Original Research Article

Value Chain Analysis of Namgang Chili: The Produce of Pakshikha, Chukha, Bhutan

Abstract

Chili is the most ubiquitous spice used in Bhutanese cuisine. Almost all dishes in Bhutan contain chilies in various forms. Bhutan produces many variants of chilies, one of which is Namgang chili, commonly known for being one of the hottest and tastiest variants in Bhutan. This variant is cultivated in Pakshikha, Bongo Gewog, Chukha. This study is aimed at identifying value chain actors of Namgang chili, their roles, and margins, and to draw the map of its overall value chain. The quantitative and qualitative data for this study were collected from 29 out of 49 households in Pakshikha, Bongo, Chukha that produce Namgang chili. Other published sources were also referred for gathering secondary data required for this study. Descriptive statistics were used to analyze the data, and chain mapping was used to identify actors and their supply linkages. Margin analysis was conducted to assess the value gained by each player in the value chain. The identified actors of the value chain were input suppliers, farmers, transporters, retailers, and consumers. Farmers, retailers, and transporters share 53, 28.5, and 5 percentage of the margin respectively. Some of the critical constraints and challenges faced by farmers are 1. pest infestation on the rise; 2. lack of awareness about modern tools and techniques; 3. lack of agency support; 4. lack of motivation and encouragement for mass commercial farming; 5. no initiative for organizing farmers' cooperative/group, and; 6. Lack of crop protection mechanism. The findings suggest that the overall value chain of Namgang chili is underdeveloped. Therefore, it is recommended that the relevant agencies need to encourage groups/cooperatives for Namgang chili cultivation to increase the supplies and to add more efficiency in producing and marketing the commodity.

Key words: Namgang Chili, Pakshikha Chili, Value Chain Analysis, Bhutan, Value Chain Mapping

1 Introduction

The agriculture practice in Bhutan has largely been subsistence in nature since many years. However, with the increasing focus of the government policies for being self-sufficient in agriculture products, there has been a considerable emphasis on market orientation. With the increasing drive from the government and the international organizations for commercialization of agriculture in Bhutan, the country is gradually witnessing the opportunity and possibility of attaining the goal of food security. Alongside the many agricultural commodities produced by Bhutanese farmers, chili is one of the most important commodities produced that no Bhutanese dish would be completed without. Chili is the most ubiquitous spices used in Bhutanese cuisine. Almost all dishes in Bhutan contain chilies in various forms.

In 2019, Bhutan has produced 7674 MT of chili. Varieties of chili are produced in almost all the dzongkhags in Bhutan with the high potential for returns. Given that the is scientifically a good source of natural, micronutrient, antioxidants, vitamin c, e and carotenoids, which is related in preventing chronic and age-related diseases, and because it provides an identity to Bhutanese dishes, Bhutan produces many varieties of chili such as Bhutan produces many variants of chilies such as Hot wax, Sha chili, Super solo, Yangtse Chili, SV 2319 HA, PAN 1498, SHP 4884 (Department of Agriculture, 2019).

Besides these, there are also some lesser-known varieties produced in different parts of the country which has a huge local market preference, one of such is Namgang chili, commonly known to be one of the hottest and tastiest variants in the country. This variant is cultivated in Pakshikha, Bongo Gewog, Chukha.

Having produced Namgang Chili, the farmers had benefited because of its high economic value in the market. Besides, the cultivation of Namgang Chili provides a seasonal employment for the greater part of the community. The large-scale commercial production of Namgang Chili would help curve the import of chilies from other countries (BOIC, 2015). However, Namgang Chili is infamous for being exaggeratedly costly and limited in supply, and therefore less competitive in the international and also in the domestic market.

The competitiveness of agricultural products in domestic and international markets depends largely on the way agricultural value chains are coordinated (Attaie & Fourcadet, 2003). Researches have observed that the value chains in developing countries face series of impediments and in many of the cases, smallholder farmers are disadvantaged (Bokelmann & Adamseged, 2016). Over time, the need to coordinate activities and actors along the value chain has become more evident if Bhutan is to be competent and self-sufficient with agricultural related products.

At the backdrop of this, this study proposes to conduct a value chain analysis of Namgang Chili, with a particular objective of mapping the value chain, identify actors and their roles, analyses marketing margins of actors, and point out major constraints, bottlenecks and opportunities of the value chain.

2 Research Objectives

The primary objective of this research is to study the production and marketing practices of Namgang Chili, and recommend measures to strengthen the practices by identifying constrains and new opportunities. Some of the specific objectives are:

a. To identify the actors, their roles and functions, and their interrelationships in the value chain of Namgang Chili by mapping the value chain.
b. To study the marketing margins of actors engaged in the value chain and point out major constraints, bottlenecks and opportunities of the value chain.

3. Literature Review

3.1 Value Chain Concept

Value chain can be defined as various activities involved in bringing a product or a service from its initial face of conception till it reaches to the final consumers (Kaplinsky & Morris, 2002). In the literature there are three main approaches to value chain analysis which are the French filière approach (Raikes, Jensen & Ponte, 2000), the global approach (Gereffi, Humphrey & Sturegeon, 2005) and the business strategy approach (Porter, 1985). French filière is seen as neutral and purely empirical approach which has its origin in technocratic agricultural research. This approach has been mostly applied to agricultural commodities. The business strategy approach was developed by Porter (1985). The approach analyses the value addition by primary and

secondary activities of a firm which if well-organized would give a higher margin to a firm. However, Porters' approach is restricted to the firm level activities only. On the other hand, Global approach is primarily used for the analysis of industrial commodity chains which involve activities carried out in different countries.

According to Bammann (2007), there are three levels to agricultural value chain i.e., value chain actors, value chain supporters and value chain influencers. Value chain actors are those who directly involve in value chain activities such as seed suppliers, farmers and traders, value chain supporters are actors who are involved in the value chain directly but they provide services which adds value to the product, and value chain influencers involve the regulatory framework, policies and infrastructure that support and regulate value chain activities.

3.2 Value Chain Methodology

Kaplinsky and Morris (2003) and M4P Project (2008) suggest that the analysis of value chain specifically in agricultural sector can be carried out in six steps. The first step is to identify/prioritize a specific commodity for which a value chain will be developed, the second step is to map the value chain, and the third step is to analyse the value chain performance. In the fourth step the options for possible upgradation of value chain in terms of knowledge, skills, technology and support services has to be analysed, the fifth step is to analyse the value chain governance and finally analyse the linkages among various actors in the value chain. This paper proposes to use the suggested framework for the analysis of Namgang Chili value chain.

Dubey, Singh, Singh, Mishra and Singh (2020) maintain that both qualitative and quantitative approaches can be used for value chain analysis. However, Hellin and Meijer (2006) suggest that the qualitative approach would be better to use initially followed by quantitative study. Methods such as semi-structured interviews, observations, focus group discussions and survey questionnaires are suggested to be used to study different actors in the value chain and their relationships with each other (Dubey et.al, 2020).

3.3 Agricultural Value Chain Success Factors

3.3.1 Collective Action and Leadership

Collective action is one of the important factors identified in literatures that helps smallholder farmers to strengthen agriculture value chain and subsequently helps in upgrading the socio-

economic conditions of farmers (Karatepe & Scherrer, 2019). In addition to this, Kumari, Bharti and Tripathy (2021) maintains that leadership roles played by individuals in managing and organizing the collective action among the players in the value chain of an agricultural product is very important for the success. It appears that the collective action and value chain leadership go hand in hand as one cannot be exclusive of the other. In the context of Namgang Chili where smallholder farmers are mostly engaged, silo operation of farmers might be costly and may lead to inefficiency in terms of managing pre-harvest and post-harvest management and getting market leads. Similarly, it will be difficult for smallholder farmers and other related stakeholders to upgrade their socio-economic conditions if there is an asymmetric power relation among the actors in the agricultural value chain (Karatepe & Scherrer, 2019).

3.3.2 Linkages

For a successful value chain, the urban-rural linkage also plays a vital role. According to Weerabahu et al. (2021), an efficient urban-rural linkage will enable a timely supply of agriculture mechanization facilities such as modern machines and tools and related information for the benefit of farmers. Moreover, a good urban-rural linkage will promote information flow regarding demand and supply in the market so that the key aspects of the value chain could be pre-planned accordingly. Value chain strategies in this contemporary business world requires constant updates in its structure to fit in with the need and relevance.

3.3.3 Research and Development Support

Mango et al. (2015) maintain that productivity is the most important factor that promotes competition in the market that adds to the efficiency and overall benefit of stakeholders taking roles along the value chain. Besides extending other supports to the farmers for better productivity, it is felt more crucial to prioritize agricultural research and development in order to unlock smallholder potential. This is evident in the study by Devaux et al. (2018) which suggested that for a inclusive value chain development, it is important to integrate innovative systems. The innovative systems are an aftermath of research and development.

The findings by Ordoñez et al. (2013) highlights the importance of integrating innovation in the value chain for a general benefit. In their study they recorded that many farmers had to compromise with efficiency and better productivity because they ignored recommendations and

assistance emerging from R& D, and were reluctant to change their traditional ways of doing the work. Such forcefield will create barriers for a new practice to be accepted.

3.3.4 Other supports

Providing awareness to the farmers for market oriented agricultural production practice is also one of the important factors that may lead to higher productivity, market efficiency and ensure greater profitability to value chain actors. In addition, market orientation develops farmers' adaptive behavior to make production and marketing decisions within a season that are strongly linked to the choices in the next season and hence this will lead to enhancement of a farmer's commercialization potential (Yaseen, Bryceson, & Mungai, 2018).

Similarly, finance support is also suggested to be a very important component in the agricultural value chain. Swamy and M (2016) note that financial institutions play an important role for the success of a value chain. They observed that financial institutions do nothing more than investing in one or few of the components of a chain. Instead, Swamy and M (2016) suggests that rather than investing in one component of the chain, the financial institution can grow expertise in the chain, share the knowledge and provide financing to support services. Such practice will be sustainable source of benefit for both actors in the value chain and the financial institutions.

3.4 Constraints

Zárate et al. (2019) conducted a study by using methods such as face interviews with different stakeholders as well as an in-depth analysis of different scopes to identify the main problems of the value chain of an agricultural product, specifically the panela production in Utrica, Colombia. They found out that low incomes, environmental degradation, and lack of organized practice were the serious issues concerning the value chain. Similarly, Murugananthi and Rohini (2020) note that in case of chili major constraints faced by farmers in Tamil Nadu were low productivity, labor shortage and price instability in the market.

Hassan and Jajja (2021) identified a huge variation in the crop yield, cost structure and profitability of farmers in their study. The authors noted that these constraints are all caused by the differences in cultivation practices and approach to sales. Authors identified a significant potential to lower costs, increase their yield and enhance overall profitability by using the best

technologies and advanced processes as a result of which smallholders' profits can be potentially doubled (Hassan & Jajja, 2021).

Gaire and Kattel (2019), on the other hand, argue that the main constraints in agriculture value chain appear from the four key area i.e., market information, access to market, technology and product development, and input suppliers. The deficiencies across all these areas will naturally appear as constraints.

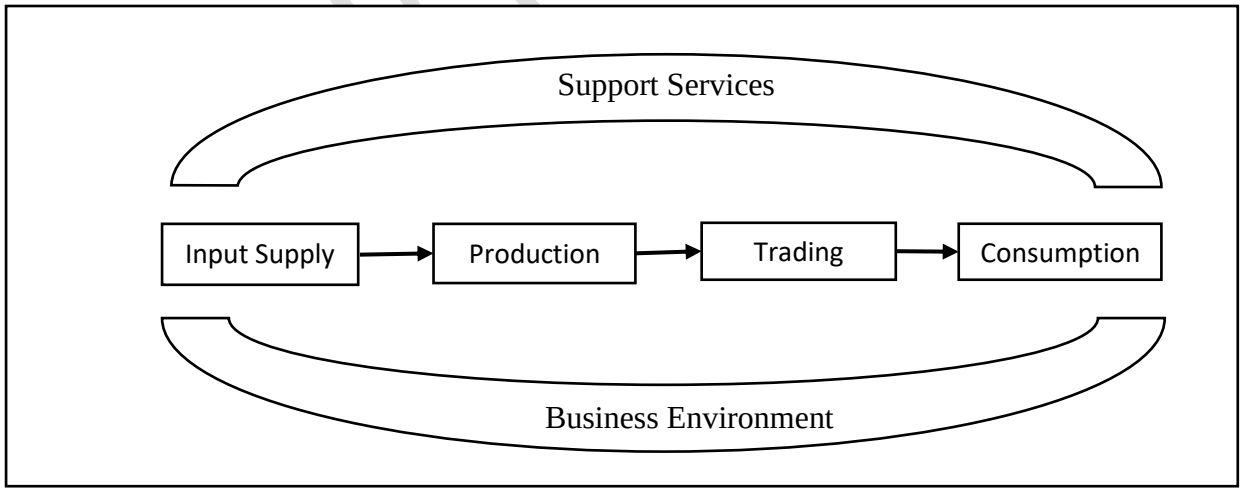
3.5 Analytical Framework for Value Chain Analysis of Namgang Chili

For the value chain analysis of Namgang Chili, the following framework (**Fig 1)** is used. The framework identifies actors, functions and activities along the value chain. In general, the framework is useful in identifying all the functions associated to chili production till it reaches to the final consumers, identifying the actors along the value chain who perform the functions, and the identify the activities that the value chain actors are engaged in.

Having identified functions, actors and activities along the value chain, the framework is used to study the availability of support services by agencies for chili farming. Similarly, the study also analyses the general business environment of Namgang Chili.

Figure 1

Analytical Framework



4. Methodology

4.1 Research Design

In order to study the current status of Pakshika Chili and realize the value addition process along its chain starting from 'farm to fork', and to recognize the prospects for value addition, a value chain methodology is used. The value chain methodology focuses on detailed mapping of functions, actors and activities along the value chain and analyze them in terms of their value addition contribution to the commodity. The study uses both qualitative and quantitative approach.

4.2 Samples

As per the record of Bongo Gewog office, in total there are 49 households in Pakhsikha. Out of these, the data is collected from 29 households through interview and survey. This accounts for 59.18 percent of total household coverage. Similarly, the interview was conducted with Pakshikha Gewog office and RNR Extension office. Two retailers from Gedu market who deal with Namgang Chili were also interviewed to study the general trend of market price and associated opportunities and challenges.

4.3 Data Collection Procedures and Tools

The data for this study was collected from farmers, traders (local retailers), and customers. The Primary data collection was done through structured interview with the help of self-developed open-ended questionnaires. Also, the field survey was carried out with farmers. Similarly, the secondary data for the study was obtained from topical and relevant review of literatures and annual publication of relevant agencies.

4.4 Data Analysis Method

The quantitative data such as socio-economic information, production information, the price information, determination of margins and the trends in prices were coded, tabulated and analyzed by using MS-Excel with the help of descriptive statistics.

The qualitative and quantitative information was used for Value Chain Mapping as it is one of the most effective descriptive tools often used in Value Chain research. The map includes the product, information and knowledge flows, the actors involved in the chain, costs and margins at

different level, and the support that the chain actors have. Thus, it also identifies different actors in the value chain and their roles and relationships to one another

5. Data Analysis and Interpretation

5.1 Value Chain Analysis

In general, value chain analysis (VCA) is an analysis of all those activities that are carried out in order to transform inputs into outputs that are valued by the customers. It can also be understood as the analysis of all the activities that is being carried out in order to create a value for customers. Typical value chain includes three or more of the actors i.e., producers, processors, distributors, brokers, wholesalers, retailers and consumers. A value chain includes a few or all of these actors who collaborate with one another in the value chain for a mutual benefit by collectively working on objectives of satisfying the demand for a specific product in the market, sharing risks and benefits and investing their resources. The actors in the value chain of Namgang Chili are:

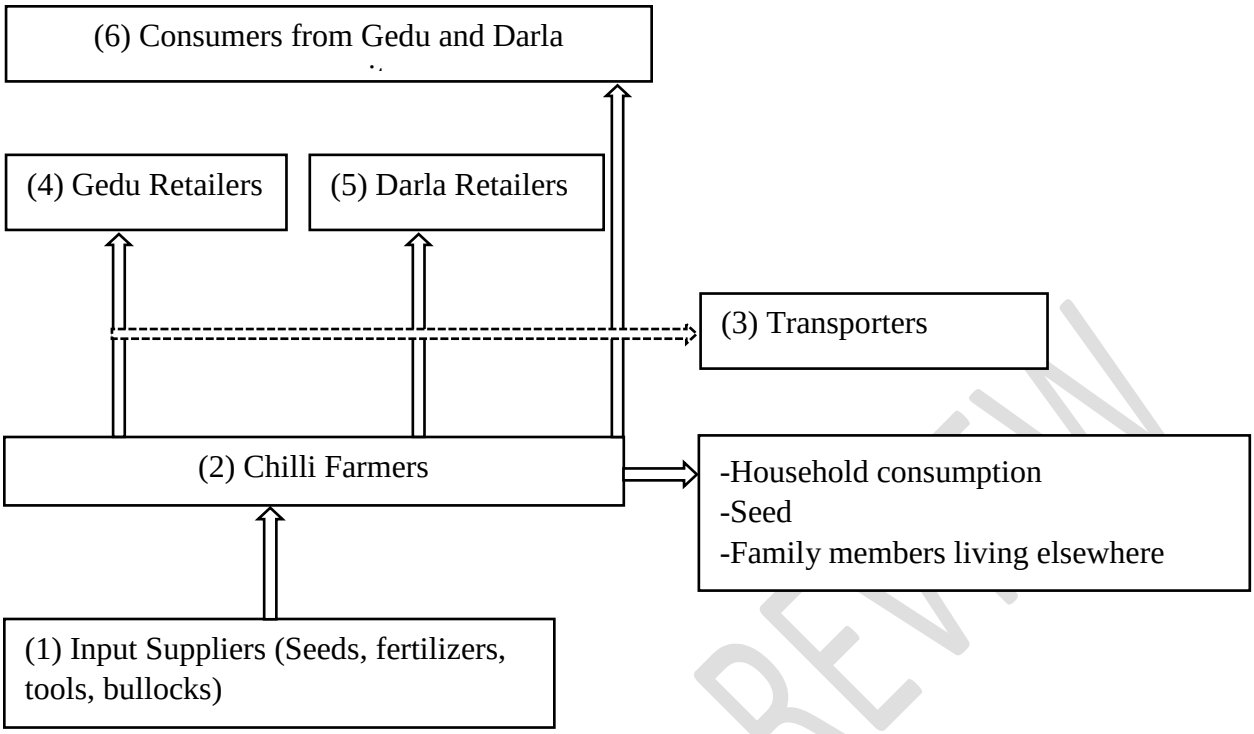
a. Input Suppliers
b. Growers
c. Transporters
d. Retailers

5.1.1 Value Chain Map

Value chain mapping is a process of drawing up a visual diagram indicating various linkages among actors engaged in the value chain i.e., input suppliers, chili growers, transporters, trade and retailers. As shown in **Fig 2,** the value chain map depicts the channel through which chili reaches the marekt, activities carried out at each stage of the value chain, the structure of actors and the support involved in the value adding process. The map portrays a general trend practiced by actors in the value chain of Namgang Chili.

Figure 2

Namgang Chili Value Chain Map



As shown in the map, chili growers in Pakshikha perform two or more functions. The study shows that besides growing and harvesting chilies, more than 90 percent of farmers arrange basic firm inputs such as FYM, seeds, bullocks and other smaller tools for chili cultivation on their own. Farmers also take the product to the road points, load and transport them to the nearest marketplace and sell them to the retailers themselves.

The study has shown that majority of farmers do not depend much on agents such as Agriculture Extension Office at Pakshikha besides 14 percent of households claiming to have received support from the agent in terms of mulching plastics and the materials to construct greenhouse for chili cultivation. The Agriculture Extension Office claims that they are ready to support farmers for chili cultivation, but most of the farmers do not seek their services. The Agriculture Extension Office also does not play an active role in providing training to farmers and providing market information.

Similarly, 21 percent of respondents claim that they use bullocks from their neighbors in exchange for money for tilling the land for chili cultivation. For the purpose of land preparation, 55 percent of respondents claim that they get help from their neighbors in exchange of cash, kind or a service.

Farmers do not sell all the harvest. The 14 percent of farmers said that they cultivate chili just for self-consumption and the 86 percent of farmers said that they cultivate chili for self-consumption and the surplus will be sold. In an average, a household retains 1.95 Kg of chili as a seed for the next season and 25 Kg for the self-consumption. Similarly, in an average a household also retains around 7-10 Kgs to send to family members living elsewhere.

The chili value chain in Pakshikha is comprised of a few key actors: (i) input suppliers; (ii) farmers; (iii) transporters; (iv) retailers in the local market, and; (v) consumers. A simplified value chain map is depicted above. Bold lines indicate functional market linkages and the dotted line indicate the transport service providers who links up the product to the market.

5.1.2 Value Chain Actors

Value chain actors are individuals, groups or agents directly involved in the value chain of a product. Literatures suggest that the value chain will be efficient and therefore successful if a well-established partnership exist between actors and support providers who participate in the value chain. Therefore, it is crucial for the value chain operators to identify and comprehend the existing relationships between value chain actors. This information helps value chain supporters involved in the strategy's design and implementation to obtain a competitive advantage and a fair distribution of income among the value chain actors could be ensured.

In case of Namgang Chili, the value chain appears to be very simple. The study found out that most of the functions are performed by chili growers themselves. The input supply such as seed, fertilizers tools are mostly arranged by farmers themselves except for 14 percent of households who received the support from the Agriculture Extension Office at Pakshikha in terms of facilities such as mulching plastics and the materials to construct greenhouse. Similarly, production is done in the farmers own land or on a sharing basis with other’s land, and the harvest is done by the farmers themselves.

Other functions such as taking the product to the road point, loading and transporting to the nearest market, and selling to retailers as well as unorganized direct selling to customers is being carried out by the farmers themselves. However, the unorganized direct selling to customers happens only when customers accidently meet up with the farmers in the market with their

products or along the road points. The retailers to whom farmers sell their product will sell it to the customers who are in a lookout for the Namgang Chili.

5.1.3 Value Addition by Different Actors in the Value Chain

As the most functions such as input supplies, production, harvesting and selling to the retailers are carried out by the farmers themselves, the unit cost of production as shown in **Table 1**, reflects all these costs. The unit value addition of all these activities is Nu. 44.66 which is 13 percent of the actual value in the market which is Nu. 350 (average). Similarly, the transports (taxi, private cars) add up Nu. 17.09 in an average to the total value. This includes the two-way fare paid for the seller (farmer) and the one-way fare paid for the product to the market. This accounts for 5 percent of value addition to the product. Similarly, retailers at Gedu and Darla market buy the product at Nu. 250 from the farmers and that accounts for 71 percent of the value addition. The retailers sell to the customers in the market at an average price of Nu. 350/kg and that would account for additional value addition of 29 percent.

It is clear from the analysis that after having deducted the cost of production which includes the cost associated with input supplies and labour costs, and the transportation cost, the major chunk of net profit which accounts for 53 percent of value addition is secured by the farmers. Similarly, Nu. 100/Kg of commission on sale is secured by retailers which accounts for 28.5 percent of value addition. The actual cost of production is Nu.44.66/Kg which accounts for 13 percent of the value addition to the product, and the transportation cost is 17.09/Kg which accounts for 5 percent of value addition to the product.

Table 1

Percentage of Value Addition Based on Activities in the Value Chain

Specifics	Nu/Kg	% of value addition/unit
Unit Cost of Production	44.66	13%
Unit Cost in Transit	17.09	5%
Retail Price (Average)	250	71%
Customer price (Average)	350	100%

5.2 Constraints and Challenges

5.2.1 Pest

The result of the analysis stands clear on the point that the major constraint faced in chili cultivation is the damage by pests. As shown in **Table 2,** 100 percent of respondents reported that they face this problem. In this regard, 73 percent of the respondents claim that they do not have awareness on pest control techniques.

5.2.2 Awareness about and Access to Modern Tools and Techniques

It appears that the chili productivity is affected by the lack of awareness on the use of modern tools and techniques. In the survey, about 90 percent of the respondents reported that they do not have adequate knowledge on the use of modern tools and techniques (**Table 2**). Almost all the producers claimed that they have not received any training on the cultivation of chili and on the use of modern tools. To this end, 89 percent of respondents reported that they do not have an access to modern machineries for chili cultivation. However, most of the respondents have basic tools for cultivation except for the 12 of respondents who reported otherwise.

These constraints are seen to be interlinked as the study revealed that not even a single modern tool is being used by the farmers and they solely depend on the drought powers and labor for cultivation. The stiff terrain, low support infrastructure and limited or no input services by agencies resulted in low productivity. Similarly, the lack of support received from the concern authority on the use of pesticides and other disease control mechanisms led to high pre-harvest losses.

5.2.3 Rain and Windstorm

As reported by 61 percent of respondents, another considerable challenge faced by chili growers is the damage of crop due rain and windstorm (**Table 2**). Pakshikha has a similar weather pattern as Gedu, which is known for incessant rainfall and windstorm during spring and the summer season.

5.2.4 Agency Support

The 55 percent of the respondents pointed out that they do not have a required amount of support from the concerned agencies to mitigate such challenges (**Table 2**). The report of lack of support

from related agencies might also include support related to awareness on chili cultivation, including tools and techniques and arranging other necessary supports.

5.2.5 Damage due to Wild Animals

As Pakshikha is located in a northeast facing mountain with scattered settlements and the peripheral land is covered by forest, the 36 percent of households also reported that they have to take loss of damage to their crop by wild animals (**Table 2**).

In an interview, a considerable number of respondents reported that about 5-10 percent of the produce was damaged by wild animals such wild boars and monkeys in the previous production year. However, such reports were not available with Renewable Natural Resource (RNR) Extension office at Pakshikha. The office verified that the instances of damages were not reported by the farmers to them.

Table 2

Problems faced by Farmers in Chili Cultivation

Sl. No	Problems	Percentage of respondent (N=28)
1	Damage by pests	100%
2	Unaware about the use of modern tools and techniques	90%
3	No access to machineries	89%
4	No awareness on pest control	73%
5	Damage due to rain and hailstorm	61%
6	Limited support from concerned authority	55%
7	Crop damaged by wild animals	36%
8	No water	29%
9	Labor shortage	25%
10	No basic tools	12%
11	Limited access to market	0%
12	Limited land	0%

5.2.6 Underdeveloped Value Chain and Limited Market Access/Information

The survey revealed that the links in the value chain such as production, post-harvest and marketing are found to be underdeveloped which has led to inefficient flow of information along the chain. Though, Pakchikha chili is known for is pungency and tase, the study revealed that

there is not even a single trader from the village to the road point collection spot and to the bigger markets besides Gedu, such as Thimphu, Paro and other Dzongkhags.

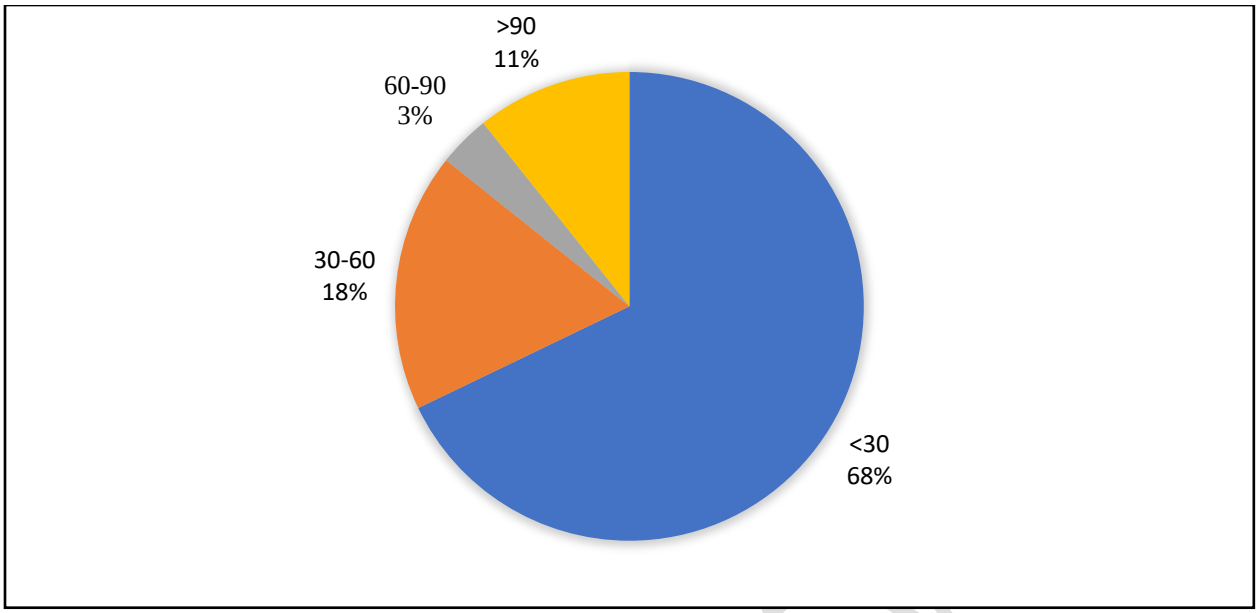
The study revealed that most of the functions along the value chain was performed by chili growers themselves. Due to the lack of agents and middle engagement, farmers do not have an information about reliable market besides Gedu. This has also constrained the flow of information regarding the demand situation from market to the primary producers. Besides, it was also observed that farmers lack idea about processing chili for related products for value addition. The study found that there is no bi-product associated with Namgang Ema in the market.

5.2.7 Lack of motivation for a mass commercial farming

Almost all the household is found growing chili which ranges from 10 kilograms to maximum of 1200 kilograms per annum. Most of the farmers in Pakshikha cultivate chili in less than one acre of land. **Fig 3** shows the size of the area used for the chili cultivation. It can be noted that 68 percent of the respondents cultivate chili in less than 30 decimals of land. Similarly, the 18 percent of respondents use 30 to 60 decimals and the 3 percent use 60 to 90 decimals of the land for chili cultivation. There were only 11 percent of respondents who claimed that they use more than 90 decimals of land for the same purpose.

Figure 3

Chili Cultivation Area (in Decimals)

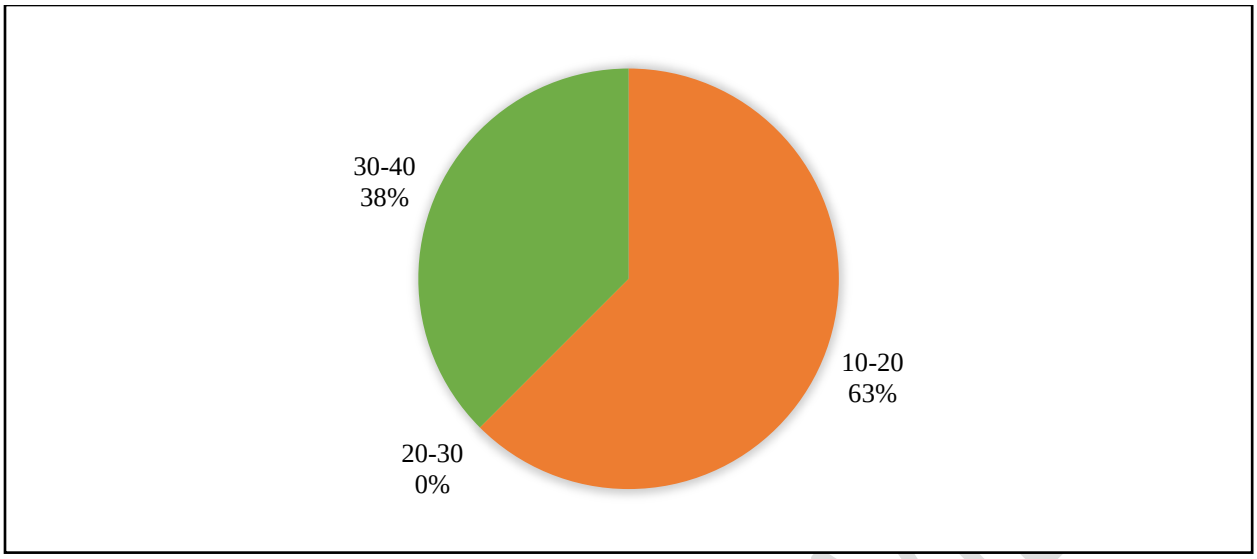


The majority of respondents claiming that they use less than 30 percent of the land for chili cultivation is a clear indication that the cultivation is not intended for a commercial purpose. Despite the respondents claiming that they hold not less than 1.5 acres of land, it is observed that there is a lack of motivation for the commercial farming of the chili.

Obvious as it may appear, the 68 percent of respondents said that they have earned less than Nu. 25000 from the sale of chili in the previous year. The 14 percent of respondents informed that they earned Nu. 25-50 thousand, and there were 18 percent of respondents claiming to have earned more than Nu. 50000 from the sale of chili in the previous income year.

Figure 4

Annual Income from Sale Of Chili (In Thousand)



5.2.8 Lack of business acumen

The analysis of the data shows that most of the chili cultivators in Pakshikha do not have awareness about business conduct. The respondents said that they do not usually note down the cost of production i.e., input costs, labour hours, transportation cost from the firm to the nearest market, etc, and heuristic decisions are made regarding the pricing of the commodity in the market.

5.2.9 No initiative for organizing farmers' cooperative/group

The study also noted that there are no farmers' cooperatives/groups in Pakshikha, which could otherwise be beneficial for the community as a whole. Cooperatives/groups enable collective action for a purpose of production, marketing and processing of firm products and also for the purchase and the production of farm inputs. Having cooperatives would also help establish a better link of the farmers with financial institutions, market information and technology for cultivation. However, due to the lack of the collective action and due to the lack of awareness about the benefits of having one, Pakshikha farmers are losing on many grounds. Primarily they are losing the collective action as a core resource in farming. Collective action would enable individuals to achieve their goals which otherwise would be difficult, such as procuring agricultural machineries and other scientific tools.

The study revealed that farmers were not convinced to cooperate with agriculture extension office and there is lack of formal knowledge management about the Namgang Chili. The

agriculture extension office informed that had the farmers agreed to cooperate with them, the efficiency, productivity and resources could have been improved significantly for chili production.

5.2.10 Lack of crop protection mechanism

The analysis of the data has shown that there is a lack of crop protection mechanism at place among chili growers in Pakshikha. Farmers are generally not aware of scientific methods of crop protection, disease and pest control techniques. This is because of the lack of interaction and consultation between relevant agencies and the chili growers. It was known that farmers do not consult with RNR extension about the problems in chili cultivation and the RNR extension also has not initiated an independent study because of lack of cooperation from farmers.

Similarly, in the survey most of the farmers reported crop damage and losses due to wild animals and natural disaster. However, there is no record of the same in the gewog extension office (RNR). Survey results show that the crop was basically damaged by the worms at an early stage and there is no way out for them to protect the crop as they are not recommended to use the pesticides. The most common disease reported by the farmers are plant wilting and fruit dropping before maturity.

5.2.11 Others

In terms of the availability of the land for chili cultivation, all the respondents said that they have enough land. However, 25 percent of respondents reported that they do not have enough manpower for extensive chili farming. Also, the 29 percent of respondents face shortage of water in clilli cultivation.

Notably, although there are no middlemen involved in marketing and selling the product, respondents reported that they do not have a problem in finding market. However, besides Gedu market they have a lack of market reach elsewhere.

5.3 Economic Analysis

5.3.1 Demand

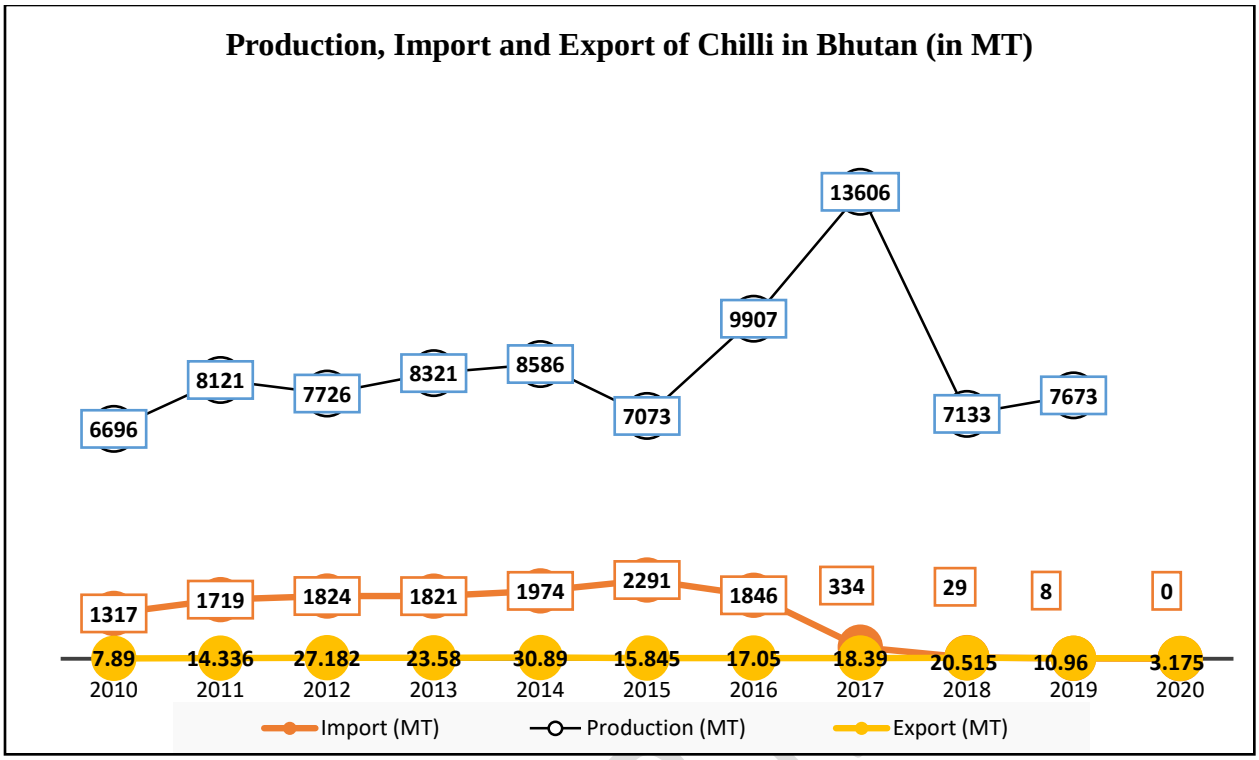
According to RNR Census Report (2019), chili is one of the most commercially viable vegetables grown by many holders in the country. The domestic demand for chill, given that it is

an inevitable ingredient in most of the dishes in Bhutan, is huge. Although the average production of chili from 2010 to 2019 is considerably high at 8484.2 MT per year, it was not enough to meet the domestic demand. Because the country was not self-sufficient with chili production, the yearly average import of the chili was 1827.429 MT from 2010 to 2016. However, as shown in **Fig 5**, the import of chili in the country fell significantly starting from 2017 because a ban on chili import was imposed by Bhutan Agriculture and Food Regularity Authority (BAFRA) in June 2016. The import ban policy on chili came in as a result of evidence showing high pesticide content in imported chilies which has an adverse effect on human health.

The fact that there have been many instances in which people were convicted for smuggling chili into the country while the law forbit the import of the same reflects that the domestic production is not enough to meet the demand. In total, 4030.67 acres of land is used for chili cultivation in the country and there are 34,524 individuals who are engaged in chili farming. It was reported that the total production of chili in Bhutan in 2019 was 7133 MT. In Chukha, there are 1997 farmers who are engaged in chili farming and the total production is reported to be 312 MT from the total cultivation area of 166.82 acres in 2019. Despite such effort from the government and farmers to go self-sufficient with chili, the shortage is still felt in the market. Moreover, the ban on chili import has widened the gap between demand and the supply in the market.

Figure 5

Production, Import and Export of Chili in Bhutan (in MT)



Besides the viable market for general breeds of chili in Bhutan, the interview with retailers at Gedu market also revealed that there is an ever-growing demand especially for Namgang chili. It was reported that the annual production of chili at Pakshikha is not able to meet the demand even within Gedu and Darla Market. The farmers also reported that at times because of a direct demand from Phuentsholing and Thimphu markets they had to directly supply the limited stock to these markets.

The retailers at Gedu market also pointed out that because of the high market demand for Namgang Chili, the market value of it does not fall below Nu. 350 at the minimum. It was also reported that at times people even buy from the market at price as high as Nu. 600.

Therefore, the study shows that there is a huge demand for chili in Bhutan beyond the scope of the production potential of Bhutanese farmers. The same may be true with the Namgang Chili. In addition to the average of 8484.2 MT of total production per year, Bhutan imports 1827.42 MT in an average annually. Summing these together it would 10200.62 MT in total, and after having subtracted the average export per year (17.25 MT), the total requirement for domestic consumption is 10294.37 MT.

5.3.2 Supply

The source of supply is the produce of individual farmers from Pakshikha. Almost every household produce chili. In total, more than 80 percent of farmers cultivate chili for self-consumption as well as for sale in the nearby market. As shown in **Table 3**, the average household production of chili is 132.29 Kg per year. In an average every households retain 1.95 Kg for the seed for cultivation in the next season and 25 Kg is retained for self-consumption. Taking into consideration the product retained for seed and self-consumption, in an average every household will have 105.34 Kg for sale in a season.

Table 3

Average Production, Retention, Consumption and Sales of Chili (in Kg)

Specifics	Quantity (Kg)
Average Household Production/year	132.29
Retained for seed (average)	1.95
Retained for consumption (average)	25
Average Household Sales/year	105.34

5.3.3 Price Dynamics

The price of chili tends to be high during the first phase of harvest period and it gradually declines. During the first phase of the harvest season the farmers could fetch as high as Nu. 400 in the Gedu Market. The second harvest could be sold for Nu. 300 and the third harvest and thereafter could fetch Nu.200. The reason for this pattern of falling price with each harvest is because of the law of supply. During the first harvest, there is not much supply in the market and therefore it fetches higher price. However, with the subsequent harvest, the supplies increase and the price also gradually falls. The data shows that in a season a farmer could sell the produce at the average price of Nu. 250 in Gedu market. The cost is only accounted for the green chili as there is no known by products of Namgang Chili sold in the market.

5.3.4 Cost of Production and Profit

It was reported that owing to the sloppy hills where the cultivation is made, there is no scope for the farmers to use machines for chili cultivation. Farmers reported that they mostly use drought power to till the field and other tools such as spade, pick axe and hoes are used for land

preparation. The cost associated with each of these activity in land preparation is given in **Table 4.** The average total cost of production which includes the average cost of tools procured, labor cost, cost of the use of drought power, cost of fertilizer and the cost of the seed is Nu. 5907.45.

Table 4

Activity Costs

Specifics	Average Cost (Nu)
Tools	569.64
Labor	3646.42
Drought power	1076.75
Machine	0
Fertilizer (FYM)	377.14
Seed	237.5
Average Total Cost	5907.45

According to MoAF (2020), the cost of production of chili in Bhutan ranges from Nu. 30-40. However, in case of Namgang Chili, the result shows that the production cost is very high. Using the same method of calculation as used by MoAF (2020), the unit cost of production of chili in Pakshikha is calculated to be Nu. 44.65 (See **Table 5)**. The high cost of production is due to high cost of labor as the process is labor intensive and there is no scope to use machines owing to sloppy land feature.

As shown in **Table 5**, the unit transit cost from field to the market is calculated to be Nu.17.09. The unit transit cost is also very high. The study has shown that farmers travel multiple times to Gedu market to sell their products usually in small quantity. This has added to higher transit cost.

It is reported that in an average farmers could sell their product in zero market at Nu. 250 per Kg. The margin that they have after deducting all the related expenses such as cost of production and the transit cost is Nu. 188.26 per Kg. Although the cost of production and the transit cost are very high, they are offset by the high profit margin.

Table 5

Costs and Profit Margin

Specifics	Nu
Unit Cost of Production	44.66

Unit Cost in Transit	17.09
Average price (Kg)	250
Profit Margin	188.26

6. Conclusion

a. The production of Nangang Chili goes through 6 stages i.e., 1. Selection of seed; 2. Seed plantation; 3. Land preparation; 5. Transplantation; 6. Weeding; 7. Harvesting, and; 8. Postharvest handling.

b. Almost all the functions in the Namgang Chili value chain are carried out by the farmers themselves as the cultivation is not solely intended for commercial purpose. Majority of the farmers reported that the cultivation is for self-consumption and they only sell the surplus.

c. The result indicates that the productivity of Namgang Chili has fallen over the years. Reasons for this most farmers have pointed out is because of increasing instances of infestation by pest.

d. The results show that there are many constraints and challenges faced by farmers in chili cultivation. These are 1. Chili diseases on rise; 2. Lack of awareness about modern tools and techniques; 3. Excessive rain and windstorms; 4. Lack of agency support; 5. Crop damage because of wild animals; 6. Lack of motivation and encouragement for a mass commercial farming; 7. Lack of business skills among farmers; 8. No initiative for organizing farmers' cooperative/group; 8. Lack of crop protection mechanism, and; 9. Lack of market information.

e. There is a high demand for Nagang Chili in the market and the supply shortage is always felt in the market. The Namgang Chili cannot even meet the demand in the local market.

f. Results show that the production of Namgang Chili is very high. The unit cost of production of chili in Pakshikha is calculated to be Nu. 44.65. The high cost of production is due to high cost of labor as the process is labor intensive and there is no scope to use machines owing to sloppy land feature.

g. Although the cost of production and the transit cost are very high, they are offset by the high profit margin. Farmers take the share of 53 percent of margin.

7. Recommendations

a. A relevant agency might encourage farmers to form a group/cooperative for as operating as a group/cooperative could add more efficiency and support in terms of production and marketing of the commodity.
b. A relevant agricultural research and development agency could support the farmers by developing and providing seeds which are more resilient to diseases and high yielding.
c. A relevant agency might work to promote integrated disease and pest management practices in Pakshikha community.
d. A need is felt for the relevant agency to provide awareness to the farmers to improve the cultivation practice.
e. It is also suggested to establish a strong and robust collaboration and coordination between the agriculture extension office and farmers. The effort for collaboration and coordination has to be initiated by the agriculture extension office.

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