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RESEARCH ARTICLE

DIMENSIONS OF SMALLHOLDERS' COPING TO DROUGHT IN BANGLADESH.

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Abstract

By providing employment and food security, agriculture and agriculture centered economy generally determines the smallholders' livelihood in Bangladesh. But, the northwestern region experienced eight dry spells of major magnitude in last 40 years. The situation is likely to be deteriorating in coming years because of climate change. It continuously modifies livelihood strategies of the smallholders. They embrace both active and avoidant coping strategies to avoid production loss, persistent income inadequacy and seasonal unemployment resulting from drought and socioeconomic vulnerabilities. The goal of the study is to investigate the dimensions and status of such coping strategies. It depicts that 'active coping' strategies assist smallholders overcoming imperatives at a few degrees. But, lack of investment capacity and poor asset-base impel them to move into low-cost and low-return exercises. 'Avoidant coping' strategies debilitate their further capability to cope with challenges. Overall, the smallholders lag far behind to cope with drought and other socioeconomic constraints.

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Introduction:-

Regardless of having considerable advancement in non-farm economic sectors, Bangladesh is still recognized as a predominantly agrarian country. However, the contribution of agriculture to the gross domestic product (GDP) of the country is declining throughout the years – 55% in 1970 to 16% in 2015. It does not necessarily portray that the significance of agriculture is going down. The significance of agriculture is rooted into providing food security and employment to majority of rural individuals (Sivakumar and Hansen, 2007; Lewis, 1954). Recent statistics demonstrate that 45.1% of the employed individuals are engaged in agriculture sector (BBS, 2015). Smallholders possess a focal position in the agricultural system of Bangladesh (Chowdhury, 2009). Drawing evidences from many parts of the world, several social scientists sort 'smallholders' as socioeconomically and politically disadvantaged community (Borras, 2009; Vorley, 2002; Freedman, 1999; Beteille, 1974). Apart from being subjugated, their livelihood is centered to subsistence farming which is highly sensitive to weather, climate and water availability (Wreford et al., 2010). For example, Salinger et al. (2005) show that climate variability, drought and other related extremes have a direct negative influence on the quantity and quality of agricultural production. Bangladesh, due to its geographical location and socioeconomic vulnerabilities, is widely known as one of the most vulnerable countries of the world. Floods, droughts and cyclones occur frequently in Bangladesh throughout the centuries (Ericksen et al., 1997). Being one of the most disaster-prone countries in the world, a decent range of literatures are available on flood and cyclone management, and on climate change issues in Bangladesh. In contrast, drought could able to draw a little attention as its impacts are not noticeable in a quick time-span. Drought resulting from deficiency of rainfalls, prolonged dry periods and lack of water supply for cultivation (Hisdal and Tallaksen, 2000) differs from

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other hazards because of its slow-on-set nature and critical impacts (Wilhite et al., 2000). It affects every single climatic locale but developing countries like Bangladesh suffer more in this regard as the socioeconomic systems and pace of technology generation do not allow them to counteract effectively to the adverse effects of varying environmental conditions.

The northwestern region of Bangladesh climatically belongs to a sub-humid zone and encounters extreme weather and frequent drought conditions compared to the other parts of the country (Hasan and Mahmud-ul-islam, 2015; MoEF, 2008; Shahid et al., 2005). The government of Bangladesh executes some strategies to face the drought challenges. Most of the strategies are inclined to facilitate irrigation facility. The country's largest groundwater-fed irrigation project is located in this region, wherein about 75% of water originates from groundwater source (Adhikary et al., 2013). This over-exploitation of groundwater in association with metrological variables (erratic precipitation and temperature) is expecting to cause drought more successive, and likely to pose more threat on agricultural sectors (Shahid and Behrawan, 2008) as well as on farmers' livelihood of the area. Drought typically affects economic, environmental and social sectors adversely as a result of its diverse origins and dimensions – meteorological, hydrological, agricultural and socioeconomic (Coleen et al., 2006). Paul (1998) shows that drought adversely affects production output, surface and ground water levels, livestock, fish and wildlife in the northern region of Bangladesh. All these have combined impacts on livelihood of the farming community. Rashid (2002) depicts that households living in the drought prone region of Bangladesh are more exposed to food insecurity and unemployment than that of flood affected areas.

The rich farmers, however, possess good position to negotiate the constraints while smallholders find themselves in more vulnerable situation. Subsequently they look for both formal and informal adjustments at household, community and beyond community levels to cope with drought impacts (Paul, 1998). United Nations International Strategy for Disaster Reduction (UNISDR) (2009) defines 'coping' as the ability of people to face and manage adverse conditions, emergencies or disasters by using available skills and resources. The capacity to cope, however, requires continuing awareness, resources and good management, both in normal times as well as in crisis or adverse conditions. As per Adams et al. (1998) and Kinsey et al. (1998), coping strategies require particular endeavors that individuals employ to master, tolerate, reduce, or to minimize short-term stressful events. On the other hand, Holahan and Moos (1987) points out two types of coping strategies – (a) active, and (b) avoidant. Active coping strategies are thought to be better ways of dealing stressful events whereas avoidant coping strategies create further stressful life events. Frankenberger (1992) identifies coping activities into different phases that indicate both ex-ante and ex-post strategies. Valdivia and Dunn (1996) describe ex-ante coping strategies as the activities that households (HHs) exercise to minify their exposure to shocks while ex-post strategies deal with after-shock effects. Most of the literatures stated here deal with the drought impact and their coping strategies. But, whether the coping strategies are sustainable or compatible for successful coping is key question of the paper. It argues that success and failure of 'coping strategies' whether 'active' or 'avoidant' largely depend on the asset-base of the households, and their access to services. If smallholders suffer from low asset-base, they are likely to depend on low-input and erosive coping activities. Therefore, the goal of the study is to investigate diemensions of smallholders' coping, and their position with respect to coping status. The following segments deal with study area and methodology. Section 3 represents the results and discussion regarding impact of drought, coping strategies and coping status of the smallholders. The section 4 concludes the discussion.

Materials and Methods:-

Description of the study area:-

The study was conducted in 2017 in 4 villages (Amda, Koronda, Palashbari, and Mamudpur) of Ganguria union (the last administrative tier of the Bangladesh Government) under Porsha Upazila (sub-district) of Naoagan district. It is located in the Northwestern part of Bangladesh and climatically belongs to sub-humid zone. Ganguria is bounded by Chak Bishnupur, Badkahenda and Tentulia unions of Porsha on the west, north and south respectively, and Tilna union of Sapahar upazila to east. The extent of the Union spreads within the latitude of N-25°4' to 25°2' and the longitude of E-88°30' to E-88°32'(Fig. 1). The study area has a uniform geomorphic history, and the pattern of topographical features or landforms differs significantly from the other parts of the country. The area belongs to Barind tract, which is the largest Pleistocene of the country, is also known as old alluvium. The demarcation of the land elevation is prominent in the Ganguria union though the cropping pattern hardly changes according to land elevation. The settlements are scattered and mostly along the roads. Most of the land of this Union is cropped single time (rain-fed aman). According to Population Census, the total population of Ganguria stands about 18,000

belonging to nearly 3000 households. There are 27 deep tubewells (DTWs) in 14 villages of Ganguria providing only 15% of irrigation coverage to the total arable land of the Union (Fig. 2).

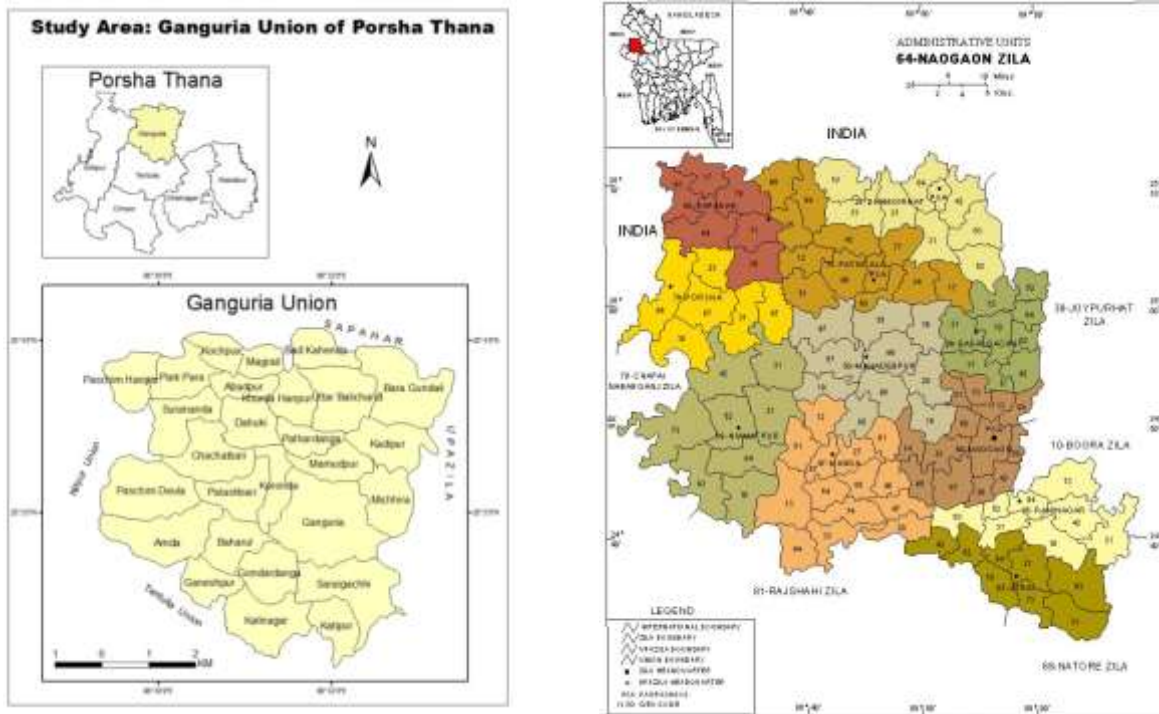


Figure 1:- Study area

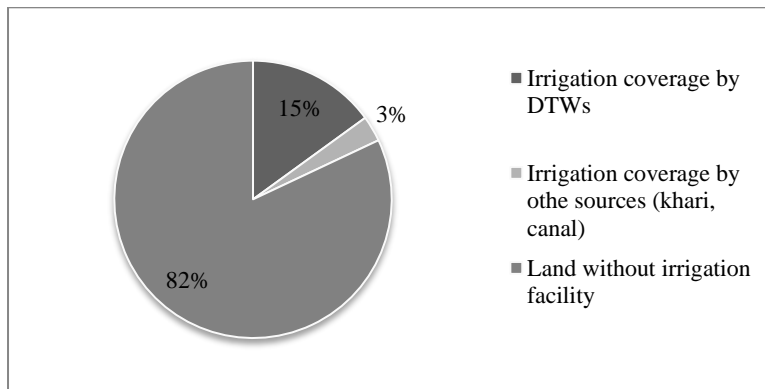


Figure 2:- Percentage of irrigation coverage in Ganguria Union (Source: field survey, 2017)

Belonging to the old alluvium the area is summer dominant hemisphere. The climate of this area is generally warm and humid. The weather of this region is classified into four groups considering rainfall, humidity, temperature, and wind pressure, such as, (i) pre-monsoon, (ii) monsoon, (iii) post-monsoon, and (iv) winter. The average temperature in summer ranges from 25 to 42 degree centigrade and 9 to 15 degree centigrade in the winter. Rainfall of this area mainly occurs in monsoon and is comparatively low in comparison to other areas of the country. The seasonal distribution of rainfall shows that almost 95% of precipitation occurs during May–October and less than 5% rainfall occurs during dry season rice (*aman*) growing period (January–April) (Fig. 3). Rainfall of this area mainly occurs in the monsoon and is comparatively low in comparison to other areas of the country. Groundwater is the main source of water for irrigation and domestic water supply during dry season (Shahid, 2008; Shahid and Behrawan, 2008) that in turn creating further hydrological drought. According to a survey, the contribution of groundwater increased from 41% in 1982/1983 to 75% in 2001/2002 and the surface water declined from 59% to less than 25% over the same period in the region. Studies show that the groundwater recharge potentiality of the region is low in 85% cases

(Jahan 2010), and rainfall has been on a declining trend resulting in more use of groundwater for irrigation (Adham et al. 2010). So, the study area experiences both hydrological and meteorological droughts.

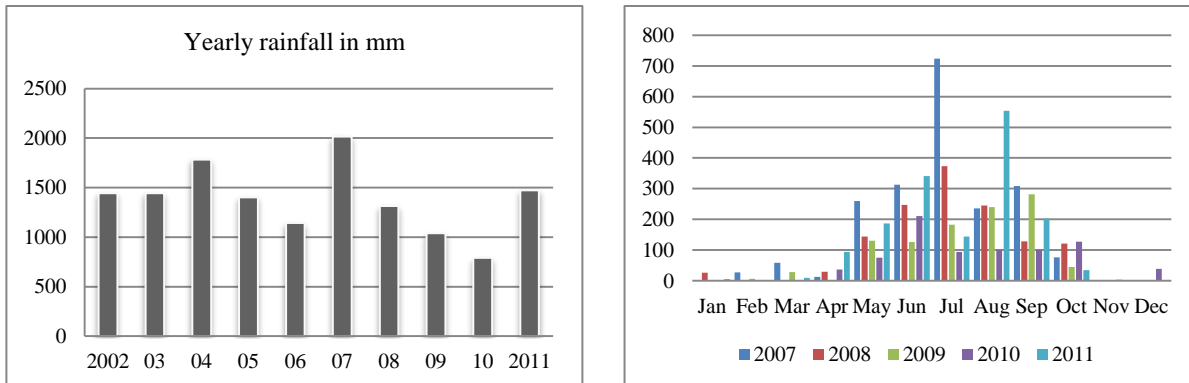


Figure 3:-Yearly (2002-2011) and monthly (Jan-Dec) precipitation of the region (Graph is developed based on the data collected from Bangladesh Meteorological Department (BMD))

Data Collection and Analysis:-

A mixed method approach was applied to collect and analyze data. Primarily, Porsha upazila (sub-district) of Naogaon district of Bangladesh was chosen as study zone after reviewing different literatures on drought and its impact. In the next stage, 4 villages were selected purposively following key informant interviews (KIIs) with personnel from Department of Agricultural Extension (DAE) and Barind Multipurpose Development Authority (BMDA). Exposure to drought and majority of the people living on subsistence farming were among the major consideration for selecting the villages. Subsequently, 4 focus group discussions (FGDs) were conducted with the representatives from key stakeholder groups of the villages to spot the smallholders on social maps. Each group discussion was comprised of 10-12 members. Since there is no specific definition of smallholders (Calcaterra, 2013) and the aspects and determinants of smallholder vary across time and society, the study considered smallholders as the HHs that possessed less than 0.5 hectare of farmland, lived on subsistence cultivation, utilized whole family labor for production, and did not pay income-tax (earn less than BDT 2,50,000 annually; USD 1 = 80 BDT). Following the procedures, 200 HHs were selected as sample from 1015 smallholder HHs by applying 'sample size calculator' (retrieved from: <https://www.listendata.com/2012/10/sample-size-calculator-in-excel.html>) in Microsoft Excel. A systematic random sampling was also applied to spot 200 HHs based on the HHs number indicated on 4 social maps and by generating random number in Microsoft Excel. Household was the unit of analysis, and household heads were interviewed as respondents by structured questionnaire. Interviews were conducted by making personal visits to the chosen households.

The questionnaire dealt with four different aspects – (a) basic demographic information; (b) total household income and occupational diversification; (c) coping strategies; and (d) coping status of the smallholders. Basic demographic data incorporates age, education, household size and total earning members. Total household income is the sum of incomes both from on-farm and off-farm activities while occupational diversification admits income generating professions outside farming. By coping, the study refers to actions or strategies that smallholders adopt to deal with the loss of crop production, income deficiency and seasonal unemployment resulted from drought. Coping strategies were broadly divided into two categories – (a) active coping strategies, and (b) avoidant coping strategies. Income generating and off-farm activities such as wage employment, pulling rickshaw/van, engaging in petty business etc. were considered as active coping strategies. Avoiding coping strategies include reducing food intake, dependence on community or beyond community support, cutting food intake, taking loan, and selling household assets and wage in advance. The study referred 'coping status as respondents' perception regarding their position in coping scale. Coping status was categorized into five scales, i.e., (i) failed to cope – the condition of the household is deteriorating as they were cutting of food intake substantially, locked into debt, selling household assets, and depending on community support; (ii) neither failing nor succeeding – their status had not changed much; (iii) coping partially – households that minimized risk and loss at small scale, compromise with food intake at minimum level, sell stacks rarely; (iv) coping moderately – enhanced income or asset-base at such a point that was potential for further development of the household, but had to compromise with some aspects; and (v) coping successfully – households gain potentials for adaptation. Subsequently, a total of 4 FGDs were organized in four villages to collect in-depth

views on collected information on coping strategies and coping status. Each group discussion comprised of 10 to 12 smallholders. The meteorological and hydrological drought scenario is established through literature review, and analyzing data collected from Bangladesh Meteorological Department (BMD). Data were arranged and analyzed in both quantitative and qualitative ways. Simple statistical techniques i.e. frequency analysis, cross tabulation and graphical presentations were processed by using Social Science Statistical Package (SPSS) software. Qualitative data collected through group discussions were interpreted non-numerically through a narrative approach and analytic description.

Results and Discussions:-

Impact Drought on Agriculture and Employment:-

The study investigated the impact of drought into two broad categories. The first is to look at the production loss because of drought and associated natural calamity, and the following one deals with employment scenario of the smallholders. It reveals that all the smallholders confronted production due to drought at some extents. The Table 1 exhibits that nearly 46% of the respondents had lost their harvest 21-30% because of dry spells and climate variability in during 2007 to 2016 followed by 18.5% that lost 31-40% of their production. Drought reduced 11-20% of crop production of 17.5% of the total HHs. A subset percentage (12.5%) of smallholders claimed more than 41% of production failure during the same period.

Table 1:- Impact of drought and climate variability on crop output

Average loss of production during the last decade (2007-2016)	Frequency (N=200)	Percent
Loss of crop output up to 10%	13	6.5
Loss of crop output by 11-20%	34	17.0
Loss of crop output by 21-30%	91	45.5
Loss of crop output by 31-40%	37	18.5
Loss of crop output by 41-50%	19	9.5
Loss of crop output by 51-60%	6	3.0

(Source: field survey, 2017)

The study demonstrates some complex findings regarding income and employment circumstances of the area. About 85% of the total households living in study villages depend on agricultural activities for their income and employment. The smallholders face a considerable period unemployment throughout the years. Fig. 4 shows a high wage inconsistency among HHs. Smallholders could find only 189 days of employment in agriculture sectors. In other ways, they confronted 124 days of unemployment per agricultural-calendar if 6-day per week employment is considered. It also depicted that they were exposed to severe unemployment in September and October. November was the only month when they got full-work as it was the harvesting period of *aman* crop (rain-fed rice).

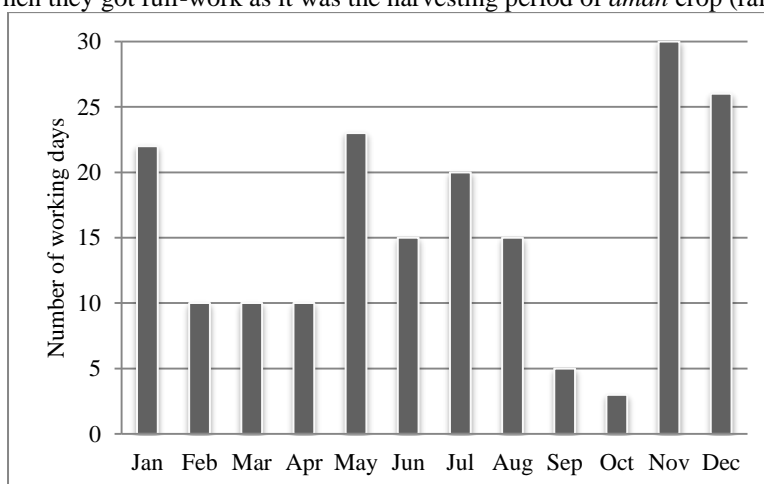


Figure 4:-Monthly working days among the smallholders (Source: field survey, 2017)

Coping Strategies:-

In many parts of rural Bangladesh, full employment is achieved through the introduction of high yielding variety (HYV) or *boro* cultivation and by expansion of irrigation facility, and promoting small scale enterprises and

technological facilities. But, the study area is prone to drought and has partial irrigation coverage. Formal sectors to provide employment to the destitute are very rare. The farming community particularly smallholders usually depend on the rain-fed *aman* crop for their employment and staple food supply. However, they face a considerable percent of production loss regularly due to drought or other natural calamity. Considering a whole year employment, they additionally confront a slack season of 2 to 4 months each year. It eventually generates seasonality in livelihoods of respondents. Consequently, they exercise a number of strategies to cope with such constraints. The strategies are divided into sections as takes after:

Active coping strategies:-

With a little resource-base, smallholders adopt multiple strategies at once to cope with income constraints. A large portion of the respondents profoundly rely on unskilled wage employment. The Table 2 demonstrates that preference of wage employment (71.5%) among the smallholders followed by raising livestock and poultry (64.5%). They contributed about 51% and 14% to the total household incomes respectively. Engaging in rickshaw/van pulling also cut a significant percentage (37.5%) bringing about 11% of aggregate household incomes. A total of 55 respondents had transferred a share of their farmland into non-cereal crops (i.e. mango, guava). It contributed 9.4% to their total incomes. Petty business, craft works and fisheries also contributed to reduce the income deficiency at different levels.

Table 2:-Active coping strategies (multiple responds counted)

#	Active coping strategies	Frequency (N=200)	Percent	Contribution to the total household income (%)
1	Wage employment (in off-farm sector)	143	71.5	51.3
2	Livestock and poultry rearing	129	64.5	13.5
3	Transformation of cereal crop field into cash/business crop	55	27.5	9.4
4	Fishery	29	14.5	2.9
5	Petty business	37	18.5	3.6
6	Van/rickshaw pulling	75	37.5	10.8
7	Others (handicrafts, tailoring etc.)	31	15.5	8.5

(Source: field survey, 2017)

Avoidant coping strategies:-

Smallholders confront great challenges to prevent their families from nourishment and income insecurities. The Table 3 incorporating multi-responds portrays various kinds of avoidant coping strategies among the smallholders. It demonstrates that 39.5% of agricultural laborers frequently sold their working days of the harvest period ahead of time. FGDs revealed that selling labor in advance substantially cut their wage into half than that of regular wage. It is an abusive practice on going in the study area for years. Yet, the smallholders barely had any choice rather to accept it. It ultimately forced them to expose to income risk during the harvest period. Taking loans stands high next as 36.5% of the respondents carried loan from different formal and informal sources to face income deficiency and unemployment. FGDs depicted that taking loan is one of the erosive coping strategies that further undermined their coping ability substantially.

The vast majority of the smallholders took loan to buy food for their family during slack season. They frequently took loans from multiple sources to pay back the past one. But, taking loans from many sources trapped them into debt, and they barely could break the cycle as reimbursement rate was high and they hardly had any surplus in hands. Livestock act as safe-guard and are often the valuable asset of the households. But, it is reported that 33.5% of the HHs sold their livestock, poultry or land during lean periods. Another 25.5% sold their non-productive household assets such as jewelry, house structures, household goods and so on. Such distress sale had another dimension as they got below normal prices as buyers were aware of their vulnerability. Participant in the FGDs claimed that once selling their household assets terribly set back in their families' savings for the next season. Due to the chronic vulnerability or income deficiency, a significant percent (23.5%) of the study people consumed less food round the year while they had to reduce the quantity per meal per day significantly during the lean periods. Sometimes they did not eat at all except the very youngest persons of the family. Some of them also relied on aids from neighbors and beyond community at some extents to move past the constraint periods.

Table 3:-Avoidant coping strategies (multiple responds counted)

#	Type of avoidant coping strategies	Frequency (N=200)	Percent
1	Sale labor in advance by accepting low wage	79	39.5
2	Take loan	73	36.5
3	Sale productive household assets (livestock, land)	67	33.5
4	Sale non-productive household assets (jewelry, house structures, goods etc.)	51	25.5
5	Reduce food intake	47	23.5
6	Get aid from neighbors/community members/development agencies	42	21.0

(Source: field survey, 2017)

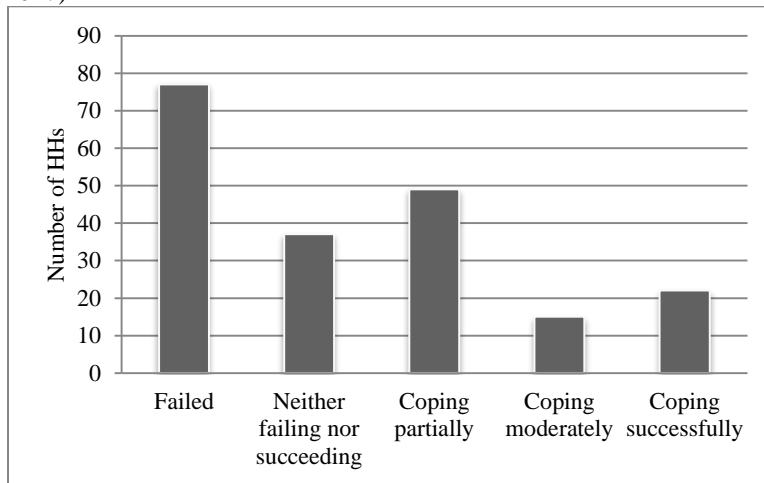


Figure 5:-Status of coping among the smallholders (Source: field survey, 2017)

Status of Coping:-

By using some indicators as stated in the materials and methods section, the study gathered data on smallholders' position with respect to coping status. It demonstrates that smallholders fall a long ways behind to cope with constraints resulting from drought and socioeconomic vulnerabilities while a very few of them make successful adjustment. The Fig. 5 depicts that a total 77 HHs (38.5%) failed back to cope with income deficiency and other related imperatives while 37 HHs asserted that their position remained same compared to near past. A total of 49 smallholders (24.5%) were coping partially whereas 'coping moderately' was claimed by 15 HHs. By embracing some sustainable adjustments, 22 HHs acclaimed successful coping. In general, the coping status of the smallholders does not demonstrate any encouraging component for a sustainable livelihood of the smallholders living with drought. The participants in the FGDs accentuated on having irrigation facility and institutional supports for building their adaptive capacity. They additionally claimed that the tenancy arrangement of the area was exploitative that considerably decreased their farm income.

Conclusion:-

Smallholders, as a distinctive social and economic group, are in the focal point of agricultural production system of Bangladesh. The biggest profession of the country, however, is being less incorporated in the development agendas. Historically, they are a community with a poor resource-base and confront difficulties to control their fate. The study explores that the smallholders experience some grim substances because of drought and climate variability. They confront persistent difficulties to adapt with these constraints. Seasonality in employment and loss of production due to drought force them to embrace multiple coping strategies at once. Coping strategies such as selling labor in advance and household assets, and reducing food intake are erosive in nature that create further vulnerability. Taking loans also limit their ability to build up an asset-base that might take them out of poverty. Smallholders also take some active coping strategies with a hope to make entry into high-return niches. Multiple sources of income, change of crop, secondary jobs and so forth enhance resilience of the smallholders to various shocks at some extents. By and large, these exercises are not equivocally tied up with sustainable livelihood strategy due to lack of institutional supports. Income deficiency, constrained farm possession, lack of access to irrigation facility, unfavorable tenancy arrangement, and poor asset-base hinder their ability to engage themselves into high return

activities as well. The study argues that smallholders lag way behind to address challenges ensuing from drought, climate variability and ever lasting socioeconomic vulnerabilities.

It is noteworthy to mention here that the study has few limitations for further interpreting these results. The sample size is non-representative. It deals with a very few variables of socioeconomic dynamics, and to comprehend coping status. Therefore, it suggests for embracing a more holistic approach to examine rural living. Finally, despite these limitations, it is hoped that present findings contribute to a growing body of knowledge of coping and smallholders' livelihood.

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