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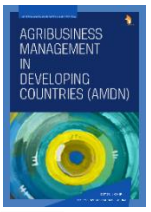

RESEARCH ARTICLE

ASSESSMENT ON ECONOMICS OF PRODUCTION AND MARKETING OF MAIZE IN SHANTINAGAR, DANG, NEPAL

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ABSTRACT

The research was conducted to assess the production economics, different marketing channel and efficiency of resource use of maize farming in Shantinagar, Dang district of Nepal. The study was conducted with 60 farmers and 20 traders. Data was gathered using a pre-tested semi-structured questionnaire survey applied to the randomly selected samples. SPSS and Microsoft excel were used for entering the data and analysis of data. Resource use efficiency of maize production was determined by using Cobb-Douglas production function. Majority of respondents were engaged in agriculture (55%). Average maize cultivated land was 2.04 hectares. Maize production was profitable in the research area as indicated by benefit cost ratio of maize growing farmer was 1.52. Discovered different marketing channel were four. Price spread and producers share were in the range from 0-6.8 and 100-80.94% respectively. 10 % increase in cost of fertilizers, seed, FYM created in increase of outcome by 3.94, 5.24% and 0.04% respectively. The sum of coefficients was 0.933. For optimal allocation of resource, expenses on fertilizers, seed, pesticides and FYM were need to be increased by 84.89% 92.90%, 92.03%, 85.07% labour, tractor, bullock and thresher were found to be over utilized resource. The sum of coefficients was 0.933 which suggested return to scale is decreasing, factor of production included in the model if increased by 100% then it would result in 93.30% increase in maize production. Further, lack of timely availability of fertilizers, incidence of disease and pest/insects, lack of influence in price determination, improper coordination between market players, producers, and government agencies were the major difficulties in the production and marketing of maize in Shantinagar, Dang. This study has highlighted the maize production's economic feasibility, marketing channels's efficiency, Resource use efficiency and major difficulties in maize production and marketing in Shantinagar, Maize block, Dang.

KEYWORDS

Economics, Farmer, Maize, Marketing, Problems, Production

1. INTRODUCTION

1.1 Background Information

Agriculture holds as backbone of Nepalese economy providing job opportunity to 65% of total population and 27.10% of total GDP of the country is covered by agriculture and forestry sector (AICC, 2020) reflecting the contribution of agriculture in total GDP is increasing at 2.72%. Cereal crops share 63% to agriculture. The country's self-sufficiency of country for food grain production has not been reached as its growth couldn't move smooth with accelerating demand of food. In the world, Nepal stands 72th position with Global Hunger Index of 22.0 (IFPRI, 2017).

Maize (*Zea mays L.*) is the world widely cultivated cereal crop and a main source of staple food in number of developing countries. It is the second important crop of Nepal grown as principal food for majority of people in the hills and as a source of feed for animal, fodder for animal in Terai area of Nepal. Reported that per capita consumption of maize in Nepal was 98g/person/day holding highest position in South Asia (Ranum, 2014). In (2018/2019), total area and production of maize have been reported 954158 ha and 2555847 mt. respectively. Maize covers about 28.15% of the total cultivated land and about 24.83% of the total production of cereal in Nepal. It shares about 6.88% to Agricultural Gross Domestic Product (MOAC, 2017/18). The proportion of maize area consists of 70% in mid hills followed by 22% in Terai and 8% in high hills (Pathik,2002). Under rain-fed condition in April-August in the hills of Nepal, maize is mostly cultivated on uplands whereas in case of inner terai, terai and some low-lying regions, maize is cultivated during spring and winter seasons due to the proper supply of irrigation. 60%, 3%, and 25% of grain were used for animal feed, seed, food, respectively in hill districts (Timilsina et al., 2016). Feed industries requires 1.5 million tons of maize affiliated to national feed industry association in Nepal (Timilsina et al., 2016). Feed serve as a very important value-added product as it supplies essential nutrients for the growth and development of livestock like poultry, cattle, buffalo, goat, pig etc. Nepal imported maize worth Rs 5 billion in 2014-2015.The consumption of maize for human and animal feed is estimated to increase by 6 to 8 percent per year in next twenty years. So, increasing the production of maize is the major need to meet this growing demand.

Dang is situated in inner terai of Lumbini province in mid-western Nepal. Gorahi is the headquarter of Dang covering 2,955 km^2 and with a population of 548,141(2011). The second biggest city of Dang is Tulsipur famous as a transportation hub. In Dang, Maize shares an area of 23458 hectares having production and productivity is 35410 and 1.51(mt/he) respectively (2018/2019). The productivity of maize was 1.49(mt/he) in (2017/2018) which is less than that in (2018/2019) (AKC, Annual Agriculture Development program, 2019),Dang.

Prime Minister Agriculture Modernization Project(PM-AMP) has included

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pockets, blocks, zones and super zones for agricultural commodity in order to address the arable land's fragmentation that is mentioned as a major hindrance for commercialization and mechanization of agriculture in the country. Dang is considered to be major maize producing district. Shantinagar has been `selected as the maize block by (PMAMP) in Dang district. This motive will encourage the farmers for maize production; thus, production as well as productivity and marketing idea of maize in Dang will be increased.

1.2 Problem Statement

In spite of rich in suitable ecological condition, In order to fullfill the demand of growing population, Nepal has fallen behind other countries in increasing the maize yield and to meet the demand of growing population. There are some constraints related with the production and marketing of maize in Dang that are affecting productivity and benefits. Delay in quality seed sowing/broadcasting, unsystematic use of manure and fertilizers, fragmentation of land, improper cropping pattern, delay in weeding and ploughing, incidence of disease-pests, field area far from homestead, inefficient marketing and price fluctuation. Similarly increase in production inputs like seed supply, labor charge, fertilizer and no assurance of governmental subsidy is an emerging issue regarding maize production. In addition, marketing problems such as proper marketing idea, market information, low influence in price determination, ineffective transportation and storage, improper communication between market players are also causing problem regarding the output from maize farming. Marketing problem resulted due to increasing trend of import of processed food and feeding items. So, farmers do not get market price of their already produced commodity as a result they are incapable of establishing commercial farming thus resulting low level of quality and low yield.

1.3 Rational of The Study

Shantinagar, Dang has been identified as a potential hub for maize production under the Prime Minister Agriculture Modernization Project (2016-2025), which aims to increase the production and productivity of the agricultural sector through mechanization and commercialization, the availability of modern technology and production materials at the lowest possible cost, and the development of necessary infrastructure for processing and enhancing marketing of agricultural products. However; farmers are unaware about modern production technologies, use of improved varieties of seed, marketing policies and different control measures about pest and diseases. In order to learn about the economics of maize production and marketing, it is crucial to do local research. Furthermore, it is currently difficult to pinpoint the key obstacles affecting maize marketing and production in this potential block. This study tries to adequately close these research gaps in this setting.

This study also provides information on the costs and advantages of maize production, the marketing channels, and related production and marketing issues; it will aid in policy development and the identification of prospective intervention areas for researchers.

1.4 Objectives

1.4.1 Broad Objective

- To assess the economics of production and marketing of maize in Shantinagar, Maize

1.4.2 Specific Objectives

- To calculate maize production's cost and return,
- To compute the producer's share and price spread in maize marketing,
- To estimate return to scale and resource use efficiency,
- To find out the major constraints of maize production and marketing,

To determine existing maize marketing channel.

2. Literature Review

2.1 Literature Review

2.1.1 Maize History and Climate

Between 7000 and 10,000 years ago, maize (Zea mays L.) was one of the first crops grown by farmers. Evidence of maize's use as food comes from some archaeological sites in Mexico where a few little corn cobs thought to be more than 5000 years old were discovered in caves. According to other views, popcorn's existence in South America is proof that maize originated in the highlands of Bolivia, Ecuador, and Peru. Regarding the development of maize as a cultivated plant and as a range of food products, the spread of maize from its birthplace in Mexico to other regions of the world has been impressive and quick. It may thrive in a range of soil types, from loamy sand to clay loam. However, soils with high water holding capacity, neutral pH, and good organic matter content are thought to be good for increased productivity. The optimum soils for its effective growth are fertile, well-drained alluvial or red loams that are free of coarse debris and rich in nitrogen. Maize is primarily a rainfed kharif crop; it can only be produced in locations that receive between 50 and 100 cm of rainfall each year. The crop is watered in places where it rains less frequently. Although it can handle temperatures as high as 35°Cers in identifying possible areas for intervention, this crop often grows well at temperatures spanning from 21°C to 27°C. Production potential of maize is high among cereal crop plants and is rich in variability in terms of morphology. It is the third important crop in world, USA holding highest production in world. The present yield of maize of Nepal is relatively low in comparison to other Asian countries.

2.1.2 Overview of Maize In Nepal

Maize cultivation is a living way of life for most farmers in hills of Nepal. The total area and production of the maize in Nepal is 954158 ha and 2555847 metric ton (mt) respectively (MOALD, Statistical Information On Nepalese Agriculture, 2074/75). Nepal imported 400000 mt maize in 2019. Over the past few decades, maize demand has been steadily increasing by roughly 5% yearly (Sapkota and Pokhrel, 2010). The demand for feed is likewise rising at a pace of 11% annually. To keep Nepal's present poultry industry running effectively, 6.46 million mt of feed are required. Thus, according the demand for maize is also changing from being used as food to being used as animal and poultry feed (8.5% and 13%) to (Timilsina et al., 2016).

Food grain production of the country compared to the total edible food requirement lagged behind by about 0.33 million tons for the fiscal year 2009/2010 (MoAD, Statistical Information In Agriculture, 2010).Though, cereals are the main staple food of Nepal however; their production is dropped by 9% since last census((NPC, 2014).The cultivated area of maize has increased marginally. The productivity of maize is just about 2.7 t/hectares (CBS, Central Bureau of Statistics, 2019)

2.1.3 Economics Potential of Maize

One of the most adaptable developing crops, maize can grow in a variety of agroclimatic settings. After rice and wheat, it is the third-most significant cereal crop worldwide. The crop is significant since it has numerous industrial uses in addition to being used as food and animal feed. Due to the crop's numerous applications in the food, feed, and industrial sectors, demand for it is increasing globally. New production technologies hold tremendous potential for boosting productivity to meet rising consumer demand.

2.1.4 Production and Marketing

The total fixed and variable costs incurred during crop production are referred to as the cost of production. Our understanding of important factors influencing farmers' profitability decisions is seriously lacking. Farmers' management skills improve after they become aware of certain facts through available information or documentation. Data on production costs can aid farmers in choosing profitable ventures during the decision-making process. By comparing the cost of production of various crops and other farming operations, farmers can learn how profitable it is to cultivate different crops that are suited to various agroclimatic conditions (Aryal et al., 2014).

Any company's gross margin is the amount that is left over after deducting its variable costs from its overall gross return. When comparing the cost of production of various crops as well as other farming operations, the gross margin provides a clear indication of whether the variable costs spent throughout the production process are covered by the value of the output (Dwett and Verma, 1980). There are various problems related to production and marketing of an agricultural commodity. Poor institutional, legal, and marketing infrastructure were found to be the main obstacles to agricultural marketing in Nepal in a research on the issues relating to it at all levels, from farmers to consumers. By increasing efficiency, the cost of seed can be decreased per unit of production. Education and experience among farmers greatly increase productivity (Thapa, 1998).

After production, marketing is the most important function, which consists of assembling, processing, and distribution of marketable surplus. The performance of all commercial operations engaged in the flow of goods and services from the point of original agricultural production until they are in the hands of consumers is how defined the term "marketing"

(Kohls and Uhl, 1980). It is a procedure that allows consumers to access products and services. For prompt product delivery and lower marketing expenses, a marketing system must be effective (Karki, 2002). By facilitating the ideal product mix, planning, and distribution, a well-developed and effective marketing system encourages and leverages the entire growth and development of an economy (Gurung et al., 1998).

According to agricultural marketing is a process that starts with the farmer's decision to produce a marketable farm product and various aspects of institutional and functional marketing structures, as well as technical and financial considerations like product assembly, market distribution planning, and end-user use (Kaini and Singh, 1998). According to agricultural marketing includes all operations related to moving agricultural products from farmers to consumers as well as supplying farm input to farmers (Acharya and Agrawal, 1999). However, agriculture marketing includes products marketing as well as input marketing. Agricultural marketing is a multifaceted process that involves a number of services and functions in order to move an agriproduct from the site of production to the point of consumption (Asian Productivity Association, 2005). It does not simply involve the buying and selling of agricultural products. An improvement in the balance between production and marketing is necessary for the agricultural sector's development. As the development of the latter is dependent on the improvement of the former, it is inefficient to focus on improving the production side while neglecting the marketing side (Rayamajhi, 2005). Production may open the door to economic expansion, but marketing is the lock-turning key. The most significant multiplier of economic growth is marketing. Therefore, an efficient marketing system is essential for sustained agricultural development.

Improvements in the agricultural marketing systems provide incentives to farm production, marketing, and farmers' income in the rural area (Pedberg et al., 1997). Price spread is defined as the difference between the price consumers pay and the price acquired by producers, while marketing margin is defined as the cost of a group of marketing services that results from the interaction of the supply and demand for those services (Tomek and Robinson, 1981). (Gurung, Subed, Gurung , Acharya, & Gurung , 1996) observed that the agricultural marketing systems in Nepal were either traditional or private sector led or the contribution by the government in the development of marketing sector was limited.

2.1.5 Marketing Channel

The term "marketing channel" describes the path that items take from the producers to the final consumers. Agriculture products go through changes in time, place, shape, and ownership during the marketing process, adding to their value. These supply networks between producers and customers are their marketing channel for the diverse produce. According to farmers who sold their produce directly to consumers received a bigger percentage of the consumer's price than farmers who sold their produce through agents (Vasisht et al., 1995).

The price of goods will increase and the producer's share will decrease as there are more middlemen in the supply chain. Therefore, we may conclude that a long marketing channel is one of the primary causes of rising marketing expenses and marketing inefficiency. The wellbeing of consumers and producers both suffer as a result of this. In comparison to shorter channels, the marketing system is less effective when intermediaries are included (Hossain et al., 1996).

2.1.6 Producer Share's

As a emphasized the inverse relationship between the producers' share and the consumers' price (Shirvastava et al., 1994). He also made the argument that the price paid by customers directly affected the share of producers and retailers. Similar to this, it has been noted that due to increasing marketing margins, retailers keep a larger portion of the price paid by consumers by (Subedi, 2000). The percentage of the retail price (the price paid by the consumer) that goes to the producer in the price that farmers receive is known as the producer's share in the consumer's rupees. The portion of the consumer's rupees that actually benefits the producer is indicated as a percentage.

2.1.7 Policies for Agriculture

To advance food security, the growth in maize productivity and production has been stressed. Since the Sixth Plan (1980–85), Nepal has been concerned with food security in order to meet peoples' basic requirements. Since then, the policies have placed a focus on boosting agricultural output, implementing income-generating initiatives, and offering food subsidies in isolated areas. The overall objective of the Agricultural Perspective Plan (APP) (1995-2015) was to increase agricultural growth from roughly 3% in the first half of the 1990s to 5% during the 20-year plan period. It placed a focus on reallocating investment to prioritized inputs and outputs, and it had a significant multiplier effect on employment and output growth in non-agricultural industries.

The main objectives of the National Agricultural Policy for 2004 are to provide food security and enhance livelihoods by converting traditional based agriculture into a commercialized and competitive sector. The Thirteenth Plan, which ran from 2013/14 to 2015/16, aimed to increase crop and livestock production and productivity, make those goods more marketable and competitive, and create and spread environmentally friendly agrotechnology. The main strategies adopted were to mechanize agricultural processes, increase the competitiveness of agricultural and livestock products by lowering their production costs, and ensure food security by producing crops and livestock products through the commercialization and dissemination of agriculture, product diversification and quality enhancement, development of rural infrastructure, and mechanization of agricultural processes. The main initiatives taken to boost output and productivity included the establishment of community seed processing facilities, the establishment of a seed self-sufficiency fund, and the promotion of production-quality maize as an import replacement. By the end of 2015/16, the strategy aimed to produce 108, 81,000 mt more food grains than the 87, 38, 000 mt produced in the base year (2012/13). The Plan also aimed to raise the yearly growth rates of the agricultural GDP to 4.5 percent (NPC, 2014). In order to enhance agricultural growth from its 1995 level of 0.5% to 4% per year, the APP (1995) was created. Through increasing factor productivity and a green revolution in agriculture based on technology, its primary goal was to accelerate the growth rate in agriculture. Similar to the aforementioned effort, the Agriculture Development Strategy (ADS, 2015-2035) is a 20-year initiative that intends to reduce poverty from 25% to 5% by the year 2035 B.S. The development strategy for agribusiness is primarily the focus. ADS seeks to realize its mission by promoting the four pillars of governance, productivity, competitiveness, and profitable commercialization.

Similar to this, the GON launched the Prime Minister Agriculture Modernization Project (2016-2025) with the goal of increasing production and productivity of the agricultural sector through mechanization in agriculture, availability of required technology and production materials, and development of essential infrastructure for processing and marketing of agricultural products. This project seeks to modernize agriculture in order to make farmers self-sufficient through commercialization. In order to overcome the fragmentation of arable land, which is seen as one of the key obstacles to agriculture mechanization and commercialization in the nation, PM-AMP has created the concept of pockets, blocks, zones, and super zones for agriculture goods. For a piece of land to be referred to as a "pocket area," it must be at least 10 hectares in size; a "block" must be at least 100 hectares; a "zone" must be at least 500 hectares; and a "super zone" must be at least 1,000 hectares in size. In order to identify specific pockets, blocks, or zones, smallholder farmers might take part in land pooling for the development of a certain crop in one location. In order to encourage smallholder farmers to participate in the program, the government has adopted a policy of consolidating landmasses through cooperatives. By establishing agri-processing enterprises and creating marketplaces based on the distinct crop production regions, the private sector actors could also gain (PMAMP, 2016).

2.2 Maize Production in Nepal

2.2.1 Production Status of Maize in Nepal

Agriculture is the backbone of the Nepalese economy. Out of total population 2, 64, 94,504, the total population involved in agriculture in Nepal is 65.7% with the contribution of agricultural sector in country's GDP by 27 % (AICC, 2020). Maize is major staple crop of hilly region of Nepal. In Nepal maize has great importance to sustain livelihood of the people. Production, exports and imports of maize with their shares and position in global market is shown in figure below:

Table 1: Production, Exports and Imports of Maize with Their Shares and Position

Shares	Position	Production and Market
Shares in this product's production = 0.2%	Ranked 38th	2.23M tons + 4.0% Yearly
Market Shares in global export = 0.0%	Ranked 126th	Export $ 1.06K - 59.0% Yearly
Market Shares in global imports = 0.3%	Ranked 50th	Import $ 93.96M - 11.9% Yearly

Table 2: Total Area, Production, Yield of Maize In Nepal			
Year	Area (Hectare)	Production (mt)	Yield (kg/he)
2007/2008	870,166	1,878,648	2,159
2008/2009	875,428	1,930,669	2,205
2009/2010	875,660	1,855,184	2,119
2010/2011	906,253	2,067,522	2,281
2011/2012	871,387	2,179,414	2,501
2012/2013	849,635	1,999,010	2,353
2013/2014	928,761	2,283,222	2,458
2014/2015	882,395	2,145,291	2,431
2015/2016	891,583	2,231,517	2,503
2016/2017	900,288	2,300,121	2,555
2017/2018	9,54,158	2,555,847	2,702

Source: (MOALD, Ministry of Agriculture and Livestock Development, 2019)

2.2.2 Production Status of Maize in Dang

In Nepal, maize is produced and consumed in different form. In Dang, 50% of population is dependent on agriculture for their livelihood. In area of about 20225.7 ha maize are cultivated by 75004 holdings with and without land (NSCoA, 2011/12). The need for maize in the feed sector is enormous. 87% of the total maize used in the production of animal feed was imported by feed industries each year from India (Timsina et al., 2016). Maize is mainly consumed in the form of grits like as rice, bread as chapatti prepared from the flour and processed products like confectionaries (Gurung et al.,2011).

Table 3: Total Area of Cultivation, Production and Productivity of Maize of Last Four Years in Dang			
Year	Area (hectares)	Production (mt)	Productivity (mt/he)
2014/2015	23500	53720	2.28
2015/2016	23950	53602	2.24
2016/2017	23900	50120	2.10
2017/2018	24843	51665	2.07

Source: (AKC, Annual Agriculture Development program, 2019),*Dang*

3. Conceptual Frameworks

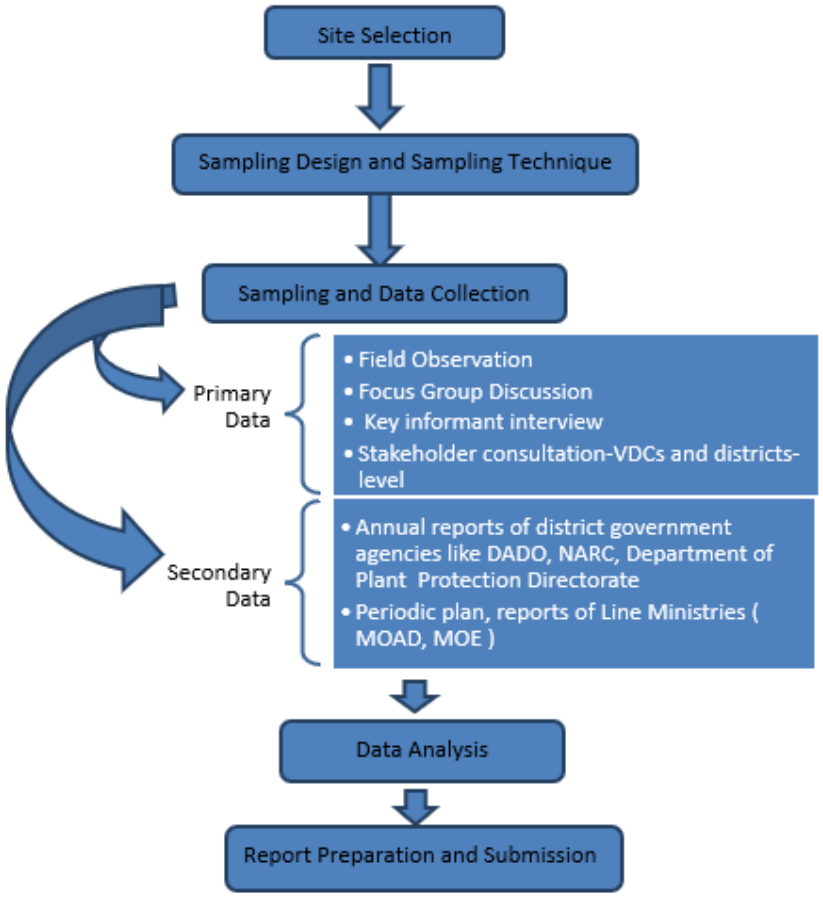


Figure 1: Conceptual Framework

4 Materials and Methods

4.1 Selection of The Study Area

The LEE site, Shantinagar was selected as the study area for the research. It was the block for maize production under PM-AMP implemented by AKC, Dang. The Study area was purposively selected based on the area of coverage of maize production. Similarly, the map of Dang district showing the study site is shown in figure below:

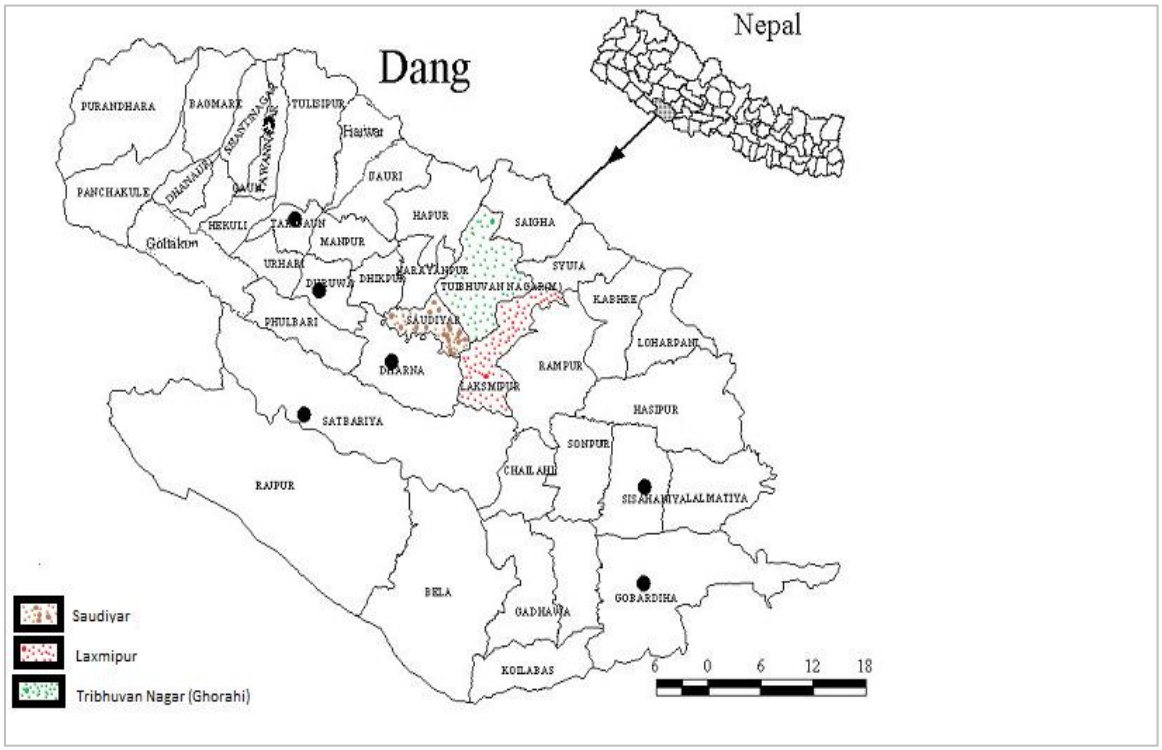


Figure 2: *Shantinagar in the map of Dang district*

4.2 Sampling Procedure

4.2.1 Selection of Respondents

Respondents were of two categories, namely, farmers and traders. Altogether 80 samples were taken for the purpose of the study. The selection of farmers and traders was done as follows:

4.2.1.1 Selection of Farmers

Sampling frame of the maize-growing farmers was obtained from AKC, Dang. 60 farmers were selected from the sampling frame. Simple random sampling techniques without replacement was followed. For this, lottery system of sampling procedure was applied.

4.2.1.2 Selection of Traders

20 traders in total were purposefully chosen based on data collected through key informant interviews and focus group discussions. Traders were the middlemen, distributors, and mills who bought corn from farmers directly or indirectly. Twenty traders were involved, of which five were local level collectors/middlemen, five were wholesalers, five were feeding mills, and the remaining five were consumers.

4.3 Sources of Data Collection

Both the primary and secondary data were used. Primary data was obtained through household survey, Focus Group Discussion and Key Informant Interview. Primary data was collected through face-to-face interview. The information on existing production system and various problems of production and marketing of maize in the study site was collected from farmers. The secondary information was obtained through reviewing different publication mainly produced by Market Development Directorate, Department of Agriculture (MoAD), CBS, AEC, NARC, AKC (Dang).

4.4 Survey Design

4.4.1 Interview Schedule Design

Semi-structured interview schedule was developed to collect the information on socioeconomic characteristics of the target group, existing production practices, agricultural land holdings, farm characteristics, income from maize production, market information along with various problems and constraints related to production and marketing of maize.

4.4.2 Pre-Testing

Prior to presenting the interview schedule to the real respondents, it was pretested to ensure its validity and dependability. 10% of responders who lived close to the research region participated in the pre-testing. The final interview schedule has the corrections.

4.4.3 Interview

The information on existing maize production and marketing system along with the associated problems was collected from the farmers and traders of the study area.

4.4.4 Focus Group Discussion

Prior to and after the final survey, a focus group discussion was held to generate ideas for scheduling interviews and to confirm the information gathered from the household survey, respectively. A checklist was utilized to collect the necessary data from the participant-targeted farms, local authorities, and other interested parties.

4.4.5 Key Informant Interview/Survey

Key informant Interview was done with the progressive farmers, AKC officers and other beneficiaries to obtain the key information. For this, a separate checklist was used.

4.5 Methods and Techniques of Data Analysis

Prior to being entered into the computer, the information gathered from the field was first coded. Software programs like Microsoft Excel and the Statistical Package for Social Science (SPSS) were used for data entry and analysis. For the investigation of socioeconomic and farm characteristics including ethnicity, education, land ownership, and so forth, basic descriptive statistics like average, standard deviation, and percentage were utilized. Pie charts and bar graphs were used to visually display the data that had been gathered. The subsequent analyses were also carried out.

4.5.1 Gross Margin

The value of the producer's product is calculated using the farm gate price less all variable costs, and this figure is known as the gross margin.

Gross return minus all variable costs is gross margin.

Where,Price x the total quantity marketed is the gross return.

Total variable cost equals the total of all variable item costs

4.5.2 Benefit Cost Analysis

After determining the entire cost and gross return from the rice crop, a benefit-cost analysis was conducted. The variable cost components of the

production process were added to determine the cost of production. Revenue from product sales was accounted for when calculating gross return. As a result, the benefit-cost analysis was performed using the formula:

$$B/C \quad ratio \quad = \quad \frac{Gross \quad return}{Total \quad cost}$$

4.5.3 Econometric Models

To determine the production economics of maize, the Cobb-Douglas production function was used. The relationship between an output and its inputs is commonly represented using this model, which provides a reasonable representation of actual production (Yuan, 2011). It is used to assess how effectively resources are used during agricultural commodity production (Dahal & Rijal, 2019).

$Y = aX_1\ b_1X_2\ b_2X_3\ b_3X_4\ b_4X_5\ b_5X_6\ b_6X_7\ b_7X_8\ b_9\ e^u$

Y is income of maize production in *katha* (NRs.),

X_1 is cost of maize seed per *katha*, X_2 is cost of animal power per *katha*, X_3 is cost of labor per *katha*, X_4 is cost of chemical fertilizer per *katha*, X_5 is cost of FYM per *katha*, X_6 is cost of pesticides per *katha*, X_7 is charge of tractor per *katha*, X_8 is charge of thresher per *katha*. e is error term and b_1 to b_9 is coefficient to be estimated.

The above-mentioned equation is linearized in logarithmic function.

$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + u$

Where, ln = Natural Logarithm, a = Constant and u = Random Disturbance

The efficiency ratio (r) was computed using the formula, $r = MVP / MFC$

Where,

MFC = Marginal factor cost

MVP = Marginal value product

(Marginal value product was computed by using formula, $MVP_i = b_i \times Y\ X_I$

where, b_i = Estimated regression, coefficients Y and X_i are the values from Geometric mean)

Efficiency estimation

r = 1 indicate the efficient use of resource

r < 1 indicate overused of resource

r > 1 indicate underuse of resource

The relative percentage change in MVP of each resource was estimated by using following formula D= (1- MFC/MVP) ×100

or, D = (1-1/r) × 100

Where,

D = Absolute value of percentage change in MVP of each resource

4.5.4 Return to Scale

To ascertain the link between inputs, outputs, and costs, return to scale is used. Profit function analysis is the main topic (JB, ME, & WN, 1986). Return to scale is constant if output grows by the same proportionate change. There is decreasing return to scale if output increases by less than the proportional change. Increasing return to scale is the term used to describe a rise in output that is greater than a proportional change. (T, 2008 Cobb-Douglas Production Function).

4.5.5 Price Spread and Marketing Channel

The price spread is the discrepancy between the price customers pay and the price farmers receive. Price spread is also the total of all marketing margins throughout the various phases of the marketing channel.

Price spread is calculated as follows: Consumer price minus Producer price (Farm gate price).

Similar to that, the producers' share (PS) is the amount paid to the farmer as a proportion of the retail price, or the cost to consumers. The formula used to calculate it is as follows.

$P_S = (P_f / P_r) \times 100$

Where,

P_f = Producer's price (farm gate price), P_r = Retailer's price

P_s = Producer's share

4.5.6 Problems in Production And Marketing

The index was created by taking into account qualitative data. Weighted indices were created based on the frequency of responses to analyze how farmers perceived the severity of production and marketing issues. Five-point ratings were used to rank farmers' perceptions of several production and marketing issues. In order to reach a reliable result, the priority index was then constructed using the weighted age average mean. The index of importance was computed by using the formula:

$$I_{imp} = \sum \frac{Sifi}{N}$$

Where,

I_{imp} = index of importance

$\sum$ = summation

S_i = i^{th} scale value

F_i = Frequency of i^{th} importance given by the respondents

N = total number of respondents

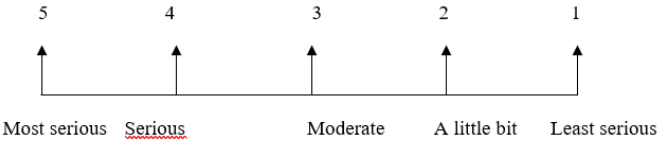


Figure 3: Scale of rating

5. RESULT

The information collected from study area was analyzed using proper statistical tools like SPSS and Ms. Excel and the result has been mentioned in this section.

5.1 Study Area

This section gives brief introduction of the study site.

5.1.1 Description of Dang District

Dang district is located in inner terai in province 5 in midwestern Nepal. Dang has 2955km^2 area and population (2011) of 548,141 with population density 190/km^2. It has latitude of 28° 00' 0.00" N and longitude of 82° 15' 60.00" E with bordering Uttar Pradesh to the north and Pyuthan, Rolpa, Salyan in the south. The altitude ranges from 300m to 3000m, climatic zone found in this district are lower tropical, upper tropical and sub-tropical. During summer, average high temperature is 36 degree Celsius and average low temperature is 26 degree Celsius. Likewise, during winter, average high temperature is 25 degree Celsius and average low temperature is 14 degree Celsius. The average mean temperature is 22 degree Celsius. On an average, there are 300 hours of sunshine per year. Variability in climate of Dang, maize can be grown in both summer and winter season. Area under maize cultivation in 2018 is 24843 hectares and total production is 51665 mt with productivity of 2.07 (mt/hectares) (AKC, 2019) Dang.

5.1.2 Shantinagar

Shantinagar is a town and Village Development Committee in Dang Deukhuri district of province 5 in south western Nepal. VDC has a total population of 4700 of which 2260(48.08%) was male population and 2440(51.91%) was female population. Shantinagar has been selected as block area for maize production under PMAMP implemented by AKC, Dang. Ward no.3 and ward no.4 of Shantinagar were selected as study

area. Shantinagar is 20km far from Tulsipur city of Dang. The total number of households in Shantinagar is 700.

5.2 Socio Economic and Farm Characteristics

All the information regarding socio economic and farm characteristics like age, sex, ethnicity, religion total own land and maize cultivated land of respondents collected is described here.

5.2.1 Age of Respondents

The age of respondents was classified into 3 categories i.e.(i) 25-34 years (ii) 35-44 years (iii) 45-54 years. 45-54 years was the major age group of respondents found in the study area followed by 34-44 years and 25-34 years.

Table 4: Distribution of respondents by age in the study area

Age of respondents in years	frequency
25-34 years	9 (15)
35-44 years	16 (26.7)
45-54 years	35 (58.3)

Note: Figure in parentheses indicate percentage

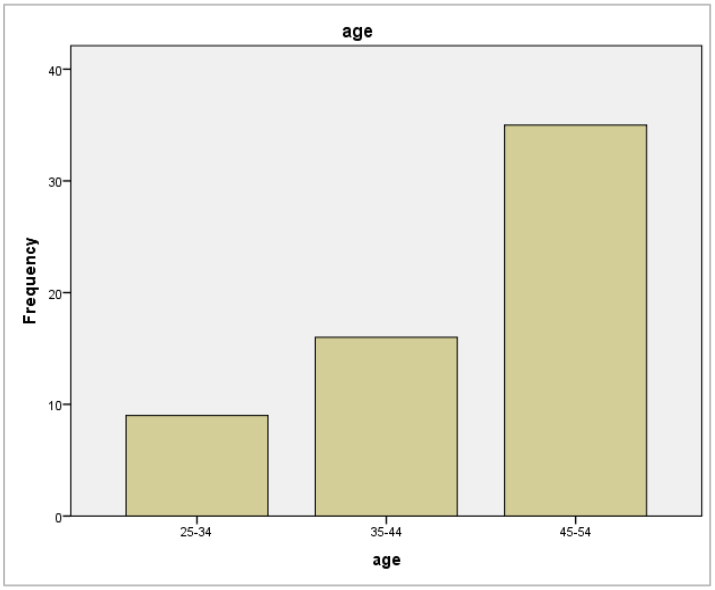


Figure 4: Graph showing the distribution of age

5.2.2 Sex of Respondents

Collected information showed that more than half of respondents were male where 39 of the total respondents were male and 21 were female.

Table 5: Distribution of Respondents by Sex in The Study Area

Male	39 (65)
Female	21 (35)

Note: Figure in parentheses indicates percentage

5.2.3 Education Status of Respondents

It is one of the determinant factors briefing socio economic and cultural characteristics in our society. Education status is more concerned with adoption of new modern technology. Respondents with good education status perform the cultivation systematically and scientifically. From the collected data of respondents, 26.7% were literate (no formal education) 23.3% had primary level of education, 13.3% had secondary level of education, 13.3% had certificate level of education (intermediate level), 5% had University level of education and illiterate level were 18.3%.

Table 6: Distribution of Respondents by Education Status in The Study Area

Education status of respondents	frequency
Illiterate	11 (18.3)
Literate	16 (27.7)
Primary	14 (23.3)
Secondary	8 (13.3)
Certificate	8 (13.3)
University	3 (5)

Note: Figure in parenthesis indicates percentage

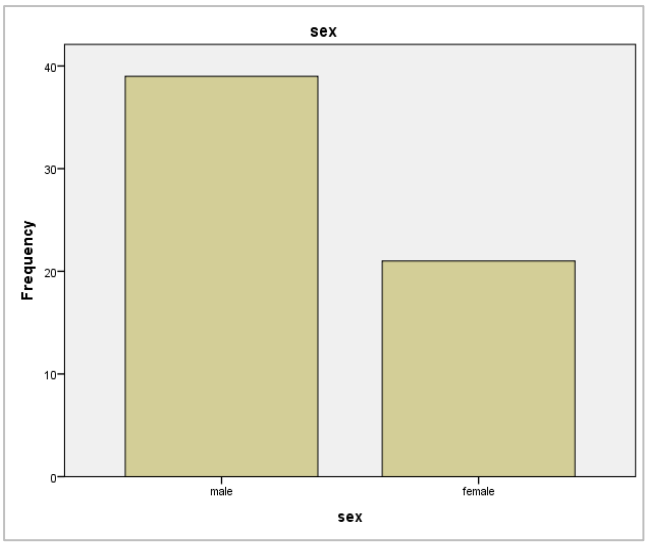


Figure 5: Bar Graph showing the gender distribution

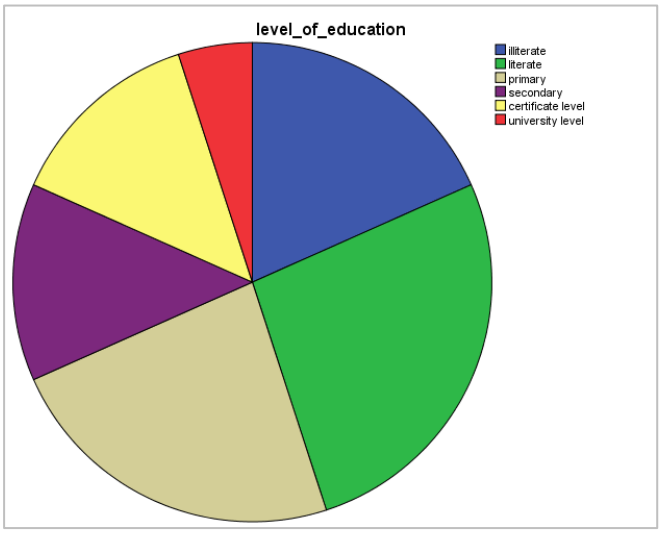


Figure 6: Education status of respondents

5.2.4 Ethnicity of Respondents

The data revealed that 51.7% of total respondents were Chhetri followed by Brahmin (21.7%), Janajati (13.3%) and Dalit (13.3%)

Table 7: Distribution of Respondents by Ethnicity in Study Area	
Ethnicity of respondents	frequency
Brahmin	13 (21.7)
Chhetri	31 (51.7)
Janajati	8 (13.3)
Dalit	8 (13.3)

Note: figure in parenthesis indicates percentage

5.2.5 Religion of The Respondents

95% of the respondents were Hindu and the rest 5% were Buddhists.

5.2.6 Occupation of Respondents

It was found that majority of the respondents were engaged in agriculture (55%) followed by foreign employment (32.50%), business (7.50%), service (5%) as their major occupation. Agriculture is the mainstay of the Nepalese economy where 66% of the active population is engaged (MoAD, 2012).

5.2.7 Family Size of Respondents

According to the report, 33.33% of respondents had families with 1-4 members, while 56.67% of respondents had families with 5-7 members. The respondent's family consisted of more than 7 people overall.

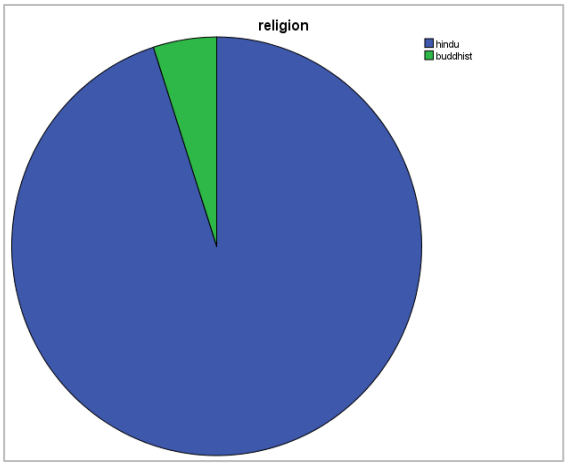


Figure 7: Religion of respondents

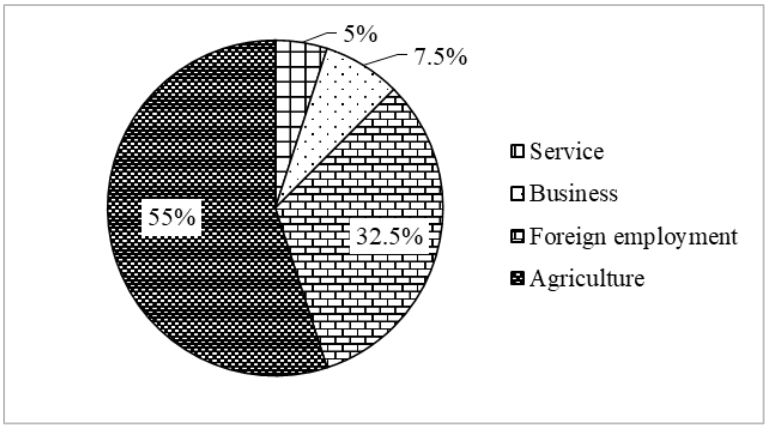


Figure 8: *Occupation of respondents*

Table 8: Family Size of Respondents	
Family size	Frequency
1-4 members	20 (33.33)
5-7 members	34 (56.67)
Above 7 members	6 (10)

Note: Figure in parenthesis indicates percentage

5.2.8 Distribution of Economically Active Population

Family members' ages were divided into three groups based on their level of economic activity: those under 15 years old, those between 15 and 59 years old, and those above 60 years old. The bulk of the population (62.5%), according to the research, were in the economically active age category.

Table 9: Distribution of Economically Active Population	
Age group	Frequency
<15years	25 (6.25)
15-59 years	125 (31.25)
>60 years	250 (62.5)

5.2.9 Annual Income of the Family:

The majority 50 percent of the respondents reported that their family income was in between Rs. 50000-100000, followed by 33.33 % above Rs100000and 16.67% below Rs.50, 0000.

Table 10: Annual Income of the Family	
Annual income (in NRs)	Frequency
<50000	10(16.67)
50000-100000	30(50)
>100000	20(33.33)

Note: Figure in parenthesis indicates percentage

5.2.10 Source of Agricultural Input

From the study, it was revealed that majority of the respondents (85%) purchased inputs from agrovets and agriculture cooperatives. Seed was provided in cheap price as government provide subsidy for seed. (11.25%) of the respondents received inputs from both governments. Both agrovets and government were the source of agricultural inputs for (2.50%) of the respondents. Similarly, the source of agricultural inputs for remaining (1.25%) of the respondent was both cooperative only.

Similarly, (75%) of the respondents obtained inputs in required quantity and time whereas (25%) of the respondents did not obtain inputs in required quantity and time which symbolizes still strong policy for easy availability of inputs is necessary to establish.

Table 11: Source of Agricultural Inputs	
Source of inputs	Percentage of respondents
Agrovets and cooperatives	85%
Government	11.25%
Agrovets and government	2.50%
Cooperatives	1.25%

5.2.11 Land Holding and Maize Cultivated Land

5.2.11.1 Land Holding Status of Respondents

The primary determinants of production cost are land, capital, infrastructure, and labor. According to the survey, 20% of respondents had total land under 15 katha, 65% of respondents had total land between 15 and 30 katha, and 9% had more than 30 katha. The respondents' average land holding was 20.08 katha, while the standard deviation was estimated at 7.26 katha.

Table 12: Land Holding Status of Respondents	
Land holding in *katha*	Frequency
<15 *katha*	12(20)
15-30 *katha*	39(65)
>30 *katha*	9(15)

Note: Figure in parenthesis indicates percentage

5.2.11.2 Maize Cultivated Land:

Most of the land owned by respondents were used for maize cultivation particularly. High density of land was Bari. The study revealed that more than two third of total respondents were engaged in maize growing in the area between 10-25 *katha* followed by 15% of respondents growing in area less than 10 *katha* and 10% of respondents growing in area more than 25 *katha*.

Table 13: Maize Cultivated Land of Respondents	
Maize Cultivated land in *katha*	Frequency
<10 *katha*	9(15)
10-25 *katha*	45(75)
>25 *katha*	6(10)

Note: Figure in parenthesis indicates percentage

5.2.11.3 Farming System

The study revealed that (78.5%) of the respondents follow both organic and inorganic farming system and (21.5%) of the respondents follow organic farming system only.

Table 14: Farming System Adopted by the Respondents (2019)	
Farming system	Shantinagar
Both organic and inorganic	78.5%
Organic only	21.5%

5.3 Economics of Maize Production

5.3.1 Cost of Production

Cost of production is defined as the expenditures incurred to obtain the factors of production such as land, labor, capital that are needed in the production stage of a commodity. Maize cultivation is a labor-intensive enterprise. For the profitability of maize, sufficient quality inputs should be incorporated during the production process. The foremost cost attributing items for the maize cultivation are manifold field preparation, improved and quality seed, chemical fertilizers, pesticides, farmyard manure, thresher, bullock, tractor and sufficient labor for several intercultural operations. The cost incurred by these items constitutes the total variable cost.

Human labor was necessary for a variety of tasks in the study region, including preparing nursery beds, clearing soil, applying pesticides and fertilizer, irrigating the area, weeding the crops, harvesting them, storing them, and transporting them.

For the analysis of cost of production, average cost of production based on farm category was calculated:

Table 15: Cost of Production Per Unit Katha		
S.N.	Variables	Average Cost (Rs.)
1	Seed	149.41
2	Farmyard manure	320.31
3	Fertilizers (Urea, DAP and MOP)	247.30
4	Labour cost (Ploughing, Land preparation, Planting, Weeding, Fertilizer spray, Pesticides spray	700.95
5	Pesticides	8.76
6	Tractor charge	302.41
7	Bullock charge	203.26
8	Thresher charge	118.86
	Total variable cost	2051.26

Farmers of Shantinagar invest less in seed (Rs149.41) because of the subsidy provided by the government under Prime minister Agriculture

modernization Project whereas labour cost (Rs700.95) was found to be dominating average cost and lowest average cost was found in pesticides cost. They invest very less in pesticides as they are less concerned for application of pesticides.

Labour cost occupied the highest portion of the cost of production i.e. (34.17%) followed by the FYM cost (15.6%), Tractor charge (14.74%), Fertilizer cost (12.05%), bullock charge (9.9%), seed (7.2%), thresher charge (5.79%) and pesticides (0.54%).

5.3.2 Profitability of Maize farming in Shantinagar

Total returns from maize in one season per *katha* was nearly Rs.3134.8679 and with the total variable cost per *katha* was Rs. 2051.26.

Gross margin = Gross returns –Total variable cost

= Rs. (3134.8679-2051.26)

= Rs. 1551.2299

Benefit cost ratio = Gross returns / Total variable cost

= 3134.8629 / 2051.26

= 1.52

Table 16: Benefit Cost Ratio Of Maize	
Cost of production per *katha*	Rs. 2051.26
Income from 1 *katha*	Rs. 3134.8629
Profit	Rs. 1551.2299
B:C ratio	1.52
Productivity (quintal /*katha*)	0.8

The average area and productivity of maize in research area was 14.68 *katha* and 0.8 (quintal/*katha*) respectively. Productivity in my research area in hectare was (2.4 tons/hectare) that is lower than that of Chitwan i.e. productivity as (2.83ton/hectare) but higher than that of Palpa (Sapkota, 2018; Dhakal, 2015). Benefit cost ratio was 1.52 which is higher than study conducted in Sindhuli by (Dahal and Rijal, 2019).

Maize farming is profitable enterprise in Dang district of Nepal.

Table 17: Production Function Analysis				
Variables	Coefficients	standard error	t-stat	p-value
ln(seed)	0.524		2.595	0.00056587
ln(fertilizer)	0.394		2.825	0.00234436
ln(fym)	0.004		0.104	0.07213
ln(pesticide)	0.182	3.023		0.0125
ln(labor)	-0.070		-0.453	0.553
ln(tractor)	-0.076		-0.934	0.752673
ln(bullock)	-0.018		-1.927	0.912834
ln(thresher)	-0.007		-0.331	0.87213
constant	8.135		1.243	0.151
R square	0.657			
Adjusted R square	0.614			
F value	11.237			
Return to scale				

F value (11.237) was statistically significant at 1% level of significance which shows that the model has good explanatory power. The R square value was 65.7% which shows that 65.7% of variation seen in the income of maize was explained by all the independent variables incurred in this model.

Cost of seed, fertilizer is statistically significant at 1% level of significance and cost of FYM, pesticide is statistically significant at 10% level of significant. 10% increase in seed will increase the income by 5.24% and also 10% increase in fertilizer will increase the income by 3.94%. Likewise, decreasing cost of labour is supported with the study conducted by (Dhakal SC, 2015) and is in contrast with the maize production in eastern part of Nepal. (Adhikari, 2018) . Decreasing cost of tractor, bullock and thresher is in line with study conducted by (Dhakal SC, 2015). Animal power is over utilized resource for potato production in Nuwakot. (S, Production Economics and determinants of potato production in Nuwakot district of Nepal, 2019). The sum of coefficients was 0.933 which is less than 1 suggested decreasing return to scale and similar result was found in study conducted by (Dhakal, 2015).

100% increase in all the factor of production would result in 93.3% increase in maize production in this research model.

5.3.4 Estimation of Resource Use Efficiency

Table 18: Estimation of Resource Use Efficiency							
Variables	co-eff	G. Mean	MVP	MFC	MVP/MFC	r	D
Labor	-0.070	14324.21	-0.435	1	-0.435	over	327.586
Fertilizers	0.394	274.23	13.13	1	13.13	under	92.38
FYM	0.004	543.87	6.62	1	6.62	under	84.89
Seed	0.524	286.97	12.55	1	12.55	under	92.03
Pesticides	0.182	536.976	6.70	1	6.70	under	85.07
Tractor	-0.076	14264.22	0.231	1	-0.231	over	332.90
Bullock	-0.018	12734.2	-0.282	1	-0.282	over	454.69
Thresher	-0.007	31231.2	-0.115	1	-0.115	over	769.564

The adjustment in the MVPs for optimal resource use is shown in Table. The data revealed that for optimal allocation of resource expenditure on fertilizers, FYM, seed, and pesticides were need to be increased by 92.90%, 84.89%, 92.03%, 85.07% .Similar result of underutilization of chemical fertilizer and seed were found by (Dhakal SC, 2015) and (Sapkota M, 2018).Decreasing cost of labor is supported by (Dhakal, 2015). Decreasing charge of animal power is supported by (Sapkota M, 2018). Increasing cost of FYM is supported by (BR and S, 2019). Similarly, for optimal allocation of resource, Tractor and thresher charge were need to be decreased by 454.69% and 769.564%

5.4 Marketing Channel

The marketing channel is the route taken by a product as it travels from the producer to the hands of the consumer. From the FGD, KIS, and field survey conducted in the study area, four marketing channels were determined. According to survey findings, just 12.5% of producers sold maize grain directly to consumers, with the majority (87.5%) selling via local level collectors. The product was transported from the local level collector to the consumer via mills and wholesalers.

Furthermore, marketing channel - (Producer – Collector – wholesaler - Consumer) was identified as major marketing channel from where 43.75% of the total produce reached to consumer. While, 26.75%, 17.5% and 12.5% of the total produce reached to consumer through marketing channels - (Producer – Collector - Consumer), (Producer-Collector-Feeding Mills) and (Producer-Consumer) respectively. The marketing channels identified in Shantinagar is better illustrated below in figure

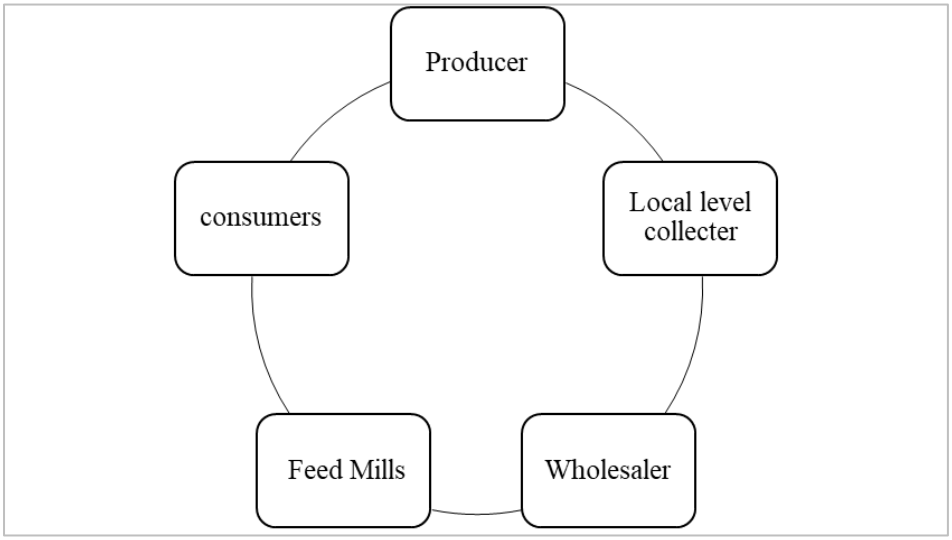


Figure 9: Marketing channel of maize identified in study area

5.5 Producers' Share and Price Spread

The entire marketing margins at various points in the marketing channel make up the price spread. It speaks of how the consumer divides the cost of the rice across many market organizations. The results of the pricing spread study for each marketing channel are displayed below. Producers' share (PS) is the amount paid to the farmer as a proportion of the retail price, or the price that consumers actually pay.

Channel 1st

Producer (NRs. 27.8) → Consumer (NRs. 27.8)

Channel 2nd

Producer (NRs. 27.8) → Local level collector (NRs.32.6) → Consumer (NRs. 32.6)

Channel 3rd

Producer (NRs. 27.8) → Local level collector (NRs. 31.8) →Mills (NRs. 34.6)

Channel 4th

Producer (NRs. 27.8) → Local level collector (NRs. 32) → Wholesaler (NRs. 32) → Consumer (NRs. 34.6)

Price spread = Price paid by consumer – Price received by producer

Price spread was observed as NRs 0, 4.8, 6.8 and 6.8 in channel 1st, 2nd, 3rd, and 4th respectively. A study found that the length of the marketing channel directly relates to price spread. Price spread increased as the length of the marketing channel grew. The marketing margin among market participants changes at different stages even when the pricing spread in the third and fourth marketing channels is equal.

Producers' share in consumers' price = (Price received by the farmers / Price paid by the consumer) × 100%

Producers' share in consumers' price was observed as 100%, 85.23%, 80.34% and 80.34% in channel 1st, 2nd, 3rd and 4th respectively According to the study, the length of the marketing channel had an inverse relationship with the producer's share, meaning that as the length of the channel increased, the producer's share declined.

5.6 Problems in Production and Marketing

Problems faced during Production and Marketing of maize is a major disturbance for diminishing the profitability. Forced Ranking method was used as a tool for analysis of production and marketing constraints faced by the farmers of this research area.

5.6.1 Production Constraints

The survey found that the most significant issue for farmers was the prevalence of illness and pests, which was followed by the scarcity of high-quality seed, land fragmentation, a lack of automation, the prevalence of disease and insect/pest, and an inadequate system of irrigation and drainage. The lack of coordination between farmers and other relevant entities, such as the government, may be the cause of this issue.

Table 19: Problems in Production and Their Indices

Production problem	Index	Rank
Lack of availability of fertilizers in required quantity and time	0.69	II
Lack of availability of quality seed	0.54	III
Land fragmentation and lackingof mechanism	0.48	IV
Incidence of disease and insects/pest	0.96	I
Lack of proper irrigation and drainage	0.32	V

5.6.2 Marketing Constraints

According to the study, the main marketing issue facing maize growers was low influence over price setting, which was followed by poor coordination between producers, market participants, and government agencies, poor understanding of marketing price, distant markets, poor transportation infrastructure, and poor storage facilities. Furthermore, these issues can be the result of delayed policy implementation.

5.7 Impact of Covid-19 On Productions And Marketing

Covid-19 is causing vulnerable condition in every sector of development activity. Covid-19 being pandemic affecting globally with death toll reaching more than 500000. Pandemic disease has descended the production of crops. Talking about the impact of Covid-19 in maize production are input crisis, labor crisis, production, loosen marketing policy, price fluctuation.

From the study, it was revealed that major impact of Covid-19 was price fluctuation followed by loosen marketing policy, labor crisis, production, and input crisis.

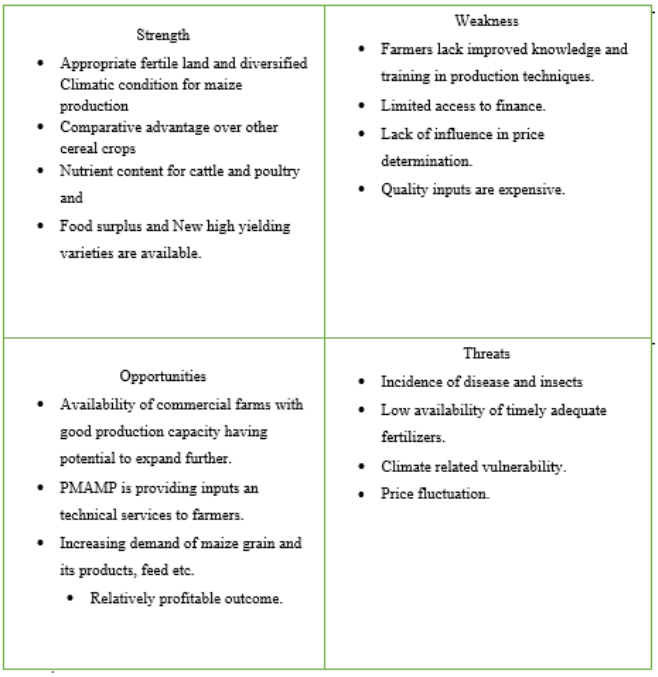
5.8 SWOT Analysis

The SWOT analysis suggests a framework for assisting researchers or planners in identifying and prioritizing the corporate goals as well as further identifying the tactics for accomplishing them. SWOT analysis is a method for evaluating a business's strengths, weaknesses, opportunities, and threats.

The study area revealed following strengths, weakness, opportunities and threats in maize farming.

Table 20: Marketing Problems Faced by Farmers		
Marketing Problems	Index	Rank
Lack of proper coordination between producers, market	0.74	III
players and government agencies		
Lack of proper knowledge for marketing price	0.80	II
Distant market and lack of transportation facilities	0.31	IV
Low influence in price determination	0.83	I
Lack of proper storage facilities	0.30	V

Table 21: Impact of Covid-19		
Impact of Covid-19	Index	Rank
Labor crisis	0.47	III
Input crisis	0.36	V
Production	0.45	IV
Loosen marketing policy	0.81	II
Price fluctuation	0.83	I



6. Conclusion

Majority of the household were engaged in agriculture (55%). Average maize cultivation land of farmers was 2.04 hectares. Productivity of maize in research area was 2.4 tons/hectares. Benefit cost ratio was calculated greater than 1 i.e. 1.52 which indicate the economic feasibility of maize farming in research area. The calculated gross margin indicated that maize cultivation is one of the profitable options for the farmers of the Shantinagar, Dang. Price spread and producers share were in the range of 0 - 6.8 and 100% - 80%. Price spread is highest in 3rd and 4th marketing channel and first marketing channel identified as most efficient. 10% increase in cost of seed, fertilizer, FYM resulted in increase in income by 5.24%, 3.94% and 0.04%. For optimal allocation of resource, expenditure on seed, fertilizers, FYM and pesticides were need to be increase by 92.90%, 84.89%, 92.03% and 85.07% respectively. Labor, tractor, bullock, thresher was found over utilized resources. The sum of coefficients was 0.933 which is less than 1 indicates diminishing returns to scale and it reflects 100% increase in all the factors of production would result in 93.3% increase in maize production.

Lack of availability of fertilizers in required quantity and time incidence of disease and insects/pest (I = 0.96) was the major problem associated with maize production in the study area. Proper supervision of subsidies in pesticides and different training related to identification and prevention of insect/pest and disease is a must to be done but it is still lacking. Even the farmers are not well aware about the recommended dose of fertilizers. Similarly, regarding marketing, lack of influence in price determination (I= 0.83) was identified as the major problem. There is an immense need of involvement of producers in price determination and government should initiate legal policy regarding this problem then only price spread will be minimized.

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