

Mushroom Industry in Bangladesh: A Critical Study

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Abstract: *This article is written to assess the competitiveness of the mushroom growers of Bangladesh using Porter's Diamond Model. The four determinants of Porter's model of competitiveness viz. factor conditions, demand conditions, firm's strategy, size, structure & rivalry and related & supporting industries. Since mushroom cultivation & marketing, research on mushroom product have taken place in last couple of decades in our country; few works have been done on mushroom. The study also reveals barriers the new entry faces, problems faced by the mushroom growers. The research did a cross sectional interview by using semi structured questionnaire. The findings point out the major weaknesses on the determinants of related & supporting industry. The factor condition is better except technology and capital, while demand condition is quite strong. This state of extreme variations in the state of determinants can't allow for an effective and efficient operation of the mushroom business in Bangladesh. In a diamond one weak determinant pulls down the performance of the rest of the determinants. Seventy percent of the respondents see the technology gap as the strongest barrier for a new entry. Several suggestive actions are mentioned at the end of the study to remedy the revealed drawbacks.*

Keywords: Mushroom in Bangladesh; entry barriers; competitive advantages; Porter's Diamond Model

Introduction

A mushroom is the fleshy, spore-bearing fruiting body of a fungus, typically produced above ground on soil or on its food source. The word mushroom is most often applied to fungi that have a stem (stipe), a cap (pileus), and gills (lamellae) on the underside of the cap just as do store-bought white mushrooms. People have harvested mushrooms from the wild for thousands of years for food and medicines. The Chinese have cultivated the mushroom for centuries. Of the estimated 1.5 million species of fungi, about 10,000 produce the fruiting bodies we call mushrooms. While commercial harvesting of wild mushrooms continues today, most of the world's supply comes from commercial mushroom growers. Roughly 300 mushroom species are edible, but only 30 have been domesticated and 10 are grown commercially. Button, oyster and shiitake mushrooms make up about 70 percent of the world's production. During the past 30 years, mushroom production worldwide increased twenty-fold, with much of that increase occurring in the 1980s and 1990s. Increased demand for specialty mushrooms has been particularly strong.¹

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¹ Growing Mushroom Commercially, Risk and Opportunity - Danny L. Barney, University of Idaho.

Benefits and Prospects of Mushroom

Mushroom is a very nutritious, delicious and fully 'halal' vegetable having medicinal qualities. It can be generated from lignocelluloses waste materials; and are rich in crude fiber and protein. According to Chang and Miles (1991), the amount of protein in mushroom is double than any other vegetables. So, it is called vegetable protein. In fact, it is enriched by the diet containing low fat, low calories and good vitamins and minerals. Mushroom also has bioactive compounds that impart unique medicinal values like anti-cancer and anti-viral properties.

With ever increasing demand for quality food, mushroom cultivation is emerging as an important activity in different parts of our country. In future, the ever-increasing population, depleting agricultural land, changes in environment, water shortage and need for quality food products at competitive rates are going to be important issues. To meet these challenges and to provide food and nutritional security to our people, it is important to diversify the agricultural activities in areas like horticulture. Diversification in any farming system imparts sustainability. Mushrooms are one such component that not only impart diversification but also help in addressing the problems of quality food, health and environment related issues. There is a huge prospect of mushroom cultivation in Bangladesh. They are as follows:

- ❖ Mushroom cultivation bears low cost. It can be cultivated on a small scale to allow personal consumption or on a large scale with commercial purpose even for export.
- ❖ Its cultivation may be "a lifeboat" for survival of the landless people. Because it can be grown in a room. Therefore, its yield as well as benefit per unit area is higher than any other vegetable in our country.
- ❖ Mushroom cultivation can alleviate poverty by generating huge scope of employment opportunities for educated unemployed people. People with physical disabilities are fully capable of accomplishing all necessary tasks in mushroom cultivation.
- ❖ It will also provide additional work for the farmers during light farming schedule.
- ❖ It requires short time (2 to 4 months), little capital and easy technique for cultivation.
- ❖ Spawns or seeds and spawn bags can be bought by the entrepreneur at a reasonably low cost with acceptable profit margin. Spawn bags can be produced for self-use and can also be sold, that will increase the profit margin and generate more income.
- ❖ The raw materials for mushroom cultivation like sawdust, paddy straw, wheat straw, sugarcane baggage, waste paper, used cotton, etc. are very cheap and available in our country.²

² Mushroom as a Mechanism to Alleviate Poverty, Unemployment and Malnutrition – Md. Hassan Shakil, Mashiyat Tasnia, Ziaul Haque Munim, Md. Humayun Kabir.

Mushroom Culture Preparation and Preservation

Successful mushroom production depends upon proper maintenance of pure culture and spawn capable of providing higher yield of quality mushrooms. Commercial mushroom production requires high levels of management input and skill. Maintenance of vigor and genetic characteristics of a pure strain in form of culture is the main objective of strain preservation. The isolation, purification and maintenance of mushroom cultures require technical expertise and aseptic laboratory facilities. Therefore, most of the small mushroom growers rely entirely on commercial spawn producers, governmental or nongovernmental organizations those play a vital role in supplying reliable spawn of the desired mushroom strain or variety.³

Mushroom Cultivation in Bangladesh

Mushroom cultivation in Bangladesh began in 1979 with assistance from Japanese organization JOCDV. Later, Japan International Cooperation Agency (JAICA) came up in 1987 with its assistance. Mushroom cultivation slowed down in 1990 following withdrawal of JAICA's support. In 2003, the government introduced a Mushroom Development Project under Agriculture Extension Department. Different research works are being conducted under the project in addition to providing, training on mushroom cultivation. Mushroom is now one of the promising concepts for crop diversification in Bangladesh. The climatic condition of Bangladesh is suitable for mushroom cultivation.

Literature review

Since mushroom cultivation, marketing, research on mushroom production has taken place in last couple of decades few works have been done on mushroom. In their study Tahmina Shireen Tanni, Sheikh Shamim Hasan, Md. Mominul Hoque, K. M. Shamsuzzaman and Mahbuba Moonmoon focuses on Impact of Mushroom Cultivation on Socio-economic Status of Bangladeshi Beneficiaries. The article titled as developing small production and marketing enterprises: mushroom contract farming in Bangladesh prepared by Md. Farhad Zamil and Jean-Joseph Cadilhan presents a case study of an activity implemented under the FAO component of the Local Partnerships for Urban Poverty Alleviation Project, funded by UNDP in Bangladesh. In Mymensingh city the project links poor urban dwellers with a niche market for oyster mushroom. This small enterprise activity appears to be sustainable, in that it develops agricultural production to cater for the specific demand of an existing small marketing enterprise. The purpose of the study named Economics of Mushroom Production in a Selected Upazila of Bangladesh conducted by T Basanta K. Barmon, Imrana Sharmin, Parvez K. Abbasi and Al Mamun was to estimate profit, benefit cost ratio (BCR) and household income of mushroom production. Ahmed Imtiajz and Syed Ajijur Rahman's study titled Short Note Economic Viability Of Mushrooms Cultivation To Poverty Reduction In Bangladesh

³ Economic viability of mushrooms cultivation to poverty reduction in Bangladesh – Ahmed Imitiaj and Syed Ajijur Rahman.

suggests that the potential of mushroom cultivation could be a possible offer to alleviate poverty and develop the life style of the vulnerable people on Bangladesh. Although the above mentioned writings focused on many issues, the competitive advantages the mushroom growers and marketers may enjoy have not been analyzed explicitly. The author of the writing feels it is necessary to explore the competitive strengths of mushroom business which in future will have a positive economic impact on Bangladesh. This study used the Diamond Model by Porter as a guide in trying to define the structure and performance of the mushroom business in Bangladesh.

Conceptual Framework of Porter's Diamond Model

Porter (1990) developed the Diamond model that incorporates four major determinants such as factor conditions, demand conditions, related and supporting industries, firm's strategy, structure and rivalry in gauging competitiveness at various levels. Some industries, in a particular country, have strong diamonds, while others have weak ones. In addition to these four determinants of competitiveness, there are two indirect facets including chance and government. The four determinants, which interact together in a diamond, are the forces that provide the pressures, incentives and capabilities for firms to undertake such improvement and innovation. Individually and as a system these four determinants create the context within which a nation's firms are created and compete. This diamond is mutually reinforcing. Wu (2006) says these determinants create the national environment in which companies are born and learn how to compete with each point of the diamond and the diamond as a system affects essential ingredients for achieving international competitive success in the industry.⁴

The first determinant is factor condition where the nation's position in factors of production necessary to compete in a given industry. Factors are basic or advanced, generalized or specialized. The most significant and sustainable competitive advantage results when the specialized and advanced factors needed to compete in a particular industry are present (Yet ton, P., J. Davis and P.L. Swan, 1992). Basic Factors such as pool of labor or raw material source do not constitute an advantage in knowledge intensive industries. To support competitive advantage, a factor must be highly specialized to an industry's particular needs. Nations succeed in industries where they are particularly good at factor creation.

The second determinant is demand conditions where nations gain competitive advantage in industries where the home demand gives their companies a clearer or earlier picture of emerging buyer needs, where demanding buyers pressure companies to innovate faster and achieve more sophisticated competitive advantage than other foreign rivals (Porter, 1998) and when a particular industry segment is larger in the domestic market than foreign markets.

⁴ Porter, M.E., (1985) *Competitive Advantage: Creating and Sustaining Superior Performance*, Free Press: New York.

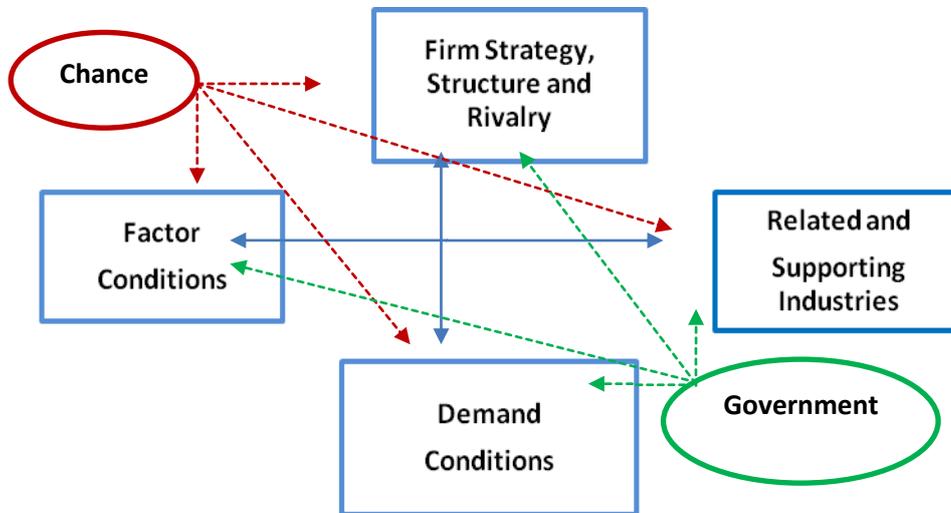


Figure 1: Porter's Diamond Model

Source: Porter, M. E., (1990) *The Competitive Advantages of Nations*, NY free press, pg. 117

The third determinant is related and supporting industries where internationally competitive home based suppliers create advantages in downstream industries in several ways. First they deliver the most cost-effective inputs in an efficient, early rapid and sometimes preferential way. Porter (1998) says far more significant is that home based related and supporting industries provide in, innovation and upgrading-an advantage based on close working relations. Suppliers and end users located near each other can take advantage of short lines of communication, quicksand constant flow of information, and ongoing exchange of ideas and innovations

Fourthly the determinant of firms' strategy structure and rivalry means that national circumstances and context create strong tendencies in how companies are created, organized, and managed as well as what the nature of domestic rivalry will be. Smith (2010) says the main emphasis here is that the strategies and structures of firms depend heavily on the national environment and that there are systematic differences in the business sectors in different countries that determine the way in which firms compete in each country and ultimately their competitive advantage.

Porter (1998) concluded that strategy describes the types of actions firms utilize to achieve both long range and short-range goals. Structure refers to the industry composition i.e. the degree to which an industry is concentrated or dispersed, competitive or monopolistic, or global or domestic. Rivalry indicates both the number of players and the level of competition among firms in an industry. Greater rivalry in an industry would lead a firm to higher levels of competitiveness vies- a- vies its rivals. Rivalry is thought to

be the most comprehensive of the three factors, as it often indicates the underlying strategy and structure of the competitors.

The government is yet another determinant where the government sets up policies, rules, regulations in industry activities. Government can influence all the four general determinants either positively or negatively. As Porter (1990) pointed out, government can affect factor conditions by imposing subsidiary policies, capital market regulations, and educational policies. A government that is working to reduce bureaucratic red tape and facilitate the process of opening a new business will encourage the entrepreneurial spirit. Similarly, government as encouragement of joint ventures with foreign firms will facilitate the transfer of technology. Studies Support that market-controlled economies are more efficient in improving productivity and innovation than these under government protection (Blumenthal, 1999).

Chance is also another determinant that may affect or benefit a nation or industry. Barraging (2005) says chance is the likelihood that external events such as war and natural disasters, pure invention, breakthroughs in basic technologies, economic crisis, can affect or benefit a country or industry, but these events are entirely out of the control of the governments or managers within the industries.

Objectives of the Study

The main objective of the report is to analyze the competitiveness of Mushroom industry of Bangladesh by using Porter's diamond model. It mapped each players against the determinants laid out by the model with a view to examine how individual players in the industry are working in terms of gaining competitiveness. This will help the producer and marketer to realize the affecting factors that determine the viability of mushroom industry and reforms required to stay competitive in a market arrangement.

The specific objectives are to explore its readers the entry barriers and problems faced by the mushroom growers of Bangladesh.

Methodology

The study was conducted using primary data. In order to collect relevant information an interview schedule was carefully designed keeping the objectives of the study in view and the data were collected from the selected respondents (mushroom growers) through personal face to face interview. The research chooses simple random sampling technique to select 15 respondents as sample. The research uses the semi-structure questionnaires. The questions were divided into several sub-headings to gather data about the general background of the firms, aspects of competitiveness and strategies employed and the challenges faced by them. Some of the questions were closed questions to collect information on the determinants to test industry competitiveness. To learn the entry barriers and problems in operating the business. Data were analyzed mainly applying simple percentage analysis.

Findings and Analysis

Overview of the companies' characteristics

The majority (75 percent) of the farmers are not more than 7 years old. Most of the firms are sole proprietors. Few of them are operating as Partnership, Joint venture or limited liability companies. All of them are mushroom growers. Some of them produce spawn for self-consumption or to supply other mushroom growers. Few of them are involved in culture tissue since it requires high technical knowledge and caution. Some growers produce several mushroom products like medicine, mushroom powder, mushroom flour etc.

Barriers for New Farms to Entry the Industry:

Barriers to Industry Entry	Percentage
Technology Gap	70
High cost of capital	50
Lack of raw material	30
Government Bureaucracy	40
Rules and regulation by government	20
Other existing players	20
Market knowledge	40
Comprehensive idea on mushroom	50

Table 1: Responses on barriers for new farms to entry the industry

Table one shows that technology gap remains the biggest hindrance for new farms to enter the industry; while *Comprehensive idea on mushroom and high cost of capital (especially when farms plan to produce in large scale)* are considered as the next major barriers.

Problems Facing the Existing Farms:

Problems Faced In The Industry	Percentage of respondents			
	Problem Faced Very Serious	Fairly Serious	Not Serious	Not Serious At All
Poor technology	70	20	10	
Poor quality of raw materials	30	15	15	40
Lack of seeds, sawdust	30	30	40	
Govt. Support		20	20	60
High cost raw materials		20	35	45

Problems Faced In The Industry	Percentage of respondents			
	Problem Faced Very Serious	Fairly Serious	Not Serious	Not Serious At All
Competition from local rivals	14	14	70	
Lack of funds to expand	60	40		
Transportation from farm house to end user	40	20	30	10
Hot and dry weather	20	45	35	
Poor marketing promotion	65	10	20	5
Middle man	30	45	25	
Poor roads/infrastructure	45	20	35	
Competition from cheaper imports		10	20	70
Lack of research	80	20		
High Taxes	5			95
Traditional production system	70	20	10	
High cost of seed of mushrooms and raw materials	5	15	20	60
High cost of labor	5		15	80
Poor distributor channels	10	60	20	10
Govt. Policy/Regulation	70	25	5	
Demand for products		30	70	

Table 2: Responses on Problems Facing the Existing Farms:

Among all the sampled farms, the most serious problem is perceived to be the Lack of research (80%). 70-65 percent of the respondents indicated that the poor technology, Government Policy/Regulation, traditional production system, poor marketing promotion are emerge as key challenge with serious threat to their operations. They thought that demand for their products is high. They cited lack of funds for expansion and modernization (60%) as another major drawback for the farms.

Discussion of the Porter's Diamond Model Determinants in the Mushroom Industry

This section seeks to discuss the outcomes registered when the mushroom industry was mapped against the determinants as spelt out by Porter's Diamond Model in a bid to gauge the overall competitiveness of the industry.

Factor Conditions:

Factor Conditions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
A lot of capital is required to enter this industry (small scale)	35	40			25
A lot of capital is required to enter this industry (large scale)				5	95
Finding raw material is tedious and expensive	56		24	15	5
Skilled and non-skilled labor is readily available and affordable	20			45	35
Sources of energy to run production is sufficient and reliable	10	30		20	40
The poor state of roads increases our costs significantly	40	20		30	10
Technology in the industry is sufficient and helpful in production are operating effectively and efficiently	56	30	14		
Access to capital for expansion and modernization is easy	56	40	4		

Table 3: Responses on Factor Conditions

Majority of the respondents (56 percent) don't agree that access to capital for expansion and modernization is easy. Most respondents (86%) either strongly disagree or disagree that technology in the industry is sufficient and helpful in production are operating effectively and efficiently. In terms of huge capital required to enter the industry as a small scale player most (60 percent) disagree. But all of them believe that to form a large scale huge amount of capital is necessary. 80 percent believe that skilled and non-skilled labor is readily available and affordable. 45 percent disagree that the poor state of roads increases our costs significantly. Further to this most (96 %) farmers said finding access to capital for expansion and modernization remains a serious challenge.

Demand Conditions and Chances:

Demand Conditions and Chances	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The demand for mushrooms and mushrooms products is huge in the country		5	15	15	65
The demand for mushrooms and related by products is huge in the region		35	25	10	40
The potential of opening new product fronts is huge		10	20	42	28

Demand Conditions and Chances	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Consumer behavior for products locally points to future trends in the global markets	14	10		40	36

Table 4: Responses to Demand Conditions and Chances

The findings indicate that the demand for mushrooms and mushrooms products is remains very strong in the country (80 percent) albeit higher than demand in the region (50 percent). The current consumer behavior, that is inclined towards more healthy lifestyles, is believed to be indicative of future trends in the global markets (40 percent) agreed and (36 percent) strongly agreed. Most of them both old and new see a very huge potential (70 percent) in opening new products to gain some form of competitive advantage.

Related and Supporting Industries

Related and Supporting Industries	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The work relation between the government, millers, regulators and researchers is strong	50	15	25	10	
Ties with researcher institutions have contributed to success in the industry	56	30	14		
The link between suppliers both local and international is effective and efficient	45	30	15	10	
The product distribution networks are vibrant and effective	30	30	20	10	10

Table 5: Responses on Related and Supporting Industries

A dominant view among the growers is that connection between the government, growers, regulators and researchers (65percent) yet to develop and it could only be improved to help ensure success in the industry.

Farm Strategy, Structure and Rivalry

Farm Strategy, Structure and Rivalry	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Companies that have been in the industry for long have special advantages that others don't have	15	10	10	40	25
The business environment in Bangladesh shapes the structure, size and hierarchy of firms		10	30	30	30

Farm Strategy, Structure and Rivalry	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The number of players in the industry has influence the style operations	50	20	20	10	
The localization of firms in one region has increased pressure in the industry to innovate	28	30	30	12	
Supply Chain system has influence in the industry		28		22	50

Table 6: Responses on Farm Strategy, Structure and Rivalry

Most respondents (65 percent) indicated that companies that have been in the industry for longer have advantages over new ones on several grounds such as the establishment of good network to collect raw materials. A majority (70 percent) oppose that the fact that the number of players in the industry has influence on the style of operations. Further to that most farms (72 percent) pointed out that the Supply Chain system has influence in the industry. 58 percent don't consider the factor that localization of firms in one region puts pressure on them to be innovative or remain behind. Many scattered people are involved in the business

Government:

Advantage Factors	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Government role in industry					
Government interferes very much with our operations	40			35	25
Taxes by government add a significant cost to our business	72			14	14
Policies by government help cushion against cheap imports	42	35	23		
The country's business climate is ideal for investment		30	56	14	

Table 7: Responses on Government's Role in Industry

The influence of government actions in the industry has a big impact on the operations of the industry. Majority of farms (60 percent) indicated that Government interferes numerous. This is by virtue of the fact that they are still they are under the direct management of the Agriculture ministry which has to sanction most of the decisions they make on key matters such as production. High taxation by government added a significant cost in case of export. 30 percent don't view the country's business climate favorable for investment.

Major Findings

Factor condition emerged a strong link within the diamond except technology with most respondents concur that existing technology is not good enough to support an efficient and effective operation. The demand condition is quite strong in the industry since most respondents agreed that the trend of demand for the product is good. Another determinant Related and Supporting Industries presents a weaker link for the industry. The findings indicate that the work relation between the government, millers, regulators and researchers is not strong; researcher institutions' contribution is insufficient. And finally Farm Strategy, Structure and Rivalry as a force is quite weak since the result shows that old farms in the industry have not special advantages than newer, The number of players in the industry doesn't influence the style of operations.

The growers of mushrooms face the following problems:

Demand for mushroom is rising but not at satisfactory rate. People are aware about health benefits of mushroom. A communication gap remains among producers, doctors or food nutritionist and end users.

Two common mistakes new growers make. One is to believe that growing mushrooms is easy. But each species requires specialized treatment to produce consistent yields of high-quality, marketable mushrooms. Another common mistake is to start too large and diversify too soon.

Trying to learn a single crop is difficult enough, and mastering several different mushroom crops at once is almost impossible.

The mushroom training center focuses the trainees on cost benefit, profitability, huge market demand, small capital. The farmers are trained only on cultivation method, but they are not informed well about the risk hidden in the business.

Mushroom Training Center of Savar is now converted as Mushroom Institute with a view to enhance its scope. Thus the institution is not getting enough budgets for training purpose, more over after training the growers are seldom provided with capital, advised or supervised to successfully run their operations which finally lead to drop out many growers.

Growers cannot venture capital when they plan to establish or expand a large scale farm. Government has fund named E.F. fund. The loan system is good. The loan for first eight years is interest free. After 8 years the interest is charged at 2.5% on the principal amount. But farmers find it difficult to collect this fund.

One specific type of tissue is being repeatedly used for long time and consequently it got degenerated. This is why spawn contaminated at unfavorable weather. Sometimes even mushroom center cannot prevent or cure the contamination. Researches are conducted in insufficient number and the farms are not getting the result of the research. Producers rarely generate idea to prevent contamination, but most of them suffer. Many farmers

don't know tissue culture recipe, to maintain bio-security of the mushroom. In different temperature and humidity mushroom needs different treatment. But researchers of Bangladesh are doing little to enrich production method and develop the farmers. New invented production process has reduced production cost of mushroom, but spawn contamination is yet to prevent. Thus the growers' total profitability declines and they lose their cost effectiveness. An association is formed for mushroom growers where most of the farmers are not enlisted as member of it.

Some producers steam straw rather than directly boil in water. This new method brings an amazing result. Per straw packet productivity has been improved as well as spawn contamination rate has been reduced at greater rate. The growers said before applying this method when a spawn in a straw packet got contaminated it infected the rest of the packets of the same lot.

Small or medium scale growers find it difficult to maintain international standard. After harvesting, for supplying fresh mushroom it is needed to take out the mushrooms from the packet before it get matured and to keep in cold freezing situation for half an hour (temperature between 10- 12°C). Then a cold chain is required to maintain freshness to reach the mushroom from farm house to end user. To obtain profitability the exporter must produce at least 500kg mushroom per day. These require lots of money. Many farmers cannot understand the maturity level.

Farms are unable to cover the whole supply chain of mushroom with little amount of capital, lack of comprehensive idea on mushroom nature, incomplete marketing and technological knowledge etc. They even don't conduct market survey to learn the supply & demand situation of the market. There are several stages from pre farming mushroom to reach it to end user. Though modern techniques are applied in pre-production, production, preservation work, the farmers of Bangladesh is yet to adopt the latest technology.

Conclusions

Mushroom cultivation offers a wide range of activities most suitable for people with various needs, diverse interests and specific capabilities. For people interested in experimenting, the range in types of mushrooms and cultivation techniques can prove challenging and gratifying. From the findings of the study each of the four determinants brings out both the strong and weak point of the industry. The findings pointed out the major weaknesses in the determinants of related & supporting industries. The factor conditions is better except technology, capital, while demand condition is quite strong. The state of extreme variations in the state of determinants can't allow for an effective and efficient operation of the mushroom business in Bangladesh. In a diamond one weak determinant pulls down the performance of the rest of the determinants. Seventy percent of the respondents see the technology gap as the strongest barrier for a new entry. The farmers recognized poor technology, lack of funds to expand, poor marketing promotion,

lack of research, traditional production system, government policy as major problems in mushroom industry. Since Mushroom has got a great Potential in Bangladesh the drawback it is confronting may be eliminated by taking corrective actions.

Limitation of Study

The research works with small sample size which may not represent the exact picture. The study was only limited to mushroom growers. A wider study is required to incorporate other relevant organization with a view to confirm these findings. Moreover the samples did not allow for sufficient contrasting and verification.

Recommendations

Both Government of Bangladesh and the farms must address the poor technology, lack of research on mushroom product, quality, production process, market and by improving these limitations to format the competitiveness of the mushroom business in Bangladesh, as well as boost other determinants of competitiveness in the industry. The loan crisis is among the biggest of all hindrance. Government should take initiatives to ensure loan to the potential farms.

Farmers with little amount of capital can initiate to produce only raw mushroom in small scale. Producers with large amount of money can operate all preproduction jobs in addition to their mushroom production. Since producing only raw mushroom is not the way to obtain profitable business using huge amount of money farmers can produce variety of mushroom product like medicine, mushroom powder, mushroom flour etc., even they also can export their product. Because of its highly contamination nature it can't tolerate medium/high temperature. To keep it fresh in every stage of supply chain system the producers and marketers need to put combined effort to control temperature and humidity. To control temperature humidity, supply of carbon gas, light etc. the growers may be trained the way of using control shade.

As the training center can't supply the huge number of growers the spawn to cultivate, at least one fresh farmer out of every thirty trainee may be created as entrepreneur who not only learn to produce mushroom but he will also culture tissue, prepare spawn, deliver spawn to growers .

Another set of entrepreneurs can be developed who will work at downstream of the supply chain. They will market mushroom to the end user, restaurant and department or chain store etc.

Proper institutional arrangements are required to supply the good quality of spawn at reasonable prices and in desired quantities to the mushroom growers.

Mushroom being a highly perishable crop marketing infrastructure such as cold storage facilities is of immense importance. A thorough study of mushroom production and marketing is imperative before buying equipment and starting even a small-scale operation.

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