experiencing 60 percent and 50 percent of transformation respectively. The *Shahoos* own most of the land of these villages. Hence, apart from irrigation coverage control over land is also an important factor shaping the transformation process.

**Landownership pattern and its impact on transformation process:** The findings from the FGDs show the summary of the nature and trend of transformation process (Table 2). 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 to other use. 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 facility, the ownership pattern stands stronger than the irrigation issue.

For example, the tendency of transformation among the large landowners is very high in most cases. On the contrary, smallholders 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.

**Other factors influencing transformation:** 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 under 'Land Holding Order, 1972' ([http://bdlaws.minlaw.gov.bd/pdf\\_part.php?id=411](http://bdlaws.minlaw.gov.bd/pdf_part.php?id=411), accessed on 15 May 2016). Since then the large landowners are under pressure of confiscation of land in excess of 100 *bighas* (about 16 hectares). 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. There are other climatic and social factors influencing the transformation. Loss of production due to drought or uneven rainfall was also major cited problem of the farmers. During the FGDs with the villagers, farmers estimated about 30 percent of losses of rice production due to uneven and uncertainty of rainfall in recent years. Besides, most of the large landowners now live in big cities. From the management point of view, mango farming has several advantages over rice cultivation. Low and unstable price of rice has also important influence in determining the process. So, the landowners are no longer interested in rice cultivation and transferring their farmlands into mango orchards

### **Impact of transformation of rice cultivation into mango orchard on different livelihood groups**

The transformation process is changing the agriculture structure of the study area significantly. The Table 3 demonstrates a mixed and context-specific regarding the gains and losses to the change in cropping pattern as it has an uneven effect on different livelihood groups. 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 strengthened position in society resulting an increased impoverishment for the large number of sharecroppers and agricultural wage-earners. To illustrate further, 60 small sharecroppers were asked about their status of coping strategies in comparison to a decade ago. The Table 4 shows that nearly 90 percent of the respondents claim that the transformation process was extending their unemployment as well as lean periods. The lean period mainly affects smallholder farmers by directly cutting their income opportunity for some sixty days. They also face challenges to ensure sufficient food and other basic needs for their families during this period. Borrowing money from both formal and informal sources is another major coping strategy among the smallholder farmers. About 48 percent of the respondents were taking more loans than previous. But, most of them who took loan could hardly break the cycle of debt as the burden of paying back loans was also high. Respondents also sold their working days of the harvest period in advance and got only half of the regular wage. This avoiding coping strategy therefore put them to another shock during the harvest period as they did not earn from the work as they were already paid for that. Responding to the question whether they were selling labor in advance more frequently than a decade ago, 57 percent of them responded affirmative. Besides, due to the chronic vulnerability or income deficiency, most of the study households consumed less food round the year. Almost all of the families cut their one meal per day during slack season. Sometimes they did not eat at all except the very younger persons of the family. Many of the respondents sold their household assets including livestock during this period. They claimed that once selling their livestock terribly set back in their families' savings for the next season. Hence, there may have an increase of inequality between rich and poor farmers in the coming years.

## **DISCUSSION**

The study reveals that factors behind the process of transformation of rice field into mango orchards are multi-dimensional in nature. Net-profit from mango farming is the most important factors behind the process. But, uneven distribution of land, unfair tenancy arrangement, lack of irrigation facility, and lack institutional support to protect the smallholders' livelihood are also determining the process. Large and medium landowners are rapidly transforming their paddy field into mango orchards than that of smallholder farmers. Smallholders are generally risk-averse community that keeps them staying on their traditional way of life. The process of transformation is changing the basic agricultural and socioeconomic structure of the study area. A few number of business group manage and control of the production system from nurturing to marketing. It is different from common agricultural transactions. The process is about to bring profound changes in different livelihood groups. The large and medium landowners are benefited from the financial, management and risks to hazards points of view while the smallholders and agricultural wage-earners are adversely affected by loss of employment and income opportunity. The study reveals that 123 labor-day per hectare is required for the rice cultivation to carry out all the activities in a season, whereas mango farming requires only 42 labor-day per hectare per year. Hence, low labor-intensive mango farming may result in a huge unemployment for the local agricultural labor-forces. The immediate impact will be reduction in the number of working days of the rice-farming dependent laborers. This fall in working day will happen gradually with the increase in size of the mango trees. If the transformation process follows the same trend in next 5-10 years then 80 percent of arable land of Ganguria union will be converted into mango orchards. It indicates that 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 1,500 to 2,000 households would be unemployed. It also 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 marginal and smallholder farmers to leave this place or have to change their occupations. Opportunity and security for both cases are very limited. Furthermore, since the majority of the homestead land of the sharecroppers is owned by the *Shahoos*, there will be a great threat of losing their shelters too. These will expose smallholder sharecroppers in a more vulnerable condition, and may weaken their adaptive capacity. As a result, the study found different avoiding coping strategies that are elongating due to transformation of agriculture among the lower income groups.

The history of the developed nations demonstrates that there may be nothing inherently problematic about such displacement due to changes of cropping pattern as the destitute are able to find viable alternative livelihoods. But, alternative income sources in this region are very limited. This is noteworthy to mention that vulnerability of the smallholder farmers accelerates not all because of transformation of agriculture, but in combination of their exposure to other socioeconomic and political vulnerabilities. Besides, change of cropping pattern has negative impact on rice production. The demand for cereals is increasing fast because of increasing population pressure as well as increase per capita income. With the increase in population and improved income distribution, there is a possibility of increase in rice demand in

near future in the country. It is the high time for the government and the concerned to intervene otherwise the poverty situation may deteriorate in this region. The transformation trend is also high in surrounding districts, but the author interviewed a few number of respondents in a small area. Moreover, a remote sensing technology would have more reliable to calculate the actual area converted into mango orchards. Considering these limitations, the study urges for a large scale investigation to explore the situation in greater extents.

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