

**Impact of Market Oriented Maize Cash Crop Production on  
House-hold Food Security: Bangladesh perspective**

**A Dissertation/thesis  
by  
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## LIST OF ABBREVIATIONS

BARC	Bangladesh Agricultural Research Council
BAU	Bangladesh Agriculture University
CP	Charoen Pokphand
CSISA	Cereal System Initiative South Asia
DAE	Department of Agricultural Extension
DFID	Department for International Development
FAO	Food and Agriculture Organization
GoB	Government of Bangladesh
HFS	Household Food Security
IFAD	International Fund for Agricultural Development
KBP	Krishi Banijjyo Pratihsthan

## ABSTRACT

**Farming households from some parts of Bangladesh have increasingly been taking up maize production through efforts of a development project called Katalyst as there is huge demand in the national market for maize grains to be used for poultry feed.** Maize primarily is used as a cash crop since Bangladeshi households are not habituated with maize consumption. The issue of Household Food Security at the level of farmers mainly depend on their own subsistence production. Therefore, it is very important to understand whether by switching into maize from subsistence crop production system, farmers are being worse-off in terms of their household level food security.

**Maize productions have been found to be positively interlinked with economic advancement of farmers, notwithstanding it depends on variety of factors.** It is interesting to look at the findings accrued from an independent study commissioned by Katalyst which made conclusion on the economic impact of maize cultivation. Drawn from the large  $n$  farmers' survey and verified with the in-depth small  $n$  farmer interviews, farmers have reported to make more income through maize production as opposed to their previous crop during the same season.

**Evidence shows that the economic gains of farmers through maize production have led to increased level of household food security primarily in relation to nutritional balance.** For example, 80% of the survey respondents mentioned that their food habit improvised with the additional earnings from maize production. Farming households have reported a rise in affordability consume protein based foods such as fish or meat on an weekly basis with the additional income generated from maize production.

**Evidence shows that there lies a positive relationship between increased maize production and household food security.** Farmers have positive perception about maize cultivation and they feel that by increasing maize production they have been able to reduce their dependency on rice crop.



# Chapter1. Introduction

## 1.1 Background

Food security in 21<sup>st</sup> century is undoubtedly one of the key challenges to be faced by human race. Feeding an ever-increasing global population with a constantly-shrinking resource is an issue of paramount importance globally. 870 million people remain food insecure worldwide; with many more suffering from ‘hidden hunger’ caused by micronutrient or protein deficiencies (Graham et al. 2007; FAO 2011; Khurshid et al. 2012). In the context of Bangladesh, the multiple cases of historic famines have led to the prominence of a pseudo-understanding of food security which equates rice-sufficiency with food-security as rice is the main staple crop of the country. However, food-security has an over-arching definition and that essentially defines the existence of food security as such when all people, at all times, have access to sufficient, safe and nutritious food to maintain healthy and productive lives (The World Food Summit, 1996)

The population of Bangladesh suffers badly from annual seasonal hunger and the country is high on the global hunger index (International Food Policy Research et al. 2010). According to statistical yearbook 2014, 47% of labour force is currently employed in agriculture (BBS, 2014). In Bangladesh; farming households reduce their risk of food insecurity by producing their own food as well as try to increase their income by moving into market-oriented cash-crop production such as Maize, Jute, Cotton etc. Economists have long advocated cash crop production as part of a broader strategy of comparative advantage. The underlying premise is that markets allow households to increase their incomes by producing that which provides the highest return to land and labor, and then use the cash to buy household consumption items, rather than be constrained to produce all the various goods that the household needs to consume (Timmer 1997; Pingali 1997). Farmers in northern Bangladesh have taken up maize cultivation considerably in the past ten years and farmers of other regions are also adopting maize cultivation. This phenomenon of market-oriented maize crop production can significantly be attributed to *Katalyst* a market development project in Bangladesh which has been working in Maize sector for almost a decade with the objective of enhancing poor farmer’s income by promoting maize cultivation. There has been a significant level of growth in the sector resulting into higher level of income for poor maize farmers. Average yield of the crop is almost double that of Boro rice and three fold that of wheat. Its gross margin

based on variable cost of production is fairly satisfactory as compared to Boro rice and wheat (Table 1). Its support to other enterprises especially protein generating poultry industry is also increasing through supplying feeds at an increased volume. It also supports a market chain and generates employment not only in production but in marketing, processing, value addition activities and poultry industry (Ali, *et. el*, 2008).

Table 1. Comparative Performance of Maize, Boro rice & Wheat

Item	Boro rice	Wheat	Maize
Yield (t/ha)	5.9	2.5	8.4
Gross margin (Tk/ha)	20532	20680	49000
Benefit cost ratio	1.53	1.85	2.4

Source: Ali, *et.al.*, 2008

An operational definition of household food security is proposed as follows. A household is food secure when it has access to the food needed for a healthy life for all its members (adequate in terms of quality, quantity, safety and culturally acceptable), and when it is not at undue risk of losing such access.

Adequate global and national level food supplies remain necessary but are insufficient conditions for household food security. High levels of food self-sufficiency in low income countries have no necessary relationship to their households' food security, which has to be addressed by specific policies. Households should be viewed in the context of their community, and not in isolation. Many of the problems considered below have an important community and local government dimension and cannot be addressed by the central government alone.

Even though Bangladesh has come a long way in attaining food sufficiency since its birth, however the issue of household food security in relation to nutrition and safe foods is still very much omnipresent in a significant share of rural and urban households. According to the Bangladesh Household Food Security and Nutrition Assessment Report 2009, more than 40% of households in Bangladesh were severely affected by shocks of rising food prices during 2008. (UNICEF, 2009)

## **1.2 Objectives**

With this background, this study offers insight on the effects of market oriented maize cash crop production and how it affects the issue of food security in the farming households in Northern Bangladesh and Southern Bangladesh. The main underlying motivation for this study arises from: (i) the importance of national food security in Bangladesh and the implied need for reliable projections for planning purposes; (ii) Also, the previous studies done in this regard have mainly covered effects of rice, wheat and potato on food security. There is a very limited amount of data available on the effects of maize crop in the context of farmer level food security in Bangladesh. The study will essentially look into the immediate and long term effects of maize crop cultivation on the food security of farmers. The overall goal of the study is to pinpoint the associated positive/negative/null effects on food security/nutrition status of farmers due to involvement in the production of cash crops such as maize.

## **1.3 Research questions and hypothesis**

This research will fundamentally ask following questions in order to address aforementioned concerns/objectives:

Q1. How much additional income is generated by the farmers by investing in commercial cultivation of maize?

Q2. How these farm families are ensuring their food security in the short-term and in the long-term scenarios?

The underlying hypothesis of this research is that:

*Household food security (HFS) status of farm families are not negatively affected due to involvement in producing cash crops such as Maize, if not positively.*

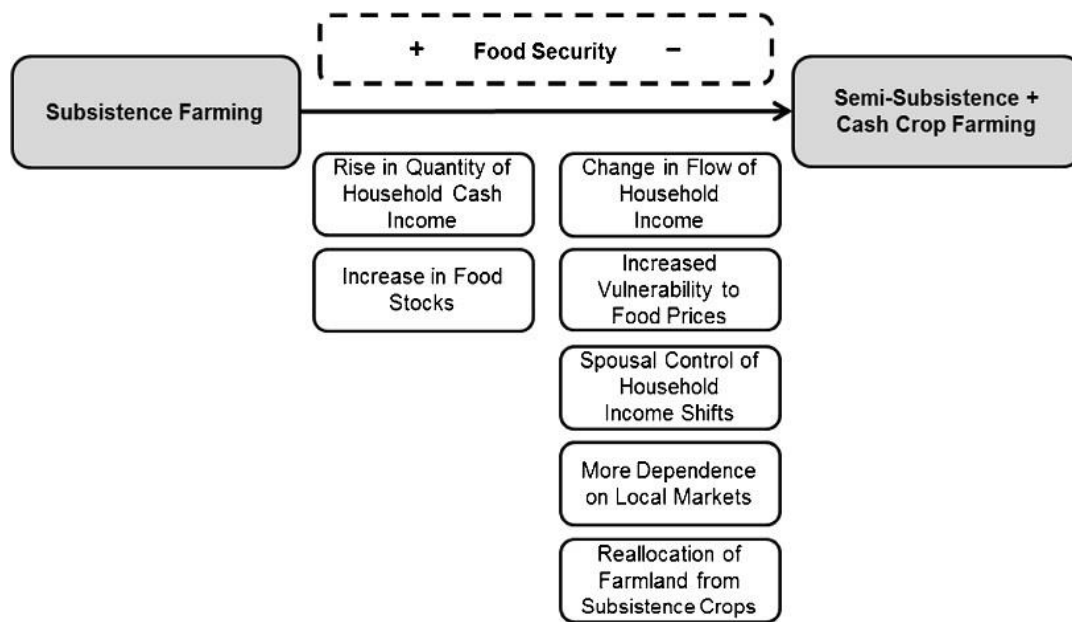
## **1.4 Rationale of the study**

In a primitive economy, a household ensures its food security mainly through subsistence production. As the economy grows and markets develop for a variety of products, subsistence production is gradually replaced by production for the market (International Fund for Agricultural Development, 1996). This tendency is further strengthened when an economy opens up to the outside world. If this happens at an advanced stage, when the population has

already crossed the threshold of hunger, as has been the case in the Western world, the shift from subsistence food production to market production does not pose a serious problem to food security (International Fund for Agricultural Development, 1996). In fact, it may even enrich the diet of the population by enabling it to obtain a wide variety of food from all over the world. But if market orientation occurs at an early stage, when a large section of the population has yet to secure access to sufficient food to guarantee a minimum required diet, questions are bound to arise regarding its impact on food security.

Indeed in recent years questions have arisen in the context of the macroeconomic reforms currently sweeping the Developing World. Markets are opening up both internally and externally, thus providing incentives to farmers to shift towards cash crops. Due to economic advancement in Bangladesh, a sizeable portion of population consumes a diet rich in poultry meat and eggs and that triggers the demand for maize/corn- a key ingredient of poultry feed.

Figure 1: Pathways to semi-subsistence & cash crop farming



Source: Anderman et al. 2014

From macro level perspective, such a strategy is being promoted across regions and countries. For example, in areas where subsistence cultivation is mainly prominent when it comes to agricultural practices, attempts are being made to encourage households to embrace

commercial agriculture. Therefore, there is a grave concern whether such a shift would add up to already existing environmental degradation. Moreover, such concerted efforts will lead to a negative effect for Household food security. The question is of considerable practical importance since the agencies responsible for policy-making ought to be aware of how their actions are likely to affect Household Food Security to the extent that they induce a shift towards market-oriented production among the poorest households.

### **1.5 Structure of the thesis**

The thesis has been structured essentially in five chapters. The first chapter talks about the reason behind choosing the topic of the thesis and provides a brief background on the topic. The second chapter talks about the methodology of the paper which has been based on an extensive literature review. This chapter delves into details of the study and how it has been formulated. The third chapter of the study presents the findings related to maize production and increased income and the succeeding chapter, presents the analysis of the increased income from maize production and household food security. The fifth chapter summarises the key findings from the study and portrays the concluding remarks and recommendations.

### **1.6 Limitations**

Although this research was cautiously prepared, there are certain limitations and shortcomings. First of all, the research was conducted in a very stringent timeline. Twelve weeks is not enough for any researcher to carry out a very through research. It would be better if it was conducted in a longer period of time. Second, the sample size for collecting data on households food security is small, only twenty farmers and hence it might not represent a holistic picture of the farmers. Third, since the questionnaire designed to measure the farmers' perspective to maize production and its relevance to their household food security was collected based on the recall method, there may have been some sort of effect of subjectivity even from farmers' end. In addition, since the data collection was conducted by the author herself, it is unavoidable that in this study, certain degree of subjectivity can be not be found. In fact, it would have been sort of objective if it had been decided by two or three enumerators.

## Chapter 2. Literature Review

### 2.1 Introduction of the intervention/case

The maize sector in Bangladesh has seen an unprecedented level of growth in terms of production in the last decade. The sector is mainly driven by the demand from poultry sector in Bangladesh as maize is one of the key ingredients for making poultry feed. By working in various maize-focused interventions for past 10 years, Katalyst (the largest market development project in Bangladesh) has contributed significantly in developing maize market of Bangladesh especially in the four regions of mainland i.e. Greater Rangpur, Greater Bogra, Greater Rajshahi and Greater Jessore in the first phase. In the second phase, since 2008, Katalyst worked in char areas of the Jamuna belt, which extends from Kurigram down to Shirajganj( Katalyst Phase 2 completion report, 2013). As mentioned earlier, Katalyst has worked to analyze the area specific issues, constraints and opportunities in those regions and has assisted in addressing those area/region specific issues and constraints utilizing the strength and opportunities to promote maize. With the advancements in the sector, the import share of maize has reduced considerably, although the demand supply gap resides at 30% currently (Kharif Study, 2013). This phenomenon coupled with the ever-growing demand of poultry sector provides the rationale for Katalyst to remain in the sector by building on the successes of earlier phases in order to assist more number of small farmers to increase their income through utilization of the growth potential of maize sector. Moreover, according to Bangladesh Agricultural Research Council (BARC, 2008), Bangladesh has more than a million hectares (out of 14 m hectares) of suitable land for maize cultivation, and this could produce between 5-9 m MT per year (BARC, 2012). Presently the area under maize cultivation covers only 0.16-0.2 m hectares (DAE, 2013) meaning a substantial increase in area coverage is very much feasible.

In phase 3, Katalyst maize sector team is promoting commercial maize cultivation across multiple seasons and regions. The sector team is essentially replicating the best case interventions of Rabi maize promotion from the previous phases in suitable regions such as Central and Southern regions of Bangladesh. In addition, the project has also identified the growing trend of summer maize cultivation in Bangladesh which has immense potential to offer to the farmers who cultivate potato, mustard and wheat mostly in Rabi season in

appropriate regions like northern region in Bangladesh. (Katalyst Maize Sector Strategy, 2015). From multiple impact assessments carried out by internal and external monitoring team, it has been found out that farmers have been able to garner additional income by getting involved in maize cultivation. However, there is no particular understanding on the effects of maize cultivation over farmers' food security. It is obvious that, maize has either replaced less profitable crop (in terms of generating cash) or accessed fallow land of farmers. Therefore, the study will essentially look into various parameters associated with house-hold food security pertaining to maize crop cultivation.

## **2.2 Introduction of Katalyst's Involvement in Maize Sector of Bangladesh**

Maize was introduced in Bangladesh in mentionable scale in the early nineties by BRAC, one of the first maize pioneers. Production rapidly increased, primarily triggered by a thriving poultry sector for which maize is the principal feed ingredient. Despite that growth, still over 75% of the milled maize was being imported at the turn of the century. Apparently, maize production had not spread as fast as it could have. Four limiting factors stood out:

- Farmers had little knowledge about maize, its cultivation requirements, post-harvest techniques such as drying and shelling and its market opportunities. Dry maize fetches a higher price than raw maize for example, also known as wet maize, but farmers didn't know how to reduce its moisture content to an optimal level. Maize is not a staple starch in a Bangladeshi diet and before its introduction in the 90s, it was a rare crop. Farmers were reluctant to try maize as little demand seemed to exist.
- Lack of inputs like seeds and finance. Input companies were not actively selling maize seeds, as few farmers asked for it, and were short of required inputs and application instructions. Maize seeds and inputs are relatively expensive and farmers, particularly in remote areas, have little capacity to invest.
- Non availability of efficient mechanical power driven maize sheller in early 90's. In that period, only manual maize sheller was available with very low capacity which made it very inefficient for usage.
- Government did not promote maize cultivation actively. Extension officers were and are important for crop promotion in Bangladesh. As explained by the Department of

Agricultural Extension, maize could potentially compete with rice and jeopardise levels of food security.

Therefore, in 2004, Katalyst decided to focus on maize. The impeding issues were typical 'market system' failures, failures that Katalyst knows how to address, and it carried great potential to benefit large numbers of rural poor. In 2007, Katalyst realised that maize could be of particular relevance for the sandy-loamy strip of land in North Bengal and on the 'char' river islands within the Ganges and Brahmaputra. These were among the poorest parts of the country where soils were not very suitable for Bangladesh's more traditional cash crops. Typically landless people, often victims of land erosion, tend to settle at these chars. Tenancy is often under the control of 'jootdars' (wealthier landowning people living in the adjoining mainland areas) who allow char dwellers to settle on this land, in exchange of a share of their produce. Logistics are complicated in these areas. It can take up to four hours to travel to the mainland by boat. There are not any markets; people have to go to the mainland to buy staples like soap and milk, to recharge their phones with credit or to sell their produce. Input suppliers like seed distributors or compost manufacturers don't go much to these areas as demand is small and potential clients too poor to buy an attractive volume. Char farmers, with their meagre incomes, tend to make the trade-off to do more subsistence based activities and more than half of their land remains idle. Moreover, cultivation knowledge of char dwellers is very limited, especially about non-traditional, new crops like maize. Speeding up the growth of maize sector in these areas would help to create income opportunities and jobs for a large number of people and would reduce Bangladesh's dependency on maize imports. Katalyst designed three sets of interventions in 2008 for more remote areas where maize was not yet grown. These are briefly explained here. A key characteristic is that none of the interventions involve farmers directly. Following a M4P approach, Katalyst aims to improve the market systems in which farmers operate so that change, and ultimately impact, has a permanent character. Interventions are therefore geared to improve that system around farmers. The three maize interventions address the previously mentioned system failures of limited knowledge about maize practices, restricted access to inputs and weak government promotion.



### ***(i)Retailer training***

The concept of retailer training program was not new to Katalyst. Since 2004, Katalyst has used retailer training as a successful model to disseminate information to a critical mass of farmers. The idea behind the retailer training model is to develop a viable business model through which an input company, their retailers, dealers and farmers can all benefit. Farmers in rural Bangladesh tend to depend on agricultural input sellers for reliable advice on the products they buy, their use and cultivation know-how. If retailers are trained well to provide this information to farmers, they will develop better sales relationship with their clients, who return for more advice and will recommend them to others as good sources of inputs and information. From the input companies perspective it also makes sense to train their retailers and dealers. They are dependent on retailers for sales. If retailers get quality training, they depend on the company for good information and products and will boost company sales. Since 2004, Katalyst has engaged in various retailer training programs, with impressive success. One of its previous partners for example, Syngenta, a global leader in input markets, has opened its own four floors training centre in 2009 to continue this intervention, without any further assistance of Katalyst. (Gibson, 2006)

In maize, Katalyst did two rounds of retailer training in 2009. It partnered with two companies, Chareon Popkhand Bangladesh Ltd. (CP) and Krishi Banijya Pratishthan (KBP) to conduct two trainings with in total 167 participants, of whom 120 were retailers, the rest mobile seed vendors and farmers (see annex IV for company profiles). The trainings covered information on quality seeds and their use in maize cultivation, appropriate dosage of fertilizers and micronutrients and general good practices for maize cultivation. (Katalyst Case Study 1, 2006)

### ***(ii)Contract farming***

Katalyst introduced the model of contract farming with Doyel Agro Limited in 2004, to develop a full service package for farmers, with easy access to inputs and secured sales (Katalyst Case Study 2, 2006). Farmers need seeds and fertilizers. Retailers could sell these to farmers on credit whereby farmers sell produced maize in return. In other word, farmers would be contracted by retailers to produce maize. For farmers, this deal provided the opportunity to produce a cash crop, substantially improving their incomes. For retailers, it

gave them the opportunity to expand their existing portfolio, play the role of a ‘trader’ and earn more income too.

Building on the success of 2004, Katalyst selected 13 contractors in 2009 and 2010 to introduce maize-based cropping pattern on the mainland and char areas where maize wasn’t being grown. Katalyst helped these contractors to do trainings, demo plots and field days to visually demonstrate farmers how to grow maize. Katalyst also helped establish linkages between these contractors and maize input companies like CP and KBP to ensure that contractors would purchase quality inputs.

In 2011, enhancing its thinking about the sustainability of the model, Katalyst wanted CP to take over its role. CP had two separate businesses, agro input and poultry mills. For their poultry mill, CP used to purchase maize from local and international markets. Katalyst contacted CP and tested its interest to become a maize contractor, to supply inputs and secure supply of domestic quality maize. CP’s retailers would supply farmers with inputs on credit, offer them training to cultivate quality maize and guarantee the uptake of maize. Retailers would sell the maize to CP and adjust the price of inputs. CP got convinced and first started working with all 13 contractors. Jointly with Katalyst, CP then trained another batch of contractors and added more contractors (of which 22 sustained) to its supply chain. These 35 contractors organized farmers meetings, demo plots and other activities, to make farmers grow quality maize. The contractors selected farmers groups, using their local networks, and trustworthy group leaders through which they kept control on practices.

### ***(iii)Introducing a maize based cropping pattern***

As discussed, maize was a new cash crop and not strongly promoted by the government. Government crop promotion, using its extensive extension network, has proved successful for a fast spread of crops. Katalyst therefore designed an intervention to introduce a maize-based cropping pattern with extension officers. These people have a mandate to go to the chars and other remote areas. If Katalyst could get extension workers to actively promote the cultivation of maize, it would multiply its outreach. In 2010 and 2011, Katalyst decided to focus on Ulipur for this intervention where maize was not grown significantly yet. Katalyst partnered with the Department of Agricultural Extension (DAE) and selected 45 of its Sub Assistant Agricultural Extension Officers (SAAOs) to introduce these cropping patterns to

farmers. Jointly, they organised trainings, demonstration plots with farmers field days, to show how to cultivate maize in each season in order to grow 2 to 4 crops consecutively on the same plot.

Similarly, Katalyst in its phase 3 is promoting maize cultivation in the south-western region in Bangladesh. Katalyst in collaboration with renowned maize input companies intends to bring in a number of changes. Firstly, farmers of the respective region will be properly educated about maize cultivation practices. Secondly, the retailers would be actively disseminating maize cultivation related information. Ultimately, this intervention will result in enhanced capacity of the input sellers and agricultural extension officials which will eventually enhance farmers' knowledge on improved maize cultivation in a sustainable manner. More farmers are expected to cultivate maize using quality seeds and improved cultivation practice. With adoption of improved cultivation techniques farmers will experience better yield. This will increase farmers' income from agricultural activity and lead to poverty alleviation

### **2.3 Other's Work**

The issue of food security has garnered a lot of attention in the academia and in relation to that, there have been many studies/researches conducted on the effect of food crop/cash crop production over food security. In light of this, the majority of the literature focusing on Bangladesh or South Asia has mainly delved into figuring out effects of rice cultivation on farmers' food security. On the contrary, there are quite a number of researches conducted in the context of African region on the aforementioned issue which have been quoted below.

According to findings from a recent paper on the relationship between rice and food security in the context of Bangladesh, advancement of the rice harvest date during the monsoon season or kharif-2, through use of short-term rice varieties, reduced the levels of hunger for the rice farming households by providing early food supply, and generated employment within the munga period for the agricultural laborers—landless farm workers and marginal farmers—thus increased their capacity to buy food (Flores et al. 2016). Seasonal hunger is likely to continue unless seasonality of production is addressed and its effects lessened (Messer 1989). This may be achieved through agricultural innovation, which is claimed as a major solution to global hunger (DFID 2004).

On the other hand, income is the main channel by which cash crops affect food security as farmers or workers earn an income by growing cash crops with which they may buy a wide variety of food (LEI Wagenigen, 2014). High-valued cash crops represent one potential avenue of crop intensification. Evidence from other parts of Africa shows that processes of agricultural intensification and productivity growth are often driven by cash crops with reliable markets and predictable returns (von Braun and Kennedy 1994). Hence, cash crops improve the food access dimension of food security. Income growth also has implications for the other dimensions of food security (food availability, utilization and stability) but these effects are indirect (Thom et al. 2014). On the other hand, study shows in the context of Ghana, a significant level of negative relationships persists between each of the pillars of food security and a household's intensity of cash crop production, measured by both quantity and area. (Tai et al. 2014).

The basic attraction of cash crops is higher returns to land and labour. Increased production of cash crops is an inevitable part of the rural development process. This need not jeopardize food security, either at national or household level, and may have significant benefits for soil fertility. However, the benefits from cash crop production are likely to be unevenly distributed, both across and within households, and there may be other environmental costs. (CPHP, 2001)

In theory, production of cash crops may enable farm households to obtain more food and income than they could obtain by devoting the same household resources to own food production. This is because:

- The crops produced for cash have a higher value than those consumed for food within the household and/or,
- Production for market is possible by (degree of) specialization in production that raises the overall level of efficiency of resource use.

Increased production of crops for market is both an inevitable feature of rural development and essential if the agricultural sector is to support economic development more generally.

The studies presented in von Braun and Kennedy (1994) suggest that household participation in cash crop production need not decrease food crop production or nutritional status, although it is equally naïve to predict that enhanced income from cash crops will

automatically translate into nutritional status. Perhaps predictably, the impact of cash crop production on total household production and nutrition depends on a number of actors that are specific to each location and context:

- Whether land is scarce or relatively abundant;
- Whether attractive available technology exists to permit more intensive food crop production on smaller parcels of land, using the higher incomes available from cash cropping to purchase inputs and/or hired labour;
- The gender balance within the household and whose priorities prevail in production and expenditure decisions.

Govereih et al. (1999) note the following complementarities between cash and food crop production:

- Under credit and input market failures, participation in cash cropping ( especially where there is a contract farming scheme or other form of input-output interlocked transactions) may improve farmers' access to inputs to the benefits of food crop production;
- The spread of input-intensive cash crops may induce investment in input distribution systems.

Under crop rotation, fertilizer residues from one season's cash crop activity might enhance the following season's food crop. Alternatively, as above, cash cropping may allow households to obtain fertiliser directly from, either on a cash or credit basis.

One of the lessons of studies of sustainable intensification (e.g. Tiffen et al. 1994) is that cash income is important in permitting labour hire and input purchase. Such income can be obtained either from non-farm employment or from crop sales. In parts of South Asia, rural industrialization is assuming increasing importance. However, in sub-Saharan Africa, excluding the polar extremes of most remote and most accessible areas, cash cropping remains the most important income source.

One of the most problematic areas for cash cropping is within the household. Control over marketing of the cash crops and over the revenue generated is often assumed by men, even when the resources of all household members are used in production. There is strong evidence that women typically spend such income on food and other basics, whereas men may spend more of the proceeds of cash crop sales on consumer durables or alcohol. Usually,

with the introduction of cash crops, female members of rural households face the burden of extra labour adding up to their already toiling responsibilities. (CPHP, 2001)

## Chapter 3: Methodology

Based on the understanding from literature review, the methodology of this paper adopts a mixed-methods approach by utilizing both quantitative and qualitative data. Mixed-method research approach is prominently used by researchers all around the world since it has characteristics of validating and triangulating data from various angles. Mixed methods research is defined as, a methodology for conducting research that involves collecting, analyzing, and integrating (or mixing) quantitative and qualitative research (and data) in a single study or a longitudinal program of inquiry (Johnson, Onwuegbuzie, & Turner, 2007). The purpose of this form of research is that both qualitative and quantitative research, in combination, provides a better understanding of a research problem or issue than either research approach alone. This method of research has various types of focus when it comes to designing the research. Essentially, approach and main focus on either qualitative or quantitative will depend on population. Following research designs are widely used research designs:

- Instrument design model
- Triangulation design model
- Data transformation design model
- Explanatory model

For this research, explanatory research design model is found to be best suitable for addressing the respective hypothesis of the paper. The key attributes of explanatory research design model are :

- Quantitative research questions or hypotheses will address the research question or issue.
- Information from the first phase will be explored further in a second qualitative phase.
- Qualitative data collection will be used to explore important quantitative results with a few participants.
- The reason for following up with qualitative research in the second phase is to acquire better understanding and to explain the quantitative results.

Therefore, it was important to analyze the income data of farmers who have taken up maize cultivation for last few years in the northern region. There is ample amount of secondary data

available through impact assessments conducted earlier by Katalyst maize sector team. By analyzing these data, identification of farmers who have been benefitted economically, has been done. Afterwards, farmers were interviewed coming from the same farm households related to their subsistence production and household food security. The primary data collections using two sets of structured questionnaires were carried out by conducting two field visits in the northern region (Nilphamari) and southern region (Pirojpur) of Bangladesh.

There were two set of questionnaires prepared for two types of farmers (control and treatment farmers). They were interviewed through the questionnaire (Annex 1 and 2) consisted of a general part identifying the respondent and the location. It included questions on whether they were (i) Contract farmers<sup>1</sup> or (ii) copy farmer<sup>2</sup>; and in which year they started maize cultivation. Farmers were asked for the sources of information they consulted for maize cultivation, the kind of information obtained from different sources and the perception of usefulness of that information. Finally, information was collected on the costs and benefits of maize cultivation and yields which is particularly very important for understanding the economic gain from maize production for directly intervened farmers in comparison to farmers who are not involved in maize production. The second category of questionnaire (Annex 3) specifically tried to find out essential information for understanding the relationship between increased income and food security in a micro level context. Thus, the questions are very much focused on issues such as food production, food consumption and food habits in order to unravel how an increase in income leads to change of food intake within a significant time span. Prior to this, sampling frame, sampling method and sample size were determined. Afterwards, the data has been analyzed in order to figure out the relationship status between income generation by maize cash crop production and HFS status in farm families.

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<sup>1</sup> Farmers who are part of contract farming system.

<sup>2</sup> Farmers who were influenced by the farmers who directly were part of Katalyst's intervention.



## Chapter 4: Study Results

In this chapter, we analyzed the economic impact of maize production on rural households who have embraced or expanded maize cultivation through the activities of Katalyst project. From the secondary data available through the impact assessments conducted earlier by Katalyst, there is a large amount of primary data and analysis available through which the economic impacts on farmers have been figured out. There are mainly two types of farmers which were taken into account while conducting the research paper. One type is farmers who have been involved in maize cultivation for quite some time (typically farmers in North) and another type is farmers who have taken up maize cultivation very recently for example farmers in south-western region. Again, in both the cases, two types of farmers were interviewed where one type is farmers (treatment farmers) who received access to quality information and inputs under the maize interventions facilitated by Katalyst and another type is farmers who did not come under Katalyst interventions.

Therefore, the conclusion on the effect of maize cultivation on farmers' income, can be made by just looking at primary study reports of Katalyst. As, it provides a solid ground to form judgement as well. It is important to look at the effects of maize production at farmers' end by pulling data collected on farmer's income by Katalyst team in the northern region. These data on farmers' income and cropping pattern has been collected in the timeframe of 2008 to 2015 and it cumulates to a large  $n$  sample. Katalyst follows the difference in difference method (DiD) which is a core method usually applied to determine impact at ultimate outcome level. This method compares before and after situations for treatment and control group. And, it requires a baseline survey and control groups. Even then the method is not error-free due to, amongst others, spatial and temporal biases.

### 4.1.1 Analysis

Yield and income were calculated as follows:

- Yield: For farmers, yield increase was calculated by comparing before and after yields, where before relied on recall, and comparing these to sector averages.
- Revenue: Yield was divided over dry and wet maize, which fetch separate prices, and multiplied with market prices.

- Income: The in-depth interviews on cost-benefit analysis for both treatment and control farmers were provide the basis for income calculation. By applying the difference in difference method, income increase for treatment farmers were calculated.

It is interesting to look at the findings accrued from an independent study commissioned by Katalyst which made conclusion on the economic impact of maize cultivation. Drawn from the large *n* farmers’ survey and verified with the in-depth small *n* farmer interviews, farmers from trained contractors had significantly higher yield gains, hence incomes, compared to the sector averages. Average additional incomes vary between different farmer groups from 22 to 367 USD per year which is showcased in Table 2. (LEI Wagenigen, 2013).

Table 2: Additional income effects from yield gains among contract farmers

	<b>Char 2011</b>	<b>Char 2009</b>	<b>Mainland 2011</b>	<b>Mainland 2009</b>	<b>Copy<sup>3</sup></b>
<b>Average annual additional income per farmer (BDT)</b>	13676	28669	1683	3692	6000
<b>Average annual additional income per farmer (USD)</b>	171	359	22	47	75

Source : LEI Wagenigen, 2013 (Details provided in Annex 2)

Table 2 shows that, Char farmers have benefited much more than farmers of the mainland. Also, the first batch of contracted farmers benefited more than the latter batch. All farmers increased yields. Some also increased the cultivation area. To capture impacts well, income effects have been calculated with and without the increases in land area and are averaged in the table 2. (LEI Wagenigen, 2013).

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<sup>3</sup> Farmers who were influenced by the farmers who directly were part of Katalyst’s intervention.

Additionally, another impact assessment conducted earlier by Katalyst internally looked into the efficacy of the contract farming intervention in 2011. To understand the early signs of impact questionnaire surveys and in-depth interviews were done at both the contractor (maize traders) and the farmer level. These data reflects the positive impact of the intervention at both level .

There were 1691 farmers cultivating maize under contract farming of 8 contractors. Among the 1691 farmers there are 30 female farmers who are in contract with a particular contractor. The contractors provided quality inputs (seeds, fertilizer etc.) and technical assistance to the farmers for better cultivation. This support helps to increase the yield at 0.2 MT/acre on average. As a result, they are considering the contract farming business as viable as their business turned to a profitable business. All the contractors expressed their interest for contract farming and already made a plan to expand their business.

#### 4.1.2 Impact on farmers

The contract farming system has created positive impact on farmers also. This impact has changed their way of thinking, attitude and the farming system. Their technical knowledge on cultivation has improved and the culture practice using the knowledge changed dramatically. A total 10 farmers were taken as sample to understand the impact of contract farming through predetermined questionnaires and in-depth interviews. After analyzing the data collected from contract farmers a positive impact were found. The table 3 below shows the changes in production and income due to contract farming than previous times.

**Table 3:** Before and after scenario on average increase in production and profit

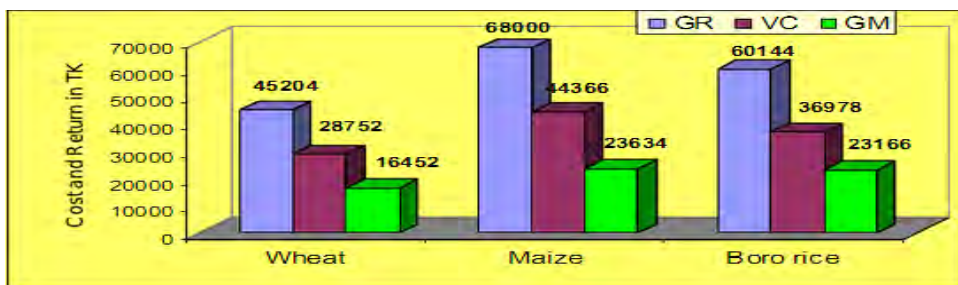
SI #	Criteria	Before contract farming	After contract farming
1	Average Production (Kg/Ha)	4643 Kg	7980 Kg
2	Average revenue (TK/Ha)	58292 Taka	99750Taka
3	Increase in production		3337 Kg, 71.12%
4	Average Production cost (Tk/ha)	29640 Taka	30608 Taka
5	Average profit Tk/Ha	28652 Taka	69142 Taka
6	Increase in profit		16393 Taka, 141.3%

**Source:** Katalyst Inception report-Maize sub-sector, 2006 and Impact assessment, Dec, 2010

Another study done very recently on the effectiveness of maize cultivation in very new regions such as Pirojpur, Barisal, Bhola, Faridpur where Katalyst is actively facilitating promotion of maize cultivation also showed positive results on the economic impact of maize cultivation on farmers. Through Katalyst’s intervention from 2014 onwards, the maize promotion intervention intends to bring in a number of changes. Firstly, farmers of the respective region will be properly educated about maize cultivation practices. Secondly, the retailers would be actively disseminating maize cultivation related information. Ultimately, this intervention will result in enhanced capacity of the input sellers and agricultural extension officials which will eventually enhance farmers' knowledge on improved maize cultivation in a sustainable manner. More farmers are expected to cultivate maize using quality seeds and improved cultivation practice. With adoption of improved cultivation techniques farmers will experience get better yield. This will increase farmers' income from agricultural activity and lead to poverty alleviation.

The results of early signs of impact assessment conducted in 2015 shows that, the number of benefitted farmers is 7695. The actual increase in income per farmer is BDT 8736. For an average land size of 107 decimal, yield increased by 7mound for treatment farmers (farmers targeted in the intervention) from previous year. However, there was no reduction in cost during cultivation. Difference in difference approach was primarily used to calculate ratios and income increase. (Katalyst Mz1 Intervention report, 2015)

Figure 2: Comparison among Wheat, Maize and Boro Rice in terms of cost, revenue and Gross Margin.



Source: Food and Agriculture Organization of the United Nations, 2013

The figure 2 shows the comparison among Maize, Wheat and Boro Rice in terms of gross revenue, variable cost and gross margin. All these three crops are prominent in Bangladesh

during winter. It is evident from the figure that, Maize's gross margin based on variable cost of production is better compared to Boro rice and Wheat. Cost of Boro production is higher due to higher irrigation cost and wheat is highly depended on weather. Moreover, the gross margin for both Boro rice and Maize is on the similar level, the factor of irrigation plays a major role in determining whether maize or Boro rice will be planted. Boro rice requires 12 to 14 times irrigation per season whereas maize requires 4 times irrigation.

While accessing these data to understand the answer to the first research question, it was possible to look into the impact stories which were captured through the Katalyst project. By evaluating these impact stories; one can comprehend the effects of maize crop cultivation at a very individual level.

#### Katalyst Maize Sector Impact Story

Babar Akter is a farmer living in Tarapur village of Puthia upazilla in Rajshahi division. He owns a small piece of land (less than 1 acre) and he keeps trying to make ends meet by cultivating various crops. He cultivates wheat/paddy in the rabi season however he keeps looking for profitable alternatives to be cultivated in kharif 1 season. Since an increased earning essentially means a better sustenance of his eight-member family. He once cultivated maize in kharif season but he was not able to receive satisfactory yield.

In 2014, Katalyst partnered up with Syngenta Seeds and two other maize seed companies with the objective in mind to promote kharif maize cultivation in suitable regions of Bangladesh. Maize being predominantly cultivated during rabi season in Bangladesh also offers insurmountable potential for cultivating in Kharif 1 season. In order to unlock this potential, Syngenta promoted better quality maize seeds, provided information on kharif maize cultivation techniques to stakeholders such as retailers and farmers.

Babar Akter usually buys seed from a retailer named 'Peeru' in Puthia upazilla. Peeru received training from Syngenta on kharif maize cultivation techniques. After the training, Peeru advised farmers in his region for kharif maize cultivation which prompted Babar to cultivate maize in his 33 decimals land. With an approximate investment of BDT 7500, Babar Akter was able to garner a production of 35 mounds/1.4MT for him. Better quality seed, timely application of fertilizer and irrigation, and knowledge of improved cultivation techniques resulted in this enriched yield which translated into profit amounts of BDT 20500 for Babar.

Through this improved knowledge on kharif maize cultivation, Babar was able to earn increased returns on his kharif 1 investment (USD 250) with which he supported his family. He also used the extra money to purchase inputs for Aman cultivation and to hire labourers for working with him.

Source: Katalyst Annual Report, 2014

From the above discussion, it is conclusive that Maize as a crop brings economic advancement for farmers. Farmers in Bangladesh who have taken up or expanded maize cultivation through facilitation activities have been economically benefitted. This conclusion definitely provides answer to our first research question which is - ‘How much additional income is generated by the famers by investing in commercial cultivation of maize?’

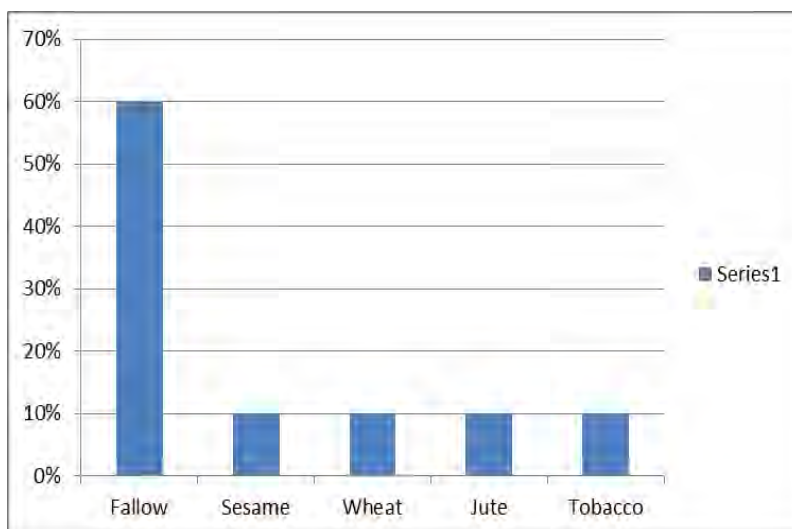
## 4.2 Relationship between Household Income and Food Security

Based on the conclusion about increased earnings in farming households through maize production, selected farmers were further interviewed in order to gather insights about the relationship between maize production and household food security status. Through questionnaire surveys (Annex 3) qualitative data were collected from farmers in Nilphamari, Jaldhaka and Pirojpur districts.

### 4.2.1 Changes in crop production and links with income increase

Analysis shows that, one of the major findings from the study revealed that, majority of the farmers switched to maize production in winter season which otherwise would have remained fallow. 60 percent of respondents of the study agreed to this phenomenon.

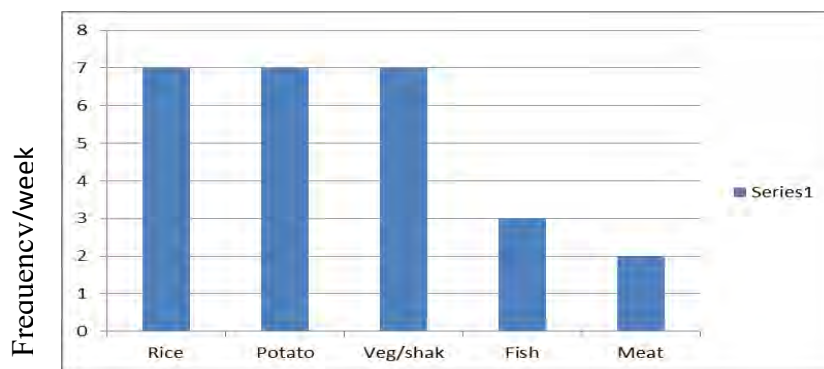
Figure 2 : Percentage of respondents’ replaced crops in order to adopt maize



Source: Field data collected for this research during March 2016.

This essentially means these farmers were able to generate additional income by adopting to maize crop production. Now the question still remains whether this extra income coming from producing crop in winter translates into better food security for the household. On the other hand, Sesame, Wheat, Jute, Tobacco are the other crops which maize replaced which constitutes of 40% of the respondents' answers. Other than wheat, all the three crops are known as cash crops for farmers. Therefore, the argument of food crops being replaced by cash crops leads to farming households being food insecure does not hold.

Figure 3: Frequency of food components being present in weekly food consumption



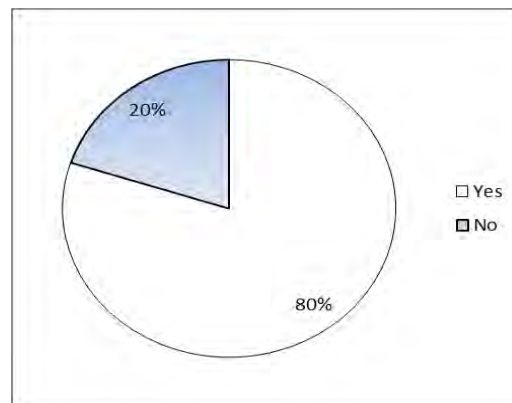
Source: Field data collected for this research during March 2016.

Figure 3 shows that, the food components that are usually present of these farming households. Rice, Potato and vegetables are the food components for the everyday meals of the survey respondents. Whereas protein based food such as fish and meat are taken usually twice a week.

### 4.2.2 Changes in Food Habit

The survey respondents confirmed changes in their food habits after getting involved in maize production. Figure 4 shows that, 80% of the respondents mentioned that their food habit improvised with the additional earnings from maize production.

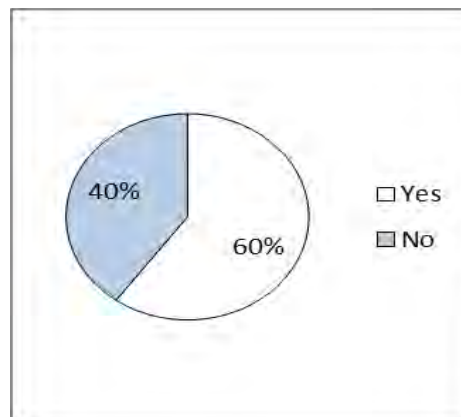
Figure 4: Change in food habit after maize production



Source: Field data collected for thesis during March 2016

The survey respondents confirmed changes in their food habits after getting involved in maize production. 80% of the respondents mentioned that their food habit improvised with the additional earnings from maize production. For example, 60% of the respondents mentioned that their protein intake became better. Previously, they could not afford buying fish and meat items from markets whereas now they can comfortably buy such products twice/thrice a week.

Figure 5: Rice sufficiency in respondents' households





Source: Field data collected for thesis during March 2016

There seems to be a positive relationship between rice sufficiency and maize production but will need further evidence. 60% of the farmers claimed that rice sufficiency has become better once they had started cultivating maize. The main reason being previously they had to sell off certain portion of the rice they used to harvest in order to meet other necessities of the house. Whereas now, they can use the earning from maize crop for the household necessities such as food consumption, children's education, land buying or leasing etc. For example - Farmers from Jaldhaka district of Rangpur region reported that by getting involved in maize production, is having impact in rice sufficiency. Previously, they had to sell off a hefty portion of their produced rice in order to meet their household needs which eventually jeopardized their on subsistence. In those circumstances, they used to consume 'Atta' (wheat grains) once or twice a day instead of rice. Whereas now, they can keep the rice produced for their subsistence and use the income from maize production for other household necessities.

Maize farmers enjoyed high levels of food self-sufficiency and adoption to cash crop did not appear to have reduced food production. This was mainly because the expansion of maize farming and their improved management had occurred through additional investments in land and hired labour rather than through the diversion of household resources away from food crops. These positive dynamics were related to the high incomes earned in maize farming. Hence most farmers could satisfy their calorie needs through own production and moreover purchase higher value foods such as meat, fish etc.

Adoption of maize production had also caused a change in the utilisation of family labour, but without seriously impacting food production, it seemed. Farmers had clearly increased their labour efforts in maize farming and processing. Most of this extra labour was supplied by women who were the main responsible for food production, but because land was the dominant production constraint, this change in labour use did not significantly reduce efforts in food production.

From the aforementioned discussion, it can be concluded that increased income from maize production has positively affected the household food security of studied farmers in Bangladesh. It is true that, the risk of increased income to be spent in other cost-heads of the

household still persists. It is also visible from the analysis that farmers were able to increase their spending on household's wellbeing by being able to spend more on buying other food items from market. This finally answers our research question two of the thesis- 'How these farm families are ensuring their food security in the short-term and in the long-term scenarios?' and we can conclude that increased income from maize cash crop production improves their nutritional well-being or even at large household food security.

## **Chapter 5. Conclusion and Recommendation**

### **5.1 Conclusion**

The consumption of maize grain in Bangladesh has been increasing gradually since 2000s due to rapid expansion of poultry industry. To meet up the increasing demand, expansion of maize production seems a promising option in terms of market dynamics, cropping patterns and profitability. From the study findings, it can be concluded that maize production have been proven to be successful to create impact at the households food security by opening up new avenues for income and using the extra income, farmers are being able to buy foods which otherwise would have been difficult for them to afford.

Farmers in the study areas perceived maize as profitable compared to other winter crops like wheat, lentils, Rice and Jute. However, this is completely an issue of subjective thought process and the study cannot conclude on the fact that which crops are less or more profitable in comparison to maize.

Farmers have positive perception about maize cultivation and they feel that by increasing maize production they have been able to reduce their dependency on rice crop. Since rice used to be their predominant crop previously, they had to forgo their rice sufficiency for meeting household necessities. But with increased maize production, they can rely on the income from maize and do not have to sell their rice produce. Further, majority of the respondents of the study acknowledged a positive relationship between increased maize production and household food security. Farmers also reported investments in new crop production, education of children and asset such as land accumulation were made possible through increased income from maize production which in itself is another positive phenomenon. By contributing to increased agriculture production and income of rural households, maize contributes to sustainable intensification. Therefore, it can be said that maize may have a catalytic effect on agricultural innovations because they add value and increase productivity in rural regions, and help develop institutions to support further growth. This argument is quite recent, and did not feature in past discussions about the relationship between cash crops and food security. Cash crops such as maize may help in accelerating these yields and help Bangladesh on a path of sustainable intensification. Thus, with the increase in population, greater reliance on cash cropping is inevitable. This need not undermine food security at household level and generally will not within the household.

Rather, as states do not try to prescribe what producers should grow, households will tend only to invest in cash crop production where they have some means of maintaining their existing food entitlements. However, the benefits from cash crop production seem to have unequal impacts within the households, both between and within the households (DFID 2012).

## **5.2 Recommendations**

Maize crop production with a focus for market consumption may potentially mean enhanced economic situation for rural households. Nonetheless, following recommendations were made based on evidences which should be carefully considered in the times of promoting market oriented maize (cash crop) production.

- Increased income from cash crop can potentially mean divergent type of food intake, but this need not automatically be beneficial for producers if food price increases outweigh income from cash crops such as maize. Therefore, conclusions can be made by considering other important factors such as local food availability, prices of food crop in local or national markets;
- Commercial agriculture can generate increased incomes for farmers on large and small farms and in the rural non-farm economy. However, a push for commercialization of agriculture should be carefully considered by taking into account of other important factors such as labour replacement, effects on food security etc.
- Geographical, economic and social contexts matter while drawing such a conclusion on relationship between cash crop production and household food security: the evidence does not support fundamentalist positions on the small versus large farm, or the subsistence versus commercial farming debates; and
- Malnutrition is only weakly correlated with income and economic wealth: other factors, notably basic health care, are of equal or greater importance depending on context.

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## Annex 1

### Questionnaire for Early Signs Impact Assessment of Mz1

**Target Group: Direct Farmer**

[The information will be used for Mz1 Intervention and will not be disclosed to others]

Respondent Detail			
Farmer Name:		Father's Name:	
Age:		Occupation:	
Mobile:		Year of Maize Farming:	
Total Land (Decimal):	Own	Lease	
Address: District:		Upazila:	
Union:	Village:	Landmark:	

Knowledge level changes	
1. Do you receive information on quality seed, cultivation technique and post -harvest for Robi /winter maize cultivation?	<u>YES</u> <u>NO</u>
1.1. If yes, from whom/where do you get that information?	i) SAAO ii) Company staff iii) Retailer/dealer iv) Farmer training program v) Farmer field day vi) Multimedia show/ Gono Natok
1.2. What key things you learned from the training or them?(just v)	I) Quality Seed II) Timing of seed sowing III) Spacing i. Line to line ii. Seed to seed  IV) Usage of Fertilizer  V) Time of Irrigation  VI) Usage of Pesticide  VII) Mature of maize grain & Collection

	VII) Post harvesting
1.3. Have you used that info on new practice of maize cultivation?	<u>Yes</u> <u>No</u>
1.4. Have you benefited from your new practice of maize cultivation?	<u>Yes</u> <u>No</u>
1.5. What is the difference you feel using the information?	i) Change in farming practice ii) Change in cropping pattern iii) Better production iv) Increase profit v) Others
2. Did you disseminate your knowledge and experience regarding quality seed, cultivation techniques and post-harvest management to other maize farmer? i) If yes, how many  ii) Type of info share  iii) Name & contract details	<u>Yes</u> <u>No</u>   i) ii) iii)
3. What type of information/techniques would you require to improve your knowledge on maize cultivation?	I) II) III)
4. What do you think, the most effective event for you or other farmer learning?	I) FTP II) Demo plot III) FFD IV) One to one discussion V) Gono Natok/ Multimedia show VI) Others.....

<b>Farming practice changes</b>			
1. Your common cropping pattern (2014-15)	<b>Robi</b>	<b>Kharif-1</b>	<b>Kharif-2</b>



2. Your common cropping pattern (2013-14)			
3. Before <b>cultivating maize after Amon</b> which crop/crops did you cultivate in those lands (2013-14 seasons)? (Replaced crop)			
4. Name of the Robi maize seed variety and Company that you used last season			
5. What are the fertilizer doses used Robi maize field last season?	<b>Fertilizers</b>	<b>Just</b> $\sqrt$	
	Decomposed cow-dung		
	Pack compost/Ash/other		
	Macro		
	Micro		
6. Spacing between seed to seed (inch)			
7. Spacing between line to line (inch)			
8. Irrigation			
9. Do you know the time of harvesting (focusing on grain maturity)  If yes, how?	<u>Yes</u>	<u>No</u>	
	.....		
10. What are the grain shelling facilities available in your area or you used?	i) By hand ii) By Sheller machine iii) others		
11. What are the drying facilities currently practiced?			
12. What is the market access available for maize grain marketing in this area?	i) From farm gate by foria ii) Bapari available in local haat iii) Buy back by retailer/ trader iv) No market access v) Others		

<b>Cost benefit analysis</b>		
<b>Total cost of production</b>	<b>Robi season-2014-15 (mainly maize)</b>	<b>Robi season-2013-14 (maize or other crop)</b>
Name of crop (cash crop):		
Land size (dc):		
Lease land cost (if applicable):		
Land preparation cost:		
Seed cost:		
<b>Fertilizer cost:</b>		
For compost:		
For macro: For Interviewer's Info, the macro names should be mentioned		
For micro: For Interviewer's Info, the micro names should be mentioned		
Macha cost (if applicable):		
Irrigation cost:		
Pesticide cost:		
Labor cost (if not mentioned earlier or if extra labor was needed)		
Harvesting cost (labor + transport):		
Shelling cost (labor + machinery rent):		
Drying cost (labor+ poly paper cost) :		
Grain transportation (if needed):		
Other cost (mention specific):		
<b>Cost of production:</b>		

Total grain/cob production (mound or pieces):	<b>Grain</b>	<b>Cob/Mocha</b>	<b>Grain</b>	<b>Cob/Mocha</b>
Last year total sold amount (mound or no. of cob):	<b>Grain</b>	<b>Cob/Mocha</b>	<b>Grain</b>	<b>Cob/Mocha</b>
Last year selling price <b>per mound or cob per piece:</b>	<b>Grain</b>	<b>Cob/Mocha</b>	<b>Grain</b>	<b>Cob/Mocha</b>
Total revenue earned after selling the grain and cob				
<b>Total profit made from Robi crop:</b>				
<b>Total points of PPI index</b>				

**Name of Interviewer:**

**Date:**

## Annex 2

### Questionnaire for Early Signs Impact Assessment of Mz1

**Target Group: Control Farmer**

[The information will be used for Mz1 Intervention and will not be disclosed to others]

Respondent detail			
Farmer Name:		Father's Name:	
Age:		Occupation:	
Mobile:			
Total Land (Decimal):	Own	Lease	
Address: District:		Upazila:	
Union:	Village:	Landmark:	

Knowledge level	
5. Do you cultivate maize in your field? If not which crop did you cultivate?	i) Yes      ii) No Crop:
6. Did you see your neighboring farmer cultivating maize in their field in proper way and getting benefit?	ii) Yes      ii) No
6.1. If yes, why you are not cultivating maize in proper way during robi or winter season?	i) lack of info ii) lack of awareness iii) Lack of Knowledge iv) lack of finance v) Other.....
6.2. From whom/where do you get any cultivation related information??(just v)	i) SAAO ii) Company staff iii) Retailer/dealer iv) Neighboring farmer v) Own experience vi) others
7. Do you think maize cultivation has problems in terms of quality inputs, cultivation technique, post- harvesting, marketing or any other?	i) Yes      ii) No
8. Do you plan to to cultivate maize in the field next year?	i) Yes      ii) No
9. What do you think, the most effective event for your or other farmer learning?	i) Farmer meeting/training ii) Demo Plot

	iii) FFD iv) One to One discussion v) Gono Natok/ Multimedia show vi) v) Others .....
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<b>Farming practice</b>			
13. Your common cropping pattern (2014-15)	<b>Robi</b>	<b>Kharif-1</b>	<b>Kharif-2</b>
14. Your common cropping pattern (2013-14)			
15. Major crop in Robi/winter season (2014-15) in terms of Land usage/Profitability			
16. Do you practice short duration T-Amon? If not, Why?	Yes	ii) No	
	If no, reason:		

<b>Cost benefit analysis</b>		
<b>Total cost of production</b>	<b>Robi season, 2014-15</b>	<b>Robi season, 2013-14</b>
<b>Name of crop</b>		
Land size		
Lease land cost (if applicable):		
Land preparation cost:		
Seed cost:		
<b>Fertilizer cost:</b>		
For compost:		
For macro: (eg Urea, MOP, TSP,DAP, NPKS, Lime)		

For micro: (eg Zinc, Boron, Gypsum, Magnesium, Sulphur)		
Irrigation cost:		
Pesticide cost:		
Cost for Macha if applicable:		
Labor cost (if not mentioned earlier or if extra labor was needed& weeding)		
Harvesting cost (labor + transport):		
Shelling & drying cost		
Transportation (if needed):		
Other cost (mention specific):		
<b>a. Cost of production:</b>		
Total production of the Robi crop (mound/kg/pieces)		
Total selling price per mound/kg/pieces		
<b>b. Total sold amount</b>		
<b>Total profit made from that Robi crop (b-a):</b>		
<b>Total points of PPI index</b>		

Name of Interviewer:

Date:

### Annex 3

### Questionnaire to Assess Impact of Cash Crop Production on HFS

Respondent Detail			
Farmer Name:		Father's Name:	
Age:		Occupation:	
Mobile:		Year of Maize Farming:	
Total Land (Decimal):	Own	Lease	
Address: District:		Upazila:	Union:
Village:		Landmark:	

Changes in Food Security					
10. How long have you been cultivating Maize?					
11. Did you increase area under maize cultivation over the years?					
12. What did you replace?					
13. What comprises of your family's daily food intake?					
14. How did it change over the years?	2015	2014	2013	2012	2011

<p>15. Which components you buy from market and which ones you grow yourself? What role your wife plays in this regard?</p>	
<p>16. Is the food grown (e.g.- Rice) in your plot enough for your yearly consumption?</p>	
<p>17. If it's not enough, how do you/your wife mitigate this matter?</p>	
<p>18. How did you/your family use the increased income from maize?</p>	

**Name of Interviewer:**

**Date:**



#### Annex 4

Analysis quoted from the paper named 'Impact evaluation of value chain interventions' by University of Wageningen

	Char 2011	Char 2009	Mainland 2011	Mainland 2009	Copy
Average annual additional production per farmer* (Maund)	35	87	5	9	18
Average annual additional revenue per farmer * (BDT)	17,410	42,980	1,938	3,879	7,947
Average annual additional production per farmer** (Maund)	78	164	11	25	39
Average annual additional revenue per farmer ** (BDT)	38,523	80,757	4,742	10,399	16,902

\* excluding change in land size: Here we use the land size of the recent season of all farmers and assume that it was the same in the previous season. For Char farmers: (Maund/Decimal Yield of Treatment Farmers in the Recent Season - Maund/Decimal Yield of Control Farmers in the Recent Season) x Land size of Treatment Farmers in the Recent Season. For Mainland Farmers: (Maund/Decimal Yield of Treatment Farmers in the Recent Season - Maund/Decimal Yield of Treatment Farmers in the Previous Season) x Land size of Treatment Farmers in the Recent Season. For Copy Farmers: The above mentioned two formulae are used giving 50% weightage to each

\*\* including land size change: Here we assume that used land size may have been different in the previous season from the recent season. This difference gets considered in the formulae here. As the acreage of most of our respondents increased in average, impact would seem to be higher when we include consideration of land size change. For Char farmers: (Maund/Decimal Yield of Treatment Farmers in the Recent Season x Land size of Treatment Farmers in the Recent Season) - (Maund/Decimal Yield of Control Farmers in the Recent

Season x Land size of the Control Farmers in the Recent Season). For Mainland Farmers: (Maund/Decimal Yield of Treatment Farmers in the Recent Season x Land size of Treatment Farmers in the Recent Season)-(Maund/Decimal Yield of Treatment Farmers in the Previous Season x Land size of Treatment Farmers in the Previous Season). For Copy Farmers: The above mentioned two formulae are used giving 50% weightage to each

Related to the ultimate outcomes of yield and income, are the intermediate outcomes of better production practices and reduced costs. As stipulated in the results chains, the knowledge exchanged between farmers and Katalyst’s retailers, contractors and extension officers was expected to reduce production costs at farmers’ level. As this result area is more directly linked to the activities of the interventions than income, attribution will be stronger. Income effects were therefore calculated by estimating production costs and revenues. This annex shows how the calculations of Table were made.

The analysis analysed production costs for all 270 contracted and 30 copy farmers. The observations were stratified per previously mentioned groups. As seen in table 8, there is an underrepresentation of farmers who started maize farming prior to 2011.

Table Stratification of sample for production cost analysis

Farmer category	n
Contract Farmer 2011 in Char	94
Contract Farmer 2009 in Char	6
Contract Farmer 2011 in Main land	141
Contract Farmer 2009 in Main land	29
Copy Farmer	32

Although existing baseline data on maize from other organisations was assessed, no useful data was found. Therefore the current industry average was used as benchmark. The calculation rules applied are presented in table 9

