Research in
AGRICULTURE, LIVESTOCK and FISHERIES
ISSN : P-2409-0603, E-2409-9325
An Open Access Peer-Reviewed International Journal

Article Code: 0238/2019/RALF
Article Type: Original Research

Res. Agric. Livest. Fish.
Vol. 6, No. 2, August 2019: 289-299.

A COMPARATIVE STUDY ON THE COSTS AND RETURNS OF ORGANIC Vs. INORGANIC FARMING PRACTICES AT SELECTED AREAS NEAR DHAKA, BANGLADESH

Md. Arafat Islam, Nazmul Ahsan Khan and Raisa Bashar

Department of Environmental Science and Management (ESM), North South University, Dhaka-1229, Bangladesh.

***Corresponding author:** Md. Arafat Islam; E-mail: arafat.nsu175@gmail.com

ARTICLE INFO

Received
12 April, 2019

Revised
08 August, 2019

Accepted
26 August, 2019

Online
31 August, 2019

Key words
Organic farming
Inorganic farming
Poverty reduction
Market management
Agricultural practices

A B S T R A C T

Inorganic farming is the norm in most areas of Bangladesh today, especially at croplands near Bangladesh's capital - Dhaka. However, several recent studies have shown that such practices cause soil degradation overtime, consequently leading to long-term harm to the environment and economic profits. This long-term cost is often avoided by most farmers as inorganic farming is believed to fetch increased productivity/monetary gains, than its environmentally friendly, organic counterpart: the primary aim of this research was to find out the validity of this belief. The research used literature review and analysis of primary data collected about input costs, returns, crop yields, environmental effects, etc., from sixty respondents (mostly farmers and consumers involved in both types of farming), using one-on-one structured interviews, and three focus group discussions at the selected areas of Savar, Sreenagar and Rupganj, focusing primarily on two popular crops – tomato and corn; graphical and tabular analyses were conducted using MS Excel to propose interpretations and record findings. Keeping all other things constant and internalizing environmental externalities, while organic farming was found to produce around 50% and 33% less tomatoes and corns in net terms, respectively, than inorganic farming, the input costs and returns from one cycle of production were found to be lower (50%) and higher (around 200USD), respectively. Hence, from a long-run perspective, organic farming was concluded as the more cost-effective choice both in economic and environmental terms, given that the Dhaka market for organic products are managed better by the producers, consumers and government, alike.

To cite this article: Islam MA, NA Khan and R Bashar, 2019. A comparative study on the costs and returns of organic vs. inorganic farming practices at selected areas near Dhaka, Bangladesh. Res. Agric. Livest. Fish. 6 (2): 289-299.

INTRODUCTION

Even though there has been success in measures to reduce poverty in recent years, using innovations and government interventions in the agriculture sector, poverty level is still considered high in Bangladesh (Paralkar, 2017). The country also faces occasional food challenges due to climatic events such as flooding, water logging, droughts or any such unexpected situation (Ahmed, 2006). Despite several such economic drawbacks, Bangladesh fulfills its food demand through primarily inorganic farming, modern technology and trained/untrained farmers (Faroque *et al.,* 2011). Also, in recent times, some crops like rice and wheat have helped Bangladesh to reach self-sufficiency and others, like jute and tea are being exported, bringing in more money and helping to alleviate poverty (Nations Encyclopedia, 2019). However, what is important to note here, but is often ignored is that, as the nation has achieved food security in at least two staples (Nations Encyclopedia, 2019) and has recently graduated to a lower–middle income status (bdnews21.com. 2015), it can now afford to balance commercial production with environmental sustainability (Saha *et al*., 2016), and sustainability in the agricultural practices of Bangladesh is only going to be possible through organic farming practices (Faruk *et al.,* 2004). However, the use of organic fertilizers and techniques (i.e. organic agriculture) needs more effort and produces lower short-term yields than its inorganic counterparts (Reganold and Wachter, 2016). Hence, unsurprisingly, inorganic farming is the existent and accepted practice in most areas of Bangladesh today, especially at croplands near Bangladesh's capital - Dhaka. However, recently published reports have declared that such practices cause soil degradation overtime, consequently leading to long-term harm to the environment and more importantly, economic profits (Kirchmann and Thorvaldsson, 2000). These long-term costs are often avoided by most farmers as inorganic farming is believed to fetch increased productivity/monetary gains, than its environmentally friendly, organic counterpart. Hence, the primary aim of this research was to find out the validity of this belief, via secondary and primary analyses at three agricultural areas near the capital – Savar, Sreenagar and Rupganj – focusing on two crops; namely tomato and corn. The assumption of the authors is that even though inorganic farming practices are bringing in more yields today, it will in reality, in the long-run, fail to alleviate poverty as the environmental issues will far outweigh the crop yields in monetary terms. The paper also aims to get an idea of the background of farming practices in the selected areas, evaluate the reasons behind the preference for inorganic farming practices, understand the awareness levels of the producers and consumers and recommend ways to promote organic products over their inorganic alternatives in Dhaka.

Under this research, inorganic farming refers to the use of chemical fertilizers and pesticides, which are detrimental to human health and the environment. Inorganic agricultural practices pollute water and reduce biodiversity; use of pesticides also pollutes the air and soil (Rahman and Debnath, 2015). Inorganic farming can produce high yields in the short term, but in the long run, production decreases due to soil degradation (Painuly and Dev, 1998). On the other hand, organic farming takes care of the soil and the yield production increases and is sustained, in the long run (Rasul and Thapa, 2004; Seufert *et al.*, 2012), as it avoids the use of chemicals and intensive practices. Organic farming is not only environmentally sustainable, but it is also financially feasible compared to conventional farming (Reganold and Wachter, 2015), especially from the long-run perspective. Several organic food report states that sales grew 170% to 63 billion USD by 2011, worldwide as they are considered costlier, but healthier alternatives (Nink, 2015). In contrast, there have been many instances when the inorganic fertilizer use in an intensive manner has caused severe health problems among members of communities (Gupta, 2017): generally, farmers use abnormally high quantity of pesticides (Rahman and Debnath, 2015); multiple cropping systems are applied in the developing countries, depending primarily on chemical fertilizers. On the other hand, organic farming can be environmentally, socially and economically good for the developing countries (Ramesh *et al.*, 2005; UNEP and UNCTAD, 2008) as apart from keeping the environmental qualities intact, the cost of the use of technology is cut down. Moreover, inorganic food has a higher content of valuable nutrients and is free from chemical residues (Faroque *et al*., 2011). The most important thing about organic farming is that it has positive externalities like the enhancement of the quality of food and freedom from pests and diseases which damage freshness and color (Halberg, 2006): all these affect the economy of the country positively.

Additionally, it is evident that the developed nations that often lead as a role model to developing nations, have now concentrated their interest in organic food consumption and production (United Nations, 2013). Even in the capital Dhaka, the demand of organic food consumption has risen and people are willing to buy organic food at higher prices (Iqbal, 2015). Hence, this research is timely as it presents a comparative analysis between the costs of organic and inorganic food production, evaluates the problems that discourage organic farming practices and analyzes the opinions/experiences of the stakeholders of three selected agricultural areas near the capital city of Dhaka to propose recommendations and identify the lacking that exists in the management of the organic food market of Dhaka, today. Even though researches concentrating on the benefits and disadvantages of both types of agricultural practices are aplenty in Bangladesh, the research at hand's novelty lies in the fact that it linked market management as a means to encourage organic farming and attempted to proof that the long-run poverty alleviation plans are going to fail if the focus is kept of inorganic farming practices.

MATERIALS AND METHODS

The research at hand was completed using data and information collected from both primary and secondary sources and via qualitative and quantitative analyses, through the employment of MS Excel to represent and evaluate results in statistical, graphical and tabular formats. The literature review helped the researchers to identify the scope of the research, areas to conduct data collection at and prepare questions for the stakeholders. To fulfill the general and specific research objectives, data and information were collected from different stakeholders like (1) farmers and residents involved in organic and/or inorganic farming practices at the three selected areas around the capital (situated in the north-eastern, western and southern directions) - Savar upazilla (sub-district) of Dhaka district, Sreenagar upazilla of Munshiganj district and Rupganj upazilla of Narayanganj district, and (2) consumers of organic and inorganic products in the elite (higher socio-economic status) (Iqbal, 2015) area's departmental stores of Dhaka city itself and these stores' managers. One-on-one interviews, using structured questionnaires prepared from analyzing previous, similar researches, of 60 farmers and other stakeholders (areas with larger population of stakeholders received larger sample sizes and vice-versa), like local consumers of organic/inorganic agricultural products, were conducted, along with one focus group discussion (FGD) at each area at the most popular local tea-stall (as pointed out by the local guide) to collect data encompassing the demographic information of the respondents, background and social, economic and environmental parameters/variables of the crops produced and awareness levels of the stakeholders of the advantages and disadvantages of both types of farming practices were conducted.

A few interviews of key informants, like managers of large departmental stores selling organic food (like fish, meat, food grains, vegetables and fruits) situated at richer areas of Dhaka city known for consumers with a taste for them, like Agora and Swapno at Gulshan 2 and Banani and surveys of 10 consumers each from these stores were also conducted to get an idea of the demand side of organic products, these products' future market prospects, awareness levels and the challenges faced, using unstructured questionnaires; authors' observations, along with the formers' opinions were later used to propose a simple market management framework. Literature was reviewed in the later months of 2017 and primary collection of data was done in March of 2018 over the course of three days (two weekdays and a weekend to maintain randomness) at each site, from morning to noon, as after lunch farmers became too busy to interview and most of the targeted shoppers visit the stores near midday. Additionally, using data and information from primary and secondary sources, respectively, a comparative analysis between organic and inorganic farming practice costs and benefits of growing two crops – tomato and corn – was conducted to conclude which type of practice is more beneficial in the long-run; this was the primary aim of the research.

Farmers were selected randomly, keeping in mind a variety of demographic and economic factors like age, sex, education levels, size of land, average crop productivity and income. From FGDs it was found that each of the selected areas had 45 – 100 farmers in the vicinity, but almost fifty percent of them were either not interested to respond and/or did not fit the criteria for selection – (a) 18 years or above; (b) middle to high income levels, as poorer farmers were too poor to have inorganic farming tools and techniques as an option; (c) resident of the area for at least five years and (d) experience of 5 years or above in farming, with or without training. The percentage of farmers at Nayarhut, Savar was found from locals and key informants to be around

24% (11 farming households from 48 in the area), at Dogachi Bazaar of Sreenagar, Mawa – 25% (25/100) and at Rupganj, Narayanganj – around 26% (23/90). During the FGDs, to maintain standardization, the less-talkative farmers were occasionally encouraged to speak over the more-talkative ones; data related to earnings and crop productivity were validated by local government officers in charge of the farm lands. The decision of areas selected for data collection was based on information from two agricultural experts of North South University and key informant interviews, that stated that (A) several of Dhaka's elite areas' stores receive organic and inorganic food products from these agricultural lands and (B) these areas had both types of farming practices, but were predominantly inorganic; Dhaka city was selected as the center for easier accessibility and also because several experts and sources (Mohiuddin, 2016; Palma, 2017) had suggested that organic food trends has started from the capital and will spread, later, to other cities/towns. In the departmental stores of Dhaka city, the shoppers of organic food were mostly women who came to the aisle labeled 'Organic Food' or asked a salesperson for these products; the manager was the person in charge at the time of the researchers' presence at the stores. The price, cost and return values, though collected in BDT, have been converted to USD and areas have been expressed in hectares (ha) to maintain a global understanding, although the values were originally collected in the local measure of 'bigha.'

DATA ANALYSIS AND RESULTS

Demographic information

Most of the farmers and consumers who were interviewed were between the ages of 25 and 35 (54%). Unsurprisingly, most of the farmers and consumers interviewed were males (78%) as these areas have patriarchal societies; 16 samples from Savar, 25 samples from Sreenagar and 19 samples from Rupganj were taken for this survey, depending on the population and availability of the farmers and consumers. Most of the respondents (80%) were farmers, but, to understand the consumers' perspectives and organic food demand, the authors also tried to involve a few consumers and suppliers, like teachers/students (10%) and businessmen (10%) from the localities, in the survey. Almost all the farmers (77%) were also the landowners. The most popular crops grown were found to be vegetables like carrots, radish, beans, cauliflower, etc. (53%), potatoes (23%), rice (16%) and corn (11%). Also, most (53%) farmers earned 10000-15000BDT/month (118.34-177.51USD/month); 26% earned between 177.53 and 236.96USD/month, while the rest (21%) earned 236.70-295.86USD/month, all of which are above the national average income of 2018 (Trading Economics, 2019). The data are summarized in Table 1.

Table 1. Demographic Information of the Respondents from the Study Areas

Demographic Parameters	**Number/Percentage**			
Age	(25-35 years) 54% [N= 32]		(36-45 years) 46% [N= 28]	
Gender	(Male) 78% [N= 47]		(Female) 22% [N= 13]	
Location	(Savar) 27% [N= 16]	(Rupganj) 32% [N= 19]	(Sreenagar) 41% [N = 25]	
Profession	(Farmers) 80% [N = 48]	(Businessman) 10% [N = 6]	(Teachers/student) 10% [N = 6]	
Owners of land	77% [N = 46]			
Landless	23% [N = 14]			
Most popular crops	Other Vegetables 50% [N = 30]	Rice 16%; [N = 10]	Corn 11%; [N = 6]	Potato 23% [N = 14]
Income per month	10000-15000 (118.34-177.51USD) 53% [N = 32]	15001-20000 (177.53-236.96USD) 26% [N = 16]	20001-25000 (236.70-295.86) 21% [N = 13]	

Background and types of farming practices at the area

Most of the farmers stated that they harvest crops twice in a year (74%) and many of the farmers declared that they use spade (7%) to plough the land. Many of the farmers (91%) believe that artificial irrigation is a better water source for their agricultural land, than rivers or rain water, because they can frequently and efficiently supply water to their land by using water pumps. Also, manure is a very common fertilizer for the farmers (80%) and is usually used before cropping the land, both as the main fertilizer by the organic farmers and as a supplement by the inorganic ones. To get a better understanding of the area's farmers and residents' views and awareness levels on both types of farming they were asked about organic fertilizer and whether they had used it before or not; 73% said that they had applied organic fertilizer and the rest said that they did not. Next, they were asked about the most used organic fertilizer they used; 43% people stated that they use manure as an organic fertilizer, followed by 18% people who preferred compost, 17% who use both manure and compost and 11% who used organic liquid pesticide. Additionally, the authors tried to evaluate how many farmers followed organic farming practices in the area; it was found that from the 95% of the people who were surveyed, only 5-10% farmers follow organic farming practices. Also, 52% people said that organic farming practice makes the soil more fertile and 18% people said that organic farming practices protect the soil microorganisms; this shows that they know about the benefits of this practice. Furthermore, 30% people said organic farming system protects the soil, leading to reduced irrigation needs and in turn, lower farming costs. When asked about the environmental effects of organic farming, 96% people claimed that they believed it to have no environmental effects. Additionally, from the 96% people who said that organic farming is beneficial for the environment gave the reasons of non-use chemical (24%), use of septic elements (19%) and preservation of beneficial insects (12%) for their belief; 45% people believed all the reasons combined provides the benefit.

Next, the farmers and other stakeholders, which included the local consumers, were asked about inorganic fertilizers and where they collected these from; 64% of the people said that they collected from the nearest market, followed by 16% who said that they were "provided at farming site" these by the non-governmental agencies; 13% and 7% respondents stated that they collect these from the nearest market, non-government agency and from government agencies, respectively. They were also asked about the popularity of inorganic fertilizers and which type they used more; 57% people replied that they mostly use urea, 7% and 5% people said that they used potash and TSP, respectively. When asked about the yield storing process, 39% responded that they depend on cold storage for storing, another 39% people said that they follow the traditional system for storing food and the rest 22% followed both types of storing processes ("as the situation required)." In addition, they were asked about the possibility of health damage by inorganic farming practices to which more than 80% people responded that inorganic farming has health effects and from among them, 53% people said that they face skin and lung problems; the rest 47% people declared that inorganic farming is also responsible for cancer. When asked about their satisfaction from inorganic farming system, 59% people said that they are not at all satisfied, while 41% people said that they are only just satisfied (not highly). Correspondingly, they were asked about the environmental effects of inorganic farming practices to which 86% replied that inorganic farming practices damage the environment through air and waterways and in the same token, 14% people believed that inorganic farming does not have any environmental effects. These results showed that the farmers and other stakeholders were highly aware of the pros and cons of both types of fertilizers and farming practices.

Organic vs. inorganic: which may lead to better poverty alleviation?

More than 80% people stated during the survey that inorganic farming system is more expensive than organic farming system. The cost of inorganic fertilizer is 3500 to 4000BDT/bigha (258.88-295.86USD/ha), whereas organic fertilizer costs from 500 to 1000BDT/bigha (39.98-73.96USD/ha). Also, the irrigation cost of inorganic farming practice is 2000 to 2500BDT (23.67-29.59USD) as stated by 77% of the people and only about 500 to 1000BDT (5.92-11.83USD) cost for lands employing organic farming system. In addition, most of the organic fertilizers (cow dung, compost, chicken witch, organic liquid pesticide) are available and can be made at home, whereas inorganic fertilizers (urea, TSP, potash, chemical pesticide) are not found easily and are costly. Additionally, 89% farmers believed that they need to take loan if they follow the inorganic agricultural system, while 97% farmers said that if they will follow the organic farming system they will not need to take loan. Loans, and more importantly, the high levels of interest attached to them, cause the farmers to be unable to ever really get out of debt and hence, poverty.

Table 2. Organic vs. Inorganic Farming Practices: Cost-Benefit Analysis

Farming/Types of Materials and Cost	**Inorganic Farming**		**Organic Farming**	
Fertilizers	Sulfur, Synthetic Fertilizer, Pre-plant Fertilizer and Zinc Foliar		Compost, Manure, Bloodmeal fertilizers, Organic Liquid pesticide and Bonemeal fertilizers	
Crops	**Tomato**	**Corn**	**Tomato**	**Corn**
Fertilizer Cost (BDT/Bigha)	4000 (47.34USD)	4000 (47.34USD)	1000 (11.83USD)	1200 (14.20USD)
Pest Control Cost (BDT/Bigha)	1500 (17.75USD)	1500 (17.75USD)	1400 (16.57USD)	1000 (11.83USD)
Technology Cost (BDT/Bigha)	2500 (29.59USD)	2500 (29.59USD)	1600 (18.93USD)	1500 (17.75USD)
Labor Cost (BDT/Bigha)	500 (5.92USD)	600 (7.10USD)	880 (10.41USD)	1000 (11.83USD)
Irrigation Cost (BDT/Bigha)	1100 (13.02USD)	1500 (17.75USD)	1100 (13.02USD)	1200 (14.20USD)
Total Input Cost (BDT/Bigha) [TIC]	9600 (113.61USD)	10100 (119.53USD)	5980 (70.77USD)	5900 (69.82USD)
Net production (Ton/Bigha) [NP]	0.25 (1.56ton/ha)	0.30 (1.88ton/ha)	0.12 (0.75ton/ha)	0.20 (1.25ton/ha)
Income from Total Output (BDT/Bigha) [ITC]	15000 (1109.47USD/ha)	17000 (1257.40USD/ha)	13800 (1020.71USD/ha)	15500 (1146.45USD/ha)
Total Benefit (BDT/Bigha) [TB]	5400 (399.41USD/ha) TBIP – tomato	6900 (510.36USD/ha) TBIP - corn	7820 (578.40USD/ha) TBOP - tomato	9600 (710.10USD/ha) TBOP – corn

Table 2 is a compilation from primary data collected and a secondary source (Klonsky, 2012) to evaluate whether truly the cost of production is lower for organic farming than inorganic farming or not. The total yield per unit area was also found and the two crops used to perform the comparison were tomato and corn as their primary and secondary data were fully and easily available. In inorganic farming practices chemical fertilizers such as sulfur, synthetic fertilizer, pre-plant fertilizer and zinc foliar were used, while organic farming needed compost, manure, blood meal fertilizers, organic liquid pesticide and bone meal fertilizers. Input costs were taken to be the costs of fertilizer, pest control, technology, labor and irrigation. For the production of inorganic tomato and corn, 9,600BDT/bigha (710.06USD/ha) and 10,100BDT/bigha (747.04USD/ha) were needed, respectively, whereas their organic counterparts' input costs were 5,980BDT/bigha (442.31USD/ha) and 5,900BDT/bigha (436.39BDT/ha), respectively: this is almost half the relative cost. However, the comparative data for inorganic vs. organic showed that organic farming practice leads to lower net production (0.25 vs. 0.12 for tomatoes (50% lesser) and 0.30 vs. 0.20 for corns (33% lesser)) in tons/bigha. Resultantly, the income from total output of inorganic tomatoes are higher than organic ones by 1,200BDT/bigha (88.76USD/ha); same is the result for corns –1,500BDT/bigha higher (110.95USD/ha). However, the bigger picture of which practice produces more benefit in total terms demonstrated that the prize goes to organic farming, as organic tomatoes and corn produce a profit of 7,820BDT/bigha (578.40USD/ha) and 9,600BDT/bigha (710.06USD/ha), respectively, while their inorganic counterparts produce the lesser total benefits of 5,400BDT/bigha (399.41USD/ha) and 6,900BDT/bigha (510.36USD/ha), respectively. Hence, at the areas under this area and for the vegetables – tomato and corn – better poverty alleviation can be brought about by applying organic farming practices over inorganic, not only because the profits in the short run is higher, but also because costs go down in the long-run too, relatively; add to this the absence of debts and that implies higher, long-term accumulation of wealth, given the demand for organic products in the urban markets remain steady at present and rise in the future.

In Table 2, TIC = Total Input Cost (found by adding the costs of fertilizer, pest, technology, labor and irrigation costs), ITC = Income from Total Output, NP = Net Production, TBOP = Total Benefit of Organic Product and TBIP = Total Benefit of Inorganic Product. Next, let us suppose that Price per kilogram of inorganic product = Y, and Price per kilogram of inorganic product = X; according to authors' observations and key informant interviews in the departmental stores (Y < X). Furthermore, for organic product, TBOP = (ITC-TIC)*NP*X and for inorganic product, TBIP = (ITC-TIC)*NP*Y. From the table, it is evident that TBOP > TBIP, for both tomatoes (578.40USD/ha > 399.41USD/ha) and corns (710.10USD/ha > 510.36USD/ha).

However, it is important to note here that the organic products do not look as appealing as inorganic products, according to the managers of stores and shoppers interviewed, and hence, many consumers avoid them as they have the misconception that the healthier the food appears, the healthier it is in terms of consumption; in reality, though, black and brown spots and less shine are an indicator of freshness and higher nutrient levels (Daily Health Post, 2015). Additionally, even though the cost of production is lower for organic farming, their market prices seems to be higher in the supermarkets that stock both inorganic and organic food in the elite areas visited by the authors; many of the key informants believed that this can be a result of the absence of economies of scale which raises the per unit cost of transporting and stocking organic food or due to the intervening parties between the farmers and the stockers who spike up the prices: it could also be due to the farmers charging higher prices, because they only see their short-term efforts, which is higher than that needed for inorganic farming (which uses chemicals and technology, making the production process easier). The prices of inorganic food are, as a result, lower as the external costs of health, environment and society are not included (Rasul and Thapa, 2004). Also, the higher price premium and lack of awareness about the benefits of organic food discourages consumers from buying them and even if they do (Iqbal, 2015) the profits do not reach the producers themselves, but gets lost in the market's supply chain.

Changes in Perspective about Organic Food

It was found that most of the farmers (52%) who were involved in the survey, knew about the national and international market demand for organic food; most (73%) believed that organic farming practices can be a way to alleviate poverty, as shown in Figure 1.

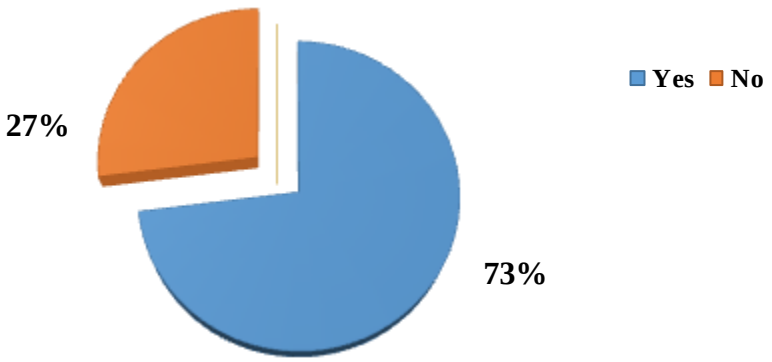

Figure 1. Poverty Reduction Possibility Perspective via Organic Farming

The authors also focused on the consumers' perspectives and found that many of the consumers (39%) are likely to buy organic food if it is available and out of this, most of the consumers (78%) would like to buy organic vegetables, because these are healthy, 16% would like to buy them because they do not have any side effects on health and 6% consumers think they are more natural and fresh.

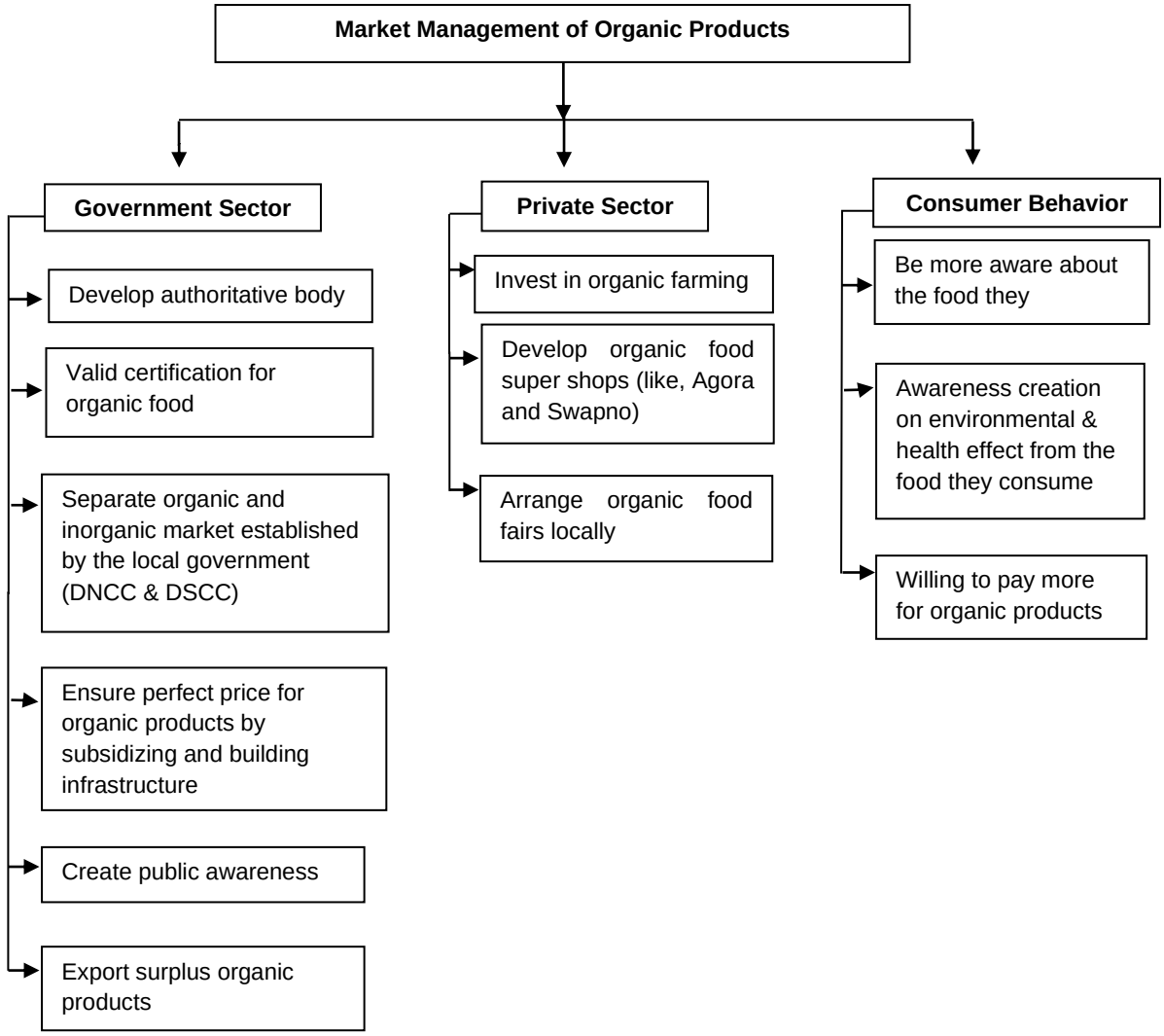

Figure 2. Proposed Market Management Framework

To summarize, it was found from the analysis and collected data and comparison with literature review that in contrast to the popular belief that inorganic farming produces more profit, organic farming practices are in reality better in economic and moreover, in environmental terms. The evidence of this was found by analyzing the cost of production, loan scenario, environmental issues and health costs associated with both types of farming. Unfortunately, most people surveyed were unaware of the increasing benefits from organic farming and increasing cost of inorganic farming in the long run and they still believe that just because the present yield for the latter is higher, that is why it is better for both short term and long run poverty alleviation. Additionally, consumer awareness of the benefit and cost of organic food and inorganic food, respectively, were low which points towards the need for enhancing market management and hence, although, the comparative analysis showed more pros on the side of organic farming/food hypothetically in terms of profitability and benefits to consumers, in reality, the real-life application is missing (The Daily Star, 2019). The implications of these and recommendations are summarized in the next chapter.

CONCLUSION AND RECOMMENDATIONS

It was found from the cost-benefit analysis that the total input cost of organic farming for tomatoes and corns is lower (around 50%) than inorganic farming. However, organic farming produces lower yield (33-50%) in terms of per unit area than inorganic farming for tomatoes and corns. Also, the income generated from total output of organic farming is lower than inorganic farming for tomatoes and corns. However, the net benefit/profit from organic farming is higher (around 30%) than inorganic farming per unit area for tomatoes and corns and is bound to go up in the long-run; this is in conflict with the popular idea among farmers and other stakeholders that inorganic farming is more profitable and hence, better for sustained poverty alleviation than organic farming. Furthermore, the external costs of organic farming practices is almost negligible, whereas for inorganic farming it is high due to the use and production of toxic substances, health and environmental issues and degradation of soil quality; this should make the prices of inorganic food higher in the market if the market was not flawed. Unfortunately, it was evaluated that even though only 32% people are unaware about environmental and health effects of inorganic farming, they still prefer it for the short-term gains. Also, organic farmers, unlike their inorganic counterparts are not dependent on loans for meeting input costs. So, to summarize, even though in the short-run profitability is higher for inorganic farming, it is higher for organic farming in the long-run.

However, supermarkets stocking both organic and inorganic food, charge higher price for the former, which implies a market flaw. The higher price and less-than-glossy appearance of the organic food discourage consumers from buying it, coupled with their lack of awareness. Inorganic farmers were also found to have higher loans than their organic counterparts as the investment cost is higher; this makes them less self-sustained and lower poverty alleviation occurs. Hence, the analysis entails that a new market management framework to supplement the existent one be created, to encourage the production, supply and consumption of organic farming/food and discourage the inorganic farming practices; such a framework is illustrated in Figure 2.

The authors believe that initiatives must come from three sectors – the government, the private producers and distributors and the consumers. The government must develop authoritative bodies to encourage and monitor organic farming and selling/buying of organic food, initiate valid certification for organic food items, create separate markets for organic and inorganic food, subsidize organic food to encourage its sell, bring down the price premium, create public awareness about the benefits of organic farming and food (both in the producer and consumer sectors) and use their links to export any surplus organic food so that it does not go to waste and harm the 'organic farmers.' Next, the private sector can contribute by investing in organic farming (with support from the government), develop organic food shops and better infrastructure in partnership with the government and hold occasional food fairs to spread awareness about organic items. Furthermore, the consumers could make themselves more aware about the benefits of organic food and the costs of inorganic food to their health and the environment and be more willing to pay a little extra to buy the organic alternatives; this especially applies for the higher-income families.

The price and quality of organic products are two main concerns for the market management of organic product (Palma, 2017), and according to the authors equality in the price of organic and inorganic products is not acceptable, because the quantity of production of organic farming is lower than inorganic farming. Certainly, it is important to note that the prices of organic products will always be higher (even if slightly) than inorganic products, not only in the local market, but also in the national and international markets, due to their positive externalities. The key informants and the authors believe that efficient access is needed for the proper market management of organic products. Additionally, it is necessary to stop or reduce the oversupply of organic products in the markets; otherwise it can decline the willingness to pay of the customers. Moreover, better contracts and links amongst the farmers, government policy-makers and sellers, new subsidization and taxation practices and infrastructure development to directly reduce costs of organic farmers will help the new growers of organic food to be guarded against price risk as well. In conclusion, going towards organic food is both economically and environmentally a good decision, but is only possible through the enhancement of market management by the authorities, producers and consumers alike; the process must be gradual, but is essential to sustain profits and keep on improving the country's farmers' economic status.

ACKNOWLEDGEMENT

The authors are grateful to the Almighty for His benevolence towards them, the Department of Environmental Science and Management of North South University for their logistic and academic support, the respondents and informants for their valuable input and their family members and friends for always being there.

CONFLICT OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Ahmed AU, 2006. Bangladesh Climate Change Impacts and Vulnerability: A Synthesis. Climate Change Cell. *Department of Environment*. Comprehensive Disaster Management Programme. Government of the People's Republic of Bangladesh.
2. bdnews24.com, 2015. Bangladesh is now lower-middle income country, says World Bank. Retrieved in June 2019 from: https://bdnews24.com/economy/2015/07/02/bangladesh-is-now-lower-middle-income-country-says-world-bank
3. Daily Health Post, 2015. Here's The Surprising Reason Why Eating Bananas With Brown Spots Is Better. Retrieved in September 2018 from: https://dailyhealthpost.com/why-you-should-eat-ripe-bananas-with-brown-spots/
4. Faroque MAA, Kashem MA and Billis SE, 2011. Sustainable Agriculture: A challenge in Bangladesh. Sustainable Agriculture, Bangladesh, 1-8.
5. Faruk MAR, Alam MJ, Sarker MMR and Kabir MB, 2004. Status of Fish Disease and Health Management Practices in Rural Freshwater Aquaculture of Bangladesh. Pakistan Journal of Biological Sciences, 7(12), pp 2092 – 2098.
6. Painuly JP and Dev SM, 1998. Environmental dimensions of fertilizer and pesticide use: Relevance to Indian agriculture. International Journal of Environment and Pollution, 10 (2): 273-288.
7. Gupta S, 2017. Food Safety and Organic Farming. Moj Food Processing & Technology, 4, 3. Retrieved in September, 2017 from: https://medcraveonline.com/MOJFPT/MOJFPT-04-00092.pdf
8. Halberg N, Alrøe HF, Knudsen MT and Kristensen ES (Eds.), 2006. *Global Development of Organic Agriculture: Challenges and Prospects*. CABI Publishing, Wallingford, United Kingdom. Retrieved in September, 2017 from: http://orgprints.org/10345/
9. Iqbal M, 2015. Consumer Behaviour of Organic Food: A Developing Country Perspective. International Journal of Marketing & Business Communication, 4: 59-68.
10. Kirchmann, H. & Thorvaldsson, G. (2000). Challenging targets for future agriculture. European Journal of Agronomy, 12: 145–161.
11. Klonsky K, 2012. Comparison of Production Costs and Resource use for Organic and Conventional Production Systems. Department of Agricultural and Resource Economics, University of California. Retrieved in June 2017 from: http://aic.ucdavis.edu/publications/NRCSKlonskypaper.pdf
12. Mohiuddin RB, 2016. Prospects of Organic Farming in Bangladesh. *Green Watch*. Retrieved in July 2019 from: http://greenwatchbd.com/prospects-of-organic-farming-in-bangladesh/
13. Nations Encyclopedia, 2019. Bangladesh-Agriculture. Retrieved in June 2019 from: https://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Bangladesh-AGRICULTURE.html
14. Nink E, 2015. Organic Farming is financially-sustainable worldwide, study finds. Food Tank. Retrieved in February 2018 from: https://www.csmonitor.com/Business/The-Bite/2015/0610/Organic-farming-is-financially-sustainable-worldwide-study-finds

15. Palma P, 2017. Choice Organic. The Daily Star. Retrieved in September 2018 from: https://www.thedailystar.net/environment/choice-organic-1415707
16. Paralkar R, 2017. Bangladesh continues to reduce poverty but at slower pace. World Bank.
17. Rahman MM and Debnath P, 2015. Urban land use changes and Urban Heat Island effect on Dhaka City, International Conference on Climate Change and Water Security (ICCWS 2015), Military Institute of Science and Technology, December 27, 2015.
18. Ramesh P, Singh M and Rao AS, 2005. Organic farming: Its relevance to the Indian context. Current Science, 88(2).
19. Rasul G and Thapa G, 2004. Sustainability of ecological and conventional agricultural systems in Bangladesh: An assessment based on environmental, economic and social perspectives. *Agricultural Systems*, 79, pp 327-351.
20. Reganold JP and Wachter JM, 2016. Organic agriculture in the twenty – first century. *Nature Plants*, 2. Retrieved from https://doi.org/10.1038/nplants.2015.221.
21. Saha SK, Saha S and Laskar PS, 2016. Food Security Status in Bangladesh: An Analytical Overview. Global Journal of Human-Social Science. Global Journals Inc. (USA). 16(2:1): 34-42.
22. Seufert V, Ramankutty N and Jonathan AF, 2012. Comparing the yields of organic and conventional agriculture. Nature, 485(4): 229 – 232.
23. The Daily Star, 2019. AGRI-BUSINESS FOR INCLUSIVE GROWTH: Prospects and Challenges for Bangladesh. Retrieved in June 2019 from: https://www.thedailystar.net/round-tables/agri-business-inclusive-growth-1549420
24. Trading Economics, 2019. Bangladesh GDP Per Capita. Retrieved in May 2019 from: https://tradingeconomics.com/bangladesh/gdp-per-capita
25. UNEP and UNCTAD, 2008. Organic agriculture and food security in Africa. UNEP-UNCTAD Capacity-building Task Force on Trade, Environment and Development.
26. United Nations, 2013. World Economic and Social Survey 2013: Sustainable Development Challenges. Department of Economic and Social Affairs. United Nations.
27. Zhang J and Li Y, 1999. Agricultural diffuse pollution from fertilizers and pesticides in China. Water Science and Technology, 39(3): 25-32.