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Prospects and Potential of Growing of Safe Vegetables Using Value Chain Approach: Case Study in Bangladesh

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Abstract--- *Bangladesh has achieved impressive growth in food production over the years to meet the ever-increasing demand of food for its population, which is currently about 160 million. Though there has been impressive growth in vegetable production over the years to meet the ever increasing demand of vegetables for its population, inland and export market, yet the biggest challenge is to ensure safe food in a sustainable manner. Indiscriminate use of harmful pesticides and chemicals in production and processing of vegetables and various other food crops and food products has made most our food unhealthy. This has created serious impact on health of the population and prevalence of various diseases has increased. Though researchers have developed technologies to use safe practices and there exist indigenous knowledge, there is a need for strengthening the value chain of food free from harmful pesticides and chemicals and food which are not adulterated so that consumers can purchase such food with trust. In order to ensure sustainable production, there is a need to consider social, technological economical, financial, environmental and marketing aspect and work along the whole value chain starting from the production to market level. This paper concentrates on safe vegetable production using value chain approach. Thereby the value chain actors, their roles and relationships, Key constraints in relation to inputs, production & marketing and the corresponding activities to address the constraints and Outcome/Impact needs to be considered.*

Keywords--- *Value Chain, Technology, Marketing.*

I. INTRODUCTION

Bangladesh has achieved impressive growth in food production over the years to meet the ever-increasing demand of food for its population, which is currently about 160 million. This is particularly case with the vegetable production. Though there has been ever increasing production of vegetable over the years in Bangladesh to meet the ever increasing demand of vegetables for its population, inland and export market, yet the biggest challenge is to ensure safe vegetables in a sustainable manner. Indiscriminate use of harmful pesticides and chemicals in production and processing of vegetables and various other food crops and food products has made most our food unhealthy. This has created serious impact on health of the population and prevalence of various diseases has increased. In order to ensure sustainable production of safe vegetable, there is a need to consider social, technological economical, financial, environmental and marketing aspects and to work along the entire value chain starting from the production to market level. That can ensure sustained supply of safe vegetables from the farmers' fields and at the same time will contribute to the farmers' income. Thereby the value chain actors, their roles and relationships, key constraints in relation to inputs, production & marketing and the corresponding activities to address the constraints and possible

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outcomes are to be considered.

II. LITERATURE REVIEW

Andersen and Cohen (1999) identified two important constraints namely natural resources management, agricultural development to food security apart from other constraints. Need for increased public investment in agricultural research is crucial. Thereby the role of technology, social and environmental factors are important. Modern biotechnology used in conjunction with traditional or conventional agricultural methods, has the potential to help agricultural productivity in developing countries. Kasturi (2009) described importance of development and technology transfer initiatives to increase the agriculture production around the world which resulted in Green Revolution. The green revolution triggered developing high yielding varieties and disease resistant grains, improved irrigation facilities, modernized infrastructure and use of fertilizer and pesticides. The potential of genetic engineering (GE) techniques for creation of virus-resistant, drought–tolerant and nutrient-enhanced crops have been stressed by UNDP (2001). This report suggested enhanced need for public investment into research and development in biotechnology to meet the agricultural needs of the world's poor.

Salin (1998) suggested the importance of IT in agricultural industry and supply chain strategy to control food quality, safety and weather-related supply variability. An appropriate usage of IT systems in agrisupply chain helps in generating information and ensuring the availability at appropriate level. Timely information helps extension workers in providing better services to farming community. The constant supply of economically reasonable priced food requires adaptation of multiple technologies (Garnett et al., 2013). World Health Organization (WHO) 2008, around 854 million people worldwide were estimated to be undernourished. Green Revolution through advancement of science, research and development and technology transfer facilitated increase of high yielding varieties, improved irrigation facilities, modernized infrastructure and use of fertilizer and pesticides. Several authors reported on the adaptation of multiple technologies (Garnett et al., 2013), natural resources management, agricultural development (Andersen and Cohen 1999), need to pursue food security and food sustainability together (Buttriss and Riley, 2013) and the challenges to achieve feed the population by 2060 (Cribb, 2011).

The biggest challenge for the world is to feed the current increasing population which in turn means it must ensure 40% increase in food production in a limited land and water using less energy, fertilizers and pesticide by 2030. The focus should be to reduce the distribution losses through improved technology.

Thereby Biotechnology plays an important role. It is a combination of diverse technologies that can be applied in different food and agriculture sectors. It includes technologies such as gene modification (manipulation) and its transfer to achieve desired characteristics in plants, development of recombinant vaccines and DNA-based methods of disease in-vitro vegetative propagation, embryo transfer etc. for increased production. The science and art of biotechnology can be utilized in plant and animal origin food products to achieve higher yields. This area requires relatively more focused research to achieve the goal of food security in developing countries. There are cases of development of transgenic plants with commercially useful traits such as resistance to herbicides, insects and viruses. The bioengineered crops require less usage of pesticide and in turn result in reduce cost to farmer, crop protection and benefit both environment and public health. GE helps to achieve better productivity by providing

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grains with increased yields and reduced inputs costs, which is required to feed a growing global population, introduce resistance to pests and disease without high cost purchased inputs, increased crop's tolerance to adverse weather and soil conditions, improve the nutritional aspects of some foods and enhance the durability of products during harvesting or shipping. The application of molecular biology-based science to agriculture has been focused mainly on large farm in developed countries.

Nanotechnology that deals with nanoparticles is not yet widely exploited to achieve food security. Nanotechnology helps scientist to understand the structure at molecular level and relate the same to microscopic level. This technology has the potential to improve the efficiency of crop production, improve food processing and food safety, minimize environmental impact of crop production and food products and increase storage and distribution capabilities (Norman and Chen, 2003). Nanotechnology can be utilised in the area of packaging and storage to increase the shelf life. However, it is equally important to establish the safety aspect while exploiting any of these technologies .Some of the plastic wraps can be developed to prevent food from spoiling by inhibiting the growth of bacteria and even edible coating can be developed using nanotechnology application (Kasturi, 2009).

Information technology is a strategic tool for agricultural development and welfare especially in rural India. The potential of IT can be explored for direct contribution to agricultural productivity by empowering farmers to take relevant information and timely quality decision which will have positive impact on the agriculture and allied activities. Precision farming extensively uses IT to make direct contribution to agricultural productivity. Other techniques such as remote sensing using satellite technologies, GIS and agronomy, soil science help to increase the agricultural output. These techniques provide useful information where large scale agriculture production is practiced .With the advent of corporate in agricultural retail sector these technologies are explored to the benefits of retailers.

Climate change appears to be the biggest threat to food security comes from the current imbalances caused by the climate change. With every 1ºC increase in temperature, there is an estimated decrease in crop production by 5%. Technology, including computers, advanced radars and the weather satellites, are keys to collecting data needed for weather forecasting for decision making. The correct weather forecasting helps the farmers to sow the seeds and harvest the plants at right time and locations.

III. METHODOLOGY

For the purpose of the study, extensive review of literature made. Besides, Focused Group Discussions' were held with the vegetable related value chain actors including the farmers, retailers, pikers, whole sellers involved in vegetable chain at the major market in Dhaka (Kawran Bazar) and also small markets including retailers were consulted.

IV. FINDINGS

Vegetables are increasingly recognized as essential for food and nutrition security, yet neither the economic nor nutritional power of vegetables is sufficiently realized. To tap the economic power of vegetables, governments will need to increase their investment in farm productivity (including improved varieties, alternatives to chemical

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pesticides, and the use of protected cultivation), good postharvest management, food safety, and market access. To tap the nutritional power of vegetables, consumers need to know how vegetables contribute to health, and find them at affordable prices or be able to grow them themselves.

Value chain actors are farmers, input sellers, local vendors, arathders, traders, retailers & consumers

Constraints in input supply (quality seeds/seedlings, resources) production (knowledge & skills), marketing (Price variations, promotional activities, lack skills on planning, collection and sales of vegetables in scale) & Finance (Accessibility of fund to buy inputs & production)

Activities to address the constraints; to develop local seed suppliers, facilitate linkage to ensure leasing of land, inputs, to provide hands-on training on how to grow, what to grow and where to grow, demonstration plots in collaboration with department of Agriculture, NGOs & private sectors.

As a result, it is expected Increased supply of desired inputs on a sustainable basis, and increased production of vegetables by the poor and smallholders can be attained & the Poor and smallholders will also increase their incomes through production of safe vegetables

4.1. Value Chain Actors and Roles

Value chain actors are farmers, input sellers, local vendors, arathders, traders, retailers & consumers

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Input Suppliers

Suppliers of seeds and seedlings; they sell seeds from reputed company who provides sometimes embedded; small seedlings grown by mini nurseries in the locality has also high demand.

Arathders who buy vegetables from commercial growers from external buyers and sell throughout the year; Arathders get supply of vegetables mainly from northwestern part (Jessore-Kushtia) region of the country and they sell through distribution outlets.

Traders who buy their daily required quantities of vegetables (mostly fleshy) and sell through their retail shops; they are the main agents for distribution of vegetables and sell various types of vegetables as per local consumers demand through retail shops.

Local vendors are those who collect fresh leafy vegetables from the HHs of their communities and sell at market places. The freshly grown vegetables are popular as they are fresh and cheap

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Wild vegetable collectors are those who collect naturally grown fresh vegetables and sell them at market places. The freshly grown vegetables are popular as they are fresh and cheap

Consumers (urban, peri-urban consumers): The consumers are individual households; hotels and restaurants

4.2. Major Constraints, Activities Suggested & Expected Results

Input supply

Constraints

- Lack of availability of quality seeds;
- Armers generally lack resources (land, money) to gain the benefit of commercial vegetable production.

Suggested Activities

- Develop local seed suppliers;
- Facilitate linkage between land owners and LCS women to lease land;
- Facilitate linkage between farmers and input sellers.

Expected Results

- Increased supply of desired inputs (seedlings) on a sustainable basis;

Production

Constraints

- Farmers lack knowledge of utilizing smallest units of their homesteads for vegetable production
- Lack of knowledge and skills on utilization of different micro-sites of their homesteads;
- Lack of promotion of home grown " organic" products grown by the poor households with no or little pesticide and using organic fertilizer
- Farmers lack necessary skills to utilize micro-sites

Suggested Activities

- Provide hands on training to the Farmers
- Train on how to grow, what to grow utilizing the micro-sites
- Access to land and cash to buy necessary inputs
- Identify local service provider
- Farmers produces vegetables for own consumption
- Farmers have required resources to plan commercial vegetable cultivation
- Price of vegetables drops when large quantity of vegetables is brought for selling in a local market
- Encourage HHs to grow early varieties which can be grown at their micro-sites;
- Develop demonstration plots with high valued/early variety in collaboration with DAE, NGOs utilizing.

Expected Results

- Enhanced income through vegetable production

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- Facilitate demonstration plots and exchange visits for the Farmers
- Farmers are practicing organic vegetable production
- Provide basic training focusing on how to utilize micro-sites for vegetable production
- Increased production of vegetables by the Farmers

Marketing

Constraints Identified

- Lack of access to market for the Poor producers to sell small quantities of surplus vegetables
- Farmers vegetable vendors lack access to commercial farmers
- Poor Farmers lack necessary funds to buy whole lot of vegetables produced by a commercial vegetable growers
- Farmers often lack skills on planning, collection and sales of vegetables in scale
- Farmers often lack ability to utilize the market based facilities

Suggested Activities

- Promote development of local vendors who will collect small quantities of vegetables from different households groups
- Facilitate development of collection points to aggregate small quantities of vegetables from the poor and small producers
- Explore the possibilities for the to get access to suitable loan products and facilities
- Train the farmers on business plan on how to procure, wherefrom to procure and costs involved and benefits derived
- Work with to enhance improved access for the enterprising women at market place
- Facilitate linkages between the local vendors and commercial growers and other farmers having surplus production of horticultural products of smallholder farmers and poor households to higher potential value chains;

Expected Results

- Increased sales of safe vegetables
- Increased production and sales of locally grown vegetables.
- Increased incomes, and improve nutritional outcomes.
- Farmers have business plan
- Increased income of the farmers through selling vegetables at market places

Financial Resources

Constraints

- HHs lack fund to lease land and to buy necessary inputs
- No access to traditional banks

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Activities

- Facilitate access to micro-credits in collaboration
- Conduct Pilot initiative in collaboration with NGOs;

Expected Results

- Farmers have access to adequate funding and are involved in regular production of vegetables

4.3. Factors to be Considered by the Implementation of Safe Vegetable Production

In order to coordinate various inputs related to safe vegetable production, including technical support required by the farmers and the value chain actors diverse partnership is required. The activities are among others; to identify companies, traders, agro-processors, shop owners interested to deal with safe vegetables & fruits; to identify universities, research organizations, government and non-government organizations in horticulture; to identify organizations working in the project areas to gain from complementarities and synergies of different programs; to organize and facilitate training in collaboration with research, extension services for the vendors, producer groups, transporters and retail sellers on how to maintain safe food supply chain and to develop MoU and effective collaboration among the farmers and the actors of value chains

Capacity development Farmers and value chain actors is equally important. Farmers needs to be organized in groups to secure inputs at reasonable costs and to sell outputs in profitable manner through bulking. The activities are among others; to organize farmers into Safe Food Producers Groups (SFPGs) consisting of 20-25 plot owners Farmers per Group); to raise awareness among framers and value chain actors through print, video, demos, theatre etc. Organized by local partners (farmers groups/local partner); to identify training needs and provide training to the participating farmer; organize contract Agreement with Groups for highly demand vegetables and fruits grown in their plots; to identify inputs required by the groups; to negotiate and agreement with local input sellers; training to the input sellers; to facilitate good trade relation between small farmers groups, local service providers and company.

Selection and production of commonly demanded vegetables and seasonal fruits will be selected. The activities are among others; to make demand list of commonly sold vegetables from the targeted shops; sample household survey to confirm of the vegetables and seasonal vegetables; selection of major vegetables and fruit items; selection of sites and areas of plots based on contiguous areas but separated from each other , pollution free area, land use history, Gher/ponds, Extensive vegetable and fruits grown area, extensive fish production areas & proximity to Dhaka (market) to be considered; farmers organized in Groups (20-25 farmers) to produce vegetables and supply to the company; prepare the Plots following the manuals, guides developed for this purpose; introduction and follow GAP by the production of selected vegetables and fruits; participate in the general Training on inputs, production & marketing of the produce organized by the farmers Groups/; share with vendors any development that could influence the business; visits Farmers Plots and advice time to time; inform any development on production on the Plot; train farmers groups on quality production, grading and packaging; check whether the manuals, guides are followed, provided any feedback.

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The items will be based on the demand and as per quantity and quality specifications of the target shops. It is expected those products will serve to increase sales volume and sales value for the company as well as for the farmers. Company will focus on non-leafy vegetables like Brinjal, Country beans, Okra, Cauliflower, bitter gourd etc. Leafy vegetables becomes quickly perishable. Unless there is high demand as reflected from the requisition given by the shops, it will not go for it. In case, the company decides for it, the item has to be collected from the places wherefrom pick up/truck can reach within 1-2 hours.

Improved access to market through Procurement & Distribution network is vital for safe food production. As a result, the farmers Groups and vendors will have their Business plans which are in conformity with that of the Company. There is smooth movement of products with appropriate packaging. The activities related to procurement are among others; to identify and develop collection points at strategic locations; to develop functional collection points (baskets, weighing scales; cool/stored place etc); to develop quality specifications and grading for different vegetables; develop different Formats required for procurement; to conduct market research to an agreed price among the involved parties; to develop business plan for vendors & the farmers groups in response to the demand of the company; to provide initial support to the vendors to collect, aggregate vegetables in a timely manner; to training on grading, improved collection and storage; to ensure timely logistic support; to prepare collection and delivery schedule with farmers groups; to maintain a group register with quantity supplied by each farmer; to assist the farmers and the vendors to secure timely & cost effective delivery of the items; to collect and aggregate and store the vegetables at a safe place till delivered to the central store ; to provide up-to-date specific information on the products available with the farmers to central store; reporting on products in the field, at the collection point and in transit on weekly basis.

The activities related to procurement are among others; to develop a distribution plan targeting the customers of shops and establishment; on a weekly basis, collect demand list of the preferred items with quantities and quality specifications by the registered consumers (local shops, chain shops, hotels and restaurants, and institutions etc.; to prepare a delivery schedule; to improve collection, sorting and storage facilities at the central store; to respond to the requisitions of the demanded items to the central store; to follow up delivery schedule; Feedback & improvement; Submit weekly sales report

Increased Access to Finance is a key factors for any success of safe vegetables. Farmers should be appraised about the loan facilities available at the Banks and by Non-financing institution level. Besides, the following activities

- To identify available credit facilities in the upazila by GoB and other banking and non-banking institutions;
- To Identify available financial service providers to respond to the needs of plot owning farmers;
- To Organize workshops with Banking & non-banking institutions; to appraise farmers of the loan facilities;
- To identify constraints faced by the framers in getting loan in their group work and interventions required to address those constraints;
- To organize training for resource farmers and to develop financing plan

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Evidence based learning highlights policy level issues and interventions required to create created enabling environment. As a result, the farmers Groups and vendors will have their Business planswhich is in conformity with that of the Company. There is smooth movement of products with appropriate packaging. The activities related to procurement are among others; to conduct survey, longitudinal case studies on successful interventions, organize national Workshops and seminars on policy based issues, organize PtP Bazar and to publish findings of different workshops and seminars.

4.4. Roles and Responsibilities of different Actors

The possible roles and responsibilities of the implementing partners are given below.

Roles of NGOs

- Overall technical coordination
- Develop base line survey questionnaire, check list and other formats as required on plot
- Organise seminars, workshops on emerging issues pertaining to Plot to plate
- Develop business plan for vendors, farmers groups
- Provide TOT to the selected Vendors, resource persons from Farmers groups on inputs, production & marketing of the produce
- Prepare manuals, guidelines for the plot owners
- Design and develop a procurement and distribution plan
- Conduct market research to fix price vegetables as agreed among the involved parties
- Develop quality specifications and grading for different vegetables.
- Develop plan of operation on movement of products
- Develop different types of monitoring formats required by the farmers, Farmer's groups & vendor & company
- Identify research and development needs and facilitate necessary linkages.
- Organize quarterly, half yearly and annual meeting, seminar & workshop to share progress with national organizations
- Document case studies, research activities.

Company

- Arrange resources for Training of the vendors, farmers' group on improved production collection and storage
- Develop plan of operation with the farmers groups and the vendors
- Arrange training for vendors & Framers groups business plan
- Agree and approve the collection points for the delivery of vegetables
- Agree and approve collection and delivery schedule with farmers groups
- Procure the items through union/upozila level vendors
- Agree on transport cost at which the collected items are to be delivered by the vendors

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- Place fund for timely payment with the delivery
- Collect information on a daily basis about the quantity & quality of the vegetables
- Inform required delivery of the items
- Follow up weekly sales (by farmers) report
- Attend monthly meeting with stakeholders
- Reporting on monthly production, procurement and sales
- Gather information on constraints faced by the vendors & farmers
- Provide logistic support including build up storage facilities for the collected items

Vendors

- Participate in the Training on grading, improved collection and storage
- Develop plan of operation with the Company, Framers groups and the Farmers
- Identify and select suitable collection points for the delivery of vegetables
- Prepare collection and delivery schedule with farmers groups
- Collect and aggregate and store the vegetables at a safe place
- Inform on a daily basis on the quantity & quality of the collected vegetables
- Arrange logistics for delivery of the items
- Produce weekly sales (by farmers) report
- Attend monthly meeting with Farmers Groups
- Prepare monthly report

Farmers Groups

- Participate in the Group Training on inputs, production & marketing of the produce
- Visits Farmers Plots time to time
- Check whether the manuals, guides are followed, provided any feedback
- Develop Group business plan to support the plot owners & the Vendors
- Together with Farmers & Vendors and other stakeholders (CARES, Company) identify and develop collection points
- Provide support to the vendors and the farmers to ensure timely collection at the collection points
- Assist vendors to collect, aggregate and store the vegetables at a safe place
- Maintain a group register with quantity supplied by each farmers.
- Maintain a functional point for gathering
- Assist the farmers and the vendors to secure timely & cost effective delivery of the items
- Attend monthly meeting with Farmers, value chain actors
- Prepare monthly report

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Farmers

- Participate in the general Training on inputs, production & marketing of the produce organized by the farmers Groups
- Prepare the Plots following the manuals, guides developed for this purpose
- Together with other Group members & Vendors and other stakeholders (CARES, Company) develop collection points
- Supply timely to the vendors, the vegetables at an agreed price.
- Cooperate with farmers Groups to record quantity and items supplied
- Inform any development on production on the Plot
- Share with vendors any development that could influence the business
- Attend monthly meeting with Farmers, value chain actors

The successful completion of the project will encourage others to replicate the project components and its elements. This may be applicable for the plots using GAP as well as the collection and distribution points. There is a need to review and analyse the impact and will incorporate lessons for the purpose of up-scaling. A cost effective procurement and distribution system will encourage others to participate and to make use of the system.

There is a need to conducting field operations including training programs and external linkages required to strengthen business. The unit will work in close contact with the procurement and sales units so that there is smooth delivery of goods and logistics are arranged accordingly. To ensure regularly supply of healthy vegetables & fruits from the plots of the farmers. He also will ensure appropriate packaging is at place and will receive technical feedback. The unit will be responsible for overall sales planning, report on sales, and designing and establishing a distribution system responsive to the new demands.

Follow up and monitoring activities are to be carried out for the purpose of the business. Among others; baseline information on the plots regarding locations, size, types of crops grown, fertiliser used, insecticides, irrigation, yield, harvesting period, grading, quality of products, grading; Seasonal, monthly and weekly purchase and sales volume to report on achievement of project targets; continuous update on information available through the vendors and farmers groups; It is important to capture and document the lessons learned and improvements further required.

V. CONCLUSION

In order to grow safe vegetables, there is a need for strengthening the value chain of food free from harmful pesticides and chemicals. There is a need to consider social, technological economical, financial, environmental and marketing aspects and to work along the whole value chain starting from the production to market level. Thereby the value chain actors, their roles and relationships, key constraints in relation to inputs, production & marketing and the corresponding activities to address the constraints and Outcome/Impact needs to be considered. The safe vegetable production requires capacity building of the farmers producing safe vegetables with required support by the local extension agents, private service providers with appropriate technology transfer and value chain approach based on market linkages. This will allow further the contract production developed between the urban distributors and the

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rural producers by establishing backward and forward linkages. There is a need to monitor the progress and necessary follow up of the interventions.

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