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Value Chain Analysis of Mazie: A Case Study of Smallholder Farmers in Southern Punjab, Pakistan

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A B S T R A C T

Maize, the third-largest cereal crop in Pakistan after wheat and rice, exhibits a noteworthy upward trajectory in both yield and production, distinguishing itself from other major crops. Its significance stems from the global demand for value-added maize products. Despite progress, barriers persist in the maize value chain, particularly in Punjab's conventional marketing system. This study focuses on Southern Punjab, investigating the maize value chain dynamics, with an emphasis on smallholder farmers. Through qualitative data from focused group discussions and quantitative data from a detailed survey, the study examines farmers' participation in value chains, revealing a prevalent preference for commission agents in grain markets. Analysis of gross margins and benefit-cost ratios (BCR) based on farm size and value chain participation shows higher BCR values for large farmers, followed by small and medium farmers. Notably, engagement with modern supply chain actors yields superior BCR values compared to traditional actors. This research identifies critical production and marketing constraints impeding efficient maize value chain management. Addressing these constraints is vital for optimizing the value chain and ensuring sustainable maize production growth in Southern Punjab, Pakistan.

Keywords: Benefit cost ratio, maize value chain, smallholder farmers, sustainable agriculture, Southern Punjab.

INTRODUCTION

In Pakistan, the agriculture industry is crucial to the nation's economy, contributing 18.9% of the GDP and 42.3% of the labor force (GOP, 2022). Agriculture is also an important source of foreign exchange income and promotes growth in other sectors of the economy. In Agriculture, the important crops, i.e., wheat, cotton, rice, sugarcane, and the contribution of maize are 19.44% to value addition in the sector and the GDP is 4.41%. Account of other crops 13.86% of the agricultural sector's value addition and 3.14 percent of the GDP (GOP, 2022).

After rice and wheat, maize is the third-most significant cereal crop in Pakistan. Corn (Maize) most of the production comes from hybrid maize over the past two decades which resulted in a significant increase in yield increasing farmers' productivity. However, this significant increase in maize production in Pakistan has not been depicted to increase farm income (Musser and Patrick 2002; Zulfiqar *et al.*, 2016).

In Pakistan, there was a corn crop grown in an area of 1.653 million hectares and made a record there was an increase of 16.6% compared to the previous mine has been cultivated area of 1.418 million hectares during 2021-22. The corn crop is recorded on an output of 10.635 million tons testifying a major development 19.0 percent more than 8.940 million tons last year. Corn contribution is 3.2 percent included in agriculture and from 0.7 percent GDP (GOP, 2022). The increased production was mainly because of the growing area, availability of better-quality seed, new production technologies, favorable weather circumstances, and better economic returns. Figure 1 presented the last 5 years' trends in the area, of the production of maize in Pakistan.

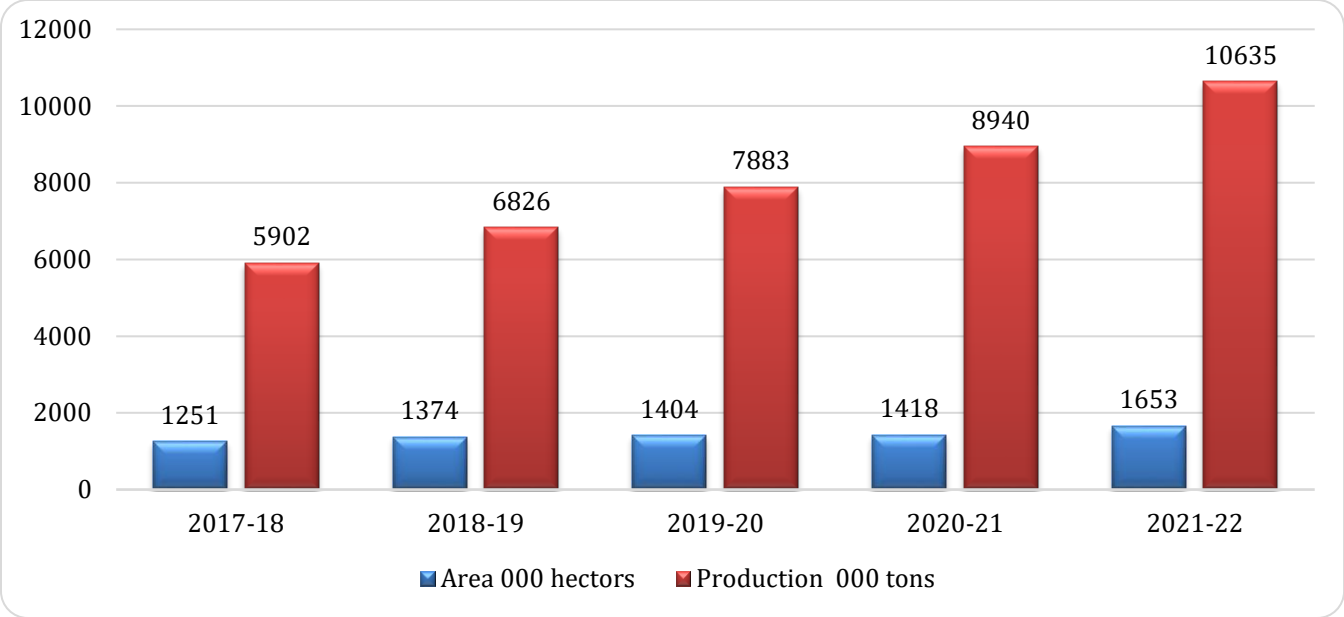

Figure 1: Area, Production trend in the last five years of maize. *Source: (GOP, 2022).*

In the world maize is the highest-yielding cereal crop, Importance countries like where is Pakistan demand from one rapidly growing population already left behind there is food available important (Memon et al., 2012, Memon et al, 2011, Ullah et al., 2011, Drishwar, 2008) feed and Supply of fodder (PARC, 2013). Khyber Pakhtunkhwa (KPK) and Punjab are traditionally the two provinces where maize is primarily farmed throughout the summer. Production of maize has been transformed by the advent of hybrid varieties, which are best planted in Punjab during the spring and produce yields of 8 to 9 tons/ hectare (t/ha) (Salam, 2012).

Maize (Corn) field, production, etc. the output is shown positive development since 1991. During the last decade, maize production growth (9.43%) came in large numbers from (8.82%) productivity increases and slow growth in areas under cultivation (0.61%). The corn crop is used for multipurpose providing raw materials to industries, poultry feed production, and livestock feed production.

The Concept of the Value Chain

A set of consecutive activities which are directed to complete strategic goals such as price competitiveness, quality management, and relationship management among the chain players (Hoque., 2003). The strategic goal of the value chain is to enhance and add value at every stage of the product lifecycle; this can be assessed by counting money spent on processes that add no value and the effort put forth to ensure product quality and profitability (Reid and Sander, 2012).

As a product transfers over the supply chain from producer to consumer, it undergoes several adjustments and exchanges, adding value along the way. The network of coordinated and integrated relationships and linkages that form when a product moves from the first producing unit to the end consumer is referred to as the "value chain" According to (Kaplinsky and Morris, 2001), the term "chain" describes the full collection of tasks necessary to move a product from conception through the intermediate stages of transformation, deliveries to end users, and final disposal following usage.

Agricultural product production, processing, and distribution are increasingly organized into value chains, where inputs, outputs, financial resources, and information resources are exchanged between farmers, processors, retailers, and other economic actors. Market dominance, consumer preferences, the institutional and legislative environment, and other factors that are related to the system's regional conditions are also linked to value chains.

In Pakistan maize production demand despite domestic inflation is facing several problems at the production level, for example, lack of maize varieties for various uses and ecologies, the delivery system of seed is week, seed prices are high, fluctuating weather, lack of new technology, and cost of input is very high, insecticide diseases, etc. The Marketing challenges for the strong value change, keeping in view the importance of high-

growing maize crop and problems faced by the different stakeholders across the entire value chain of maize production this study was planned to conduct the value chain analysis, to calculate profit across different value chain actors, and to find out the different production and marketing related constraints in maize value chain. The remainder of the paper is followed by methodology in section 2, results and discussion in section 3 and the last section is about the concluding remarks of this research.

METHODOLOGY

Case studies, surveys, simulations, field experiments, and action research are just a few of the approaches that the literature proposed (Saunders et al., 2009; Jonker and Pennink, 2010; Badar, 2015). It takes extensive research to fully understand the multifaceted and complicated dynamics of agriculture value supply networks. As a result, the case study technique will be deemed suitable for this study. Despite its shortcomings, this strategy will be able to meet the goals and research difficulties of the study. Maize crops will be selected to address the study objective of mapping the main value chain.

Study Area and Data

This study was conducted in the Punjab Province of Pakistan, which is the second-largest province in terms of area and the largest in terms of population (Naseer et al., 2016; GOP, 2018c). Punjab's agricultural Gross domestic product (GDP) is also among the highest of all other Provinces (GOP, 2018b). Punjab is also Pakistan's top producer of maize crops. Currently, South Punjab due to its fertile land is an important region in the cultivation of maize crops. Due to the budget constraints of the researcher/student, this study will only be confined to the Khanewal District of Southern Punjab. Khanewal is a very important agricultural district of South Punjab and is famous for maize production.

The desired information was collected through qualitative (focused group discussions with value chain actors) and quantitative data in the form of cost and profitability. For quantitative primary data, 75 farmers 20 commission agents, 10 wholesalers, and 5 maize processing factories were selected through purposive sampling, and farmers and other value chain actors will be interviewed with a well-developed questionnaire.

After the collection of data, respondents associated with different supply chains due to several reasons explored in the next chapter were classified as traditional and modern supply chain participants. This classification was made based on the export potential of the chain; According to (Davis, 2006), (Maertens et al., 2012), (Henderson and Isaac, 2017), and other local supply chains which are unable to take Traditional supply chains are the means of getting a product to the export level. A modern supply chain is a series of operations that results in exports.

Benefit Cost Ratio

The main objective of each activity in the business is profit maximization. Farmers took all decisions regarding the production and marketing of the products, keeping in mind the theory of profit maximization (Mehdi *et al.*, 2016). This study was also designed to calculate the profitability of the farmers and profit across different value chains using the following technique.

Profitability analysis

The following profit calculation formula was proposed by cost and revenue theories (McConnell and Brue, 2005; Mankiw, 2014).

$$\pi_i = TR_i - TC_i \quad (1)$$

TCi indicated the entire cost borne by the farmers participating in that chain, and TRi represented total revenue, where I denoted the profit of maize farmers participating in the i^{th} value chain.

Total variable and fixed costs, or TFC and TVC, respectively. Following is a breakdown of how the overall revenue was determined:

$$TC = TFC + TVC \quad (2)$$

$$TR = Q * P \quad (3)$$

Where P denotes the individual corn price and Q denotes the total amount of sold corn. As stated by (Mehdi et al., 2016), the study did not account for fixed costs related to the production of maize, such as the equipment

farmer purchased and expenses related to building the maize farm, which included land, time, and plantation, among other things. Over time, all chain participants were able to afford these expenditures, which remained constant. The four key parts of the total variable cost were the farmer's pre-harvest, post-harvest, logistical, and opportunity expenses. These are described as follows:

$$TVC = PRHC + POHC + LOGC + WCOC \quad (4)$$

The working capital described as an opportunity cost were signified by WCOC, while the logistics expenses faced by growers were denoted by LOGC. PRHC stood for pre-harvest costs and POHC for post-harvest costs. This is how the costs were determined:

$$PRHC = PLC + IRC + FRC + FYM + PSC + LBC \quad (5)$$

Where PLC stood for plowing costs, IRC for irrigation costs, FRC and FYM for fertilizer and farmyard manure costs, PSC for pesticides/chemical costs, and LBC for labor costs.

Post-harvest expenses are computed based on the methods used by the maize farmers involved in the various supply chains. Below is an illustration of each activity's specific parts.

$$POHC = HPC + SC + LBH \quad (6)$$

Where LBH is the labor cost for harvesting, SC is the cost of shelling, and HPC is the cost of harvesting and pruning, respectively.

After doing these calculations, the following method was used to determine the benefit-cost ratio for the farmers who are a part of different supply chains.

$$BCR = \frac{TR_i}{TC_i} \quad (7)$$

This also allowed for the classification of efficiency measures such as profitability, yield, and pricing across various supply chains. To more accurately characterize and map the entire value chain, the analysis would also be improved.

Constraints Ranking Analysis

Literature has reported several constraints faced by farmers in the development of supply chain management of agricultural industries (Chen and Paulraj, 2004; Sharif *et al.*, 2005; Badar, 2015; Briones, 2015; Nyaoga and Magutu, 2016; Sitek *et al.*, 2017; Yang and Shao, 2018). A total of 30 constraints were identified in this study later a detailed analysis of these studies classified the significant constraints into two different groups, namely production and marketing restrictions. Thus, it was found that a group of 30 potential restrictions was primarily focused on elements that had previously attracted attention in research studies carried out in various nations and circumstances. Farmers were asked to rate these statements on a Likert scale from 1 to 5 (strongly disagree, highly agree). For constraint analysis, the following statistical analytic methods are employed.

Cronbach's Alpha

The Cronbach alpha method is the most common way for evaluating a scale's reliability (Chan et al., 2018). The average or internal consistency of factors is calculated using this. Range of the Cronbach alpha coefficient () values is 0 to 1. It is used to discuss the elements' dependability that comes from dichotomy or Likert scales. Increasing the value of alpha means the high reliability of the measurement scale used (Santos, 1999). Generally, the value of α must be no less than 0.70 for the scale to be reliable (Tavakol and Dennick, 2011).

Mean Ranking Score Technique

In this study, essential constraints were ranked against other constraints using conventional quantitative approaches. Chan et al. (2018) utilized the same methodology to rank the key obstacles to putting a green building study into practice on a 5-point Likert scale. The restriction that ranks highest is the most important constraint. When the average scores of two constraints are equal, the constraint with the lowest standard deviation was rated highest. Standardized values of the average scores were also assessed in order to determine which 30 marketing and production restrictions farmers experience are the biggest roadblocks to the growth of supply chain management. The important constraints are determined by applying the formula to any constraints that have a normalized value larger than 0.5 (Zhao et al., 2015).

$$Normalized\ value = \frac{(mean - minimum\ mean)}{(maximum\ mean - minimum\ mean\ )} \quad (8)$$

Agreement Analysis Technique

The nonparametric test generally used to determine overall consistency between ranking sets is Kendall's consistency coefficient (Kendall's W) (Siegel, 1957). This technique does not need any specific data distribution (Lam *et al.*, 2015). Kendall's W-test is used to see if respondents in a particular group agreed with the constraints ranking. Kendall W test's null hypothesis is that "the ranking responses by the farmers were not consistent.

Kendall's W has a value between 0 and 1, with 0 denoting "1, meaning "complete consistency," and 0 meaning "no agreement." The null hypothesis is rejected, and it is determined that there is some degree of agreement among the respondents or farmers if the value of Kendall W obtained by the test is considerably lower at a particular level of significance (Siegel, 1957).

RESULTS AND DISCUSSION

The Punjab, Pakistan, maize value chain, like other agrifood industry value supply chains, begins with maize farmers (growers/producers). The private sector dominates the maize value chain, just like it does with other agricultural commodities. However, the government facilitates economic transactions by providing the necessary infrastructure and a legal framework (Siddique and Garnevska, 2018). Agri-food producers are allegedly taken advantage of by marketing intermediaries who charge them large marketing margins on their purchases (Ali, 2004).

Percentage of Product Run Through a Supply Chain

Agricultural marketing channels or value chains refer to a system or route used to transfer agricultural commodities from producers to ultimate consumers. These channels are significant to "Commodities available for sale" i.e., commodities available with farmers as surplus produce that enter the process of rotation and trade. The reason behind the trade of these commodities is to gain money in terms of profits and on the other side it is done to have access to a variety of other products. Furthermore, the ranking of the channel based on the percentage of products run through it is given in Table 1. Most of the farmers were engaged with the commission agents (Aarthi) working in the grain markets. The second important marketing channel was the village beopari or local middlemen who purchase the maize crop form farmers and sell to the other marketing actor, i.e., commission agents or the feed mills. Some of the farmers also sell their produce to mill brokers or contractors. The farmers who sell the maize directly to the processing industry were only 8 percent in our data. The least important marketing channel was local consumption, and it was about 5 percent of the survey data. These farmers use the maize crop for the animals or use the maize for making silage and selling it to the local neighboring farmers.

Table 1. Maize run through different marketing channels in the study

Channel	Farmer's sale point	%age of Product run through	Rank (1_1)
1	Local consumption	5.33	5
2	Village beopari / middlemen	33.3	2
3	Commission agents in local grain markets	36	1
4	Mill brokers / Contractors	27	3
5	Processors/ Factories / Feed mills	8	4

Farmers' shares in Consumer Rupee (I_2)

Farmers' share in the consumer Rupee is represented in Table 2 in different marketing channels. In channel V farmers' share comes out to be maximum due to the shorter path and no intermediary involved in this channel. But the percentage of farmers engaged in the channel is low because of the outreach of the processing industry and farmers have no link directly with the industry. It might be due to the dominance of a small size of farmers. The maximum price of the channels was followed by channel IV, channel III, and Channel II, and was lowest in channel I. It is observed that needless marketing layers are developed when there is a market limitation or farmers were not organized to act rationally. Moreover, this happened when access to market information is limited and bears heavy costs.

Table 2. Producer's Share in Consumer's Rupee under different Marketing Channels.

Marketing Channel	Marketing Actor	Producer's Price (Rs/40kg)
Channel-1	Local consumption	2,223
Channel-2	Village beopari / middlemen	2,190
Channel-3	Commission agents in local grain markets	2,216
Channel-4	Mill brokers / Contractors	2,229
Channel-5	Processors/ Factories / Feed mills	2,247

The Mapping of Maize Value Chain

The producer of maize initiates the maize value chain, which involves a variety of stakeholders, with the processor occupying a dominating role. The farmer's participation in this diverse value chain network of Punjab was mapped by using the data from 75 maize producers, 20 commission agents, 10 wholesalers, and 5 factories/processors (feed mills) and presented in Figure 3. Broadly speaking, there are two main maize marketing channels: (1) traditional supply chains and (2) modern supply chains.

Supply Chain Classification

Following (Naseer et. el., 2019) farmer's participation in the maize value chain was classified into traditional and modern supply chains. This classification was made based on the supply chain actor's potential to export and value addition. Supply chains actors that lead to exports and value addition are labeled as modern supply chains (Davis, 2006; Maertens *et al.*, 2012; Henderson and Isaac, 2017), and traditional supply networks are the remaining local actors in the supply chain that are unable to export or contribute value (Henderson and Isaac, 2017). Further, these two broad categories were subdivided into five distinct groups (marketing channels) of supply chain participation as present in Table 1.

Table 3. Farmer's classification within different supply chains.

Channel	Farmer's sale point	Supply chain	Value Addition	Exports
1	Local consumption	Traditional	×	×
2	Village beopari / middlemen	Traditional	×	×
3	Commission agents in local grain markets	Traditional	×	×
4	Mill brokers / Contractors	Modern	✓	✓
5	Processors/ Factories / Feed mills	Modern	✓	✓

Source: Field surveys and qualitative judgment of the researcher

Maize growers' contribution to the value chain was traced available by judging its first interaction with the other actors of the value chain. Growers who sell a major portion of their produce with the respective actors were described in Figure 3. The result of our survey shows that 42 out of 75 (56%) farmers sell associated with the traditional supply chains. In this channel farmers often sell the produce to other farmers or use it for home consumption, i.e., 4 out of 75 farmers (5.33%); sell to the local Beopari in the village, i.e., 13 out of 75 farmers (17.33%); and sell maize produce in local grain markets of the area through commission agents, i.e., 25 out of 75 farmers (33.33%). 33 out of 75 farmers, or 36%, were discovered to be involved in contemporary supply networks. In this channel, the further subdivision of farmers association was 27 out of 75 farmers (36%), who sell to the processor's local brokers or contractors, and 6 out of 75 farmers (6%) farmers sell directly to the nearby feed mill, i.e., processing industry of maize The full map of the maize value chain and farmer's participation within the distinct marketing channel were presented in Figure 3.

Profitability Analysis of Maize Crop by Farm Size

Farmers were classified into small, medium, and large categories based on operational agricultural landholding. It is evident in Table 4 that cost calculation by each activity for the production of maize across the small, medium, and large farm size categories. Following (Mehdi *et al.*, 2016), the total variable cost (TVC) of production was divided into four broader categories that are the pre-harvest cost (PRHC); post-harvest cost (POHC); logistic cost (LOGC); and last one working

capital opportunity cost (WCOC). All the activities before the harvesting are included in PRHC including ploughing cost, irrigation cost, fertilizer cost, farmyard manure cost, pesticide, and other chemical costs, pruning practices cost, and labor cost. The table clearly shows that the PRHC is higher for large farms and lower for medium farmers. The lower cost incurred by the large farmer is due to economies of scale as the concept is narrated by (Debertin, 2012).

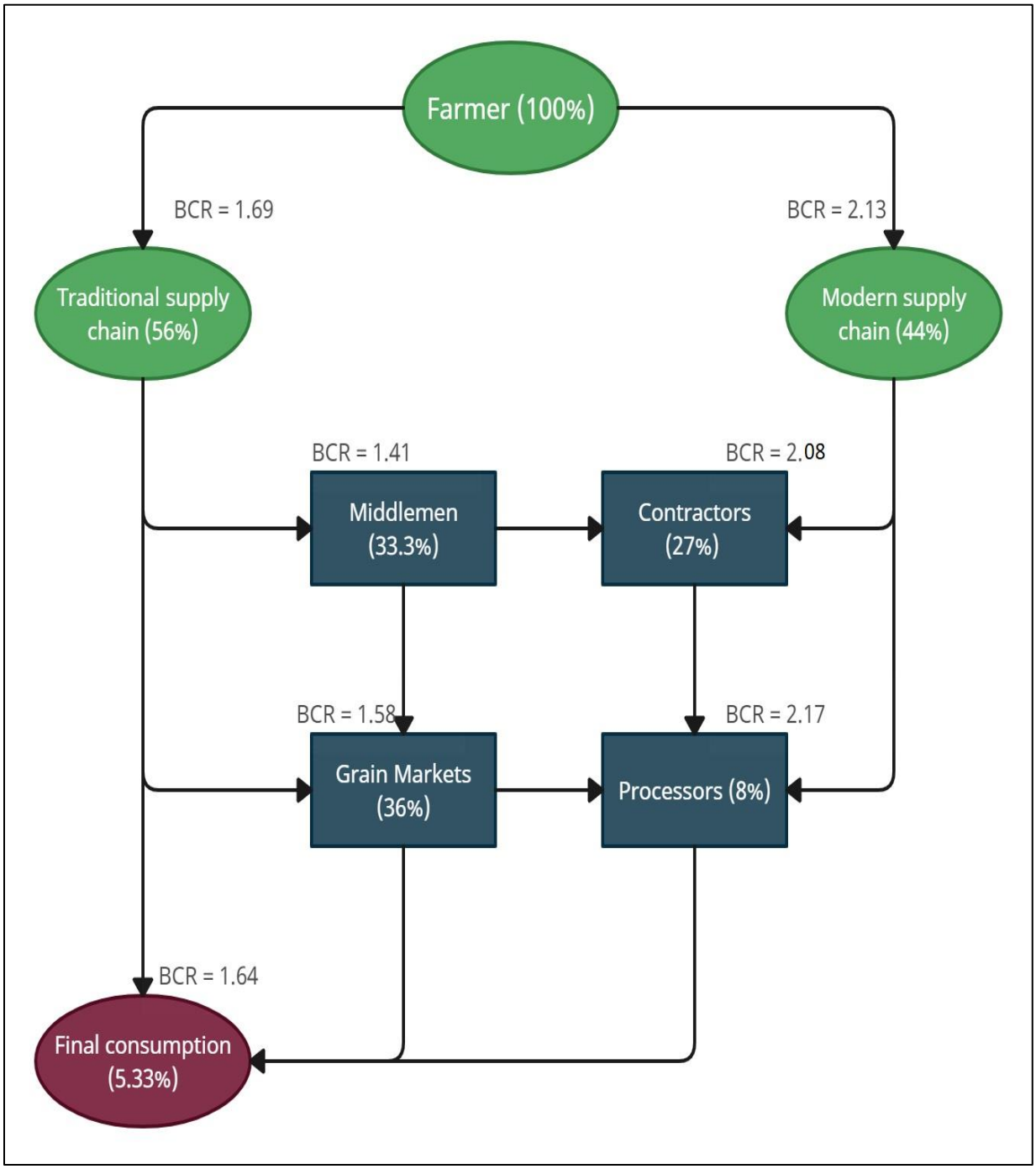

Figure 2. Farmers' association in Maize value chain map.

The farm activities and operations after the harvesting of maize crops are referred to as the Post-harvest cost (POHC). Contrary to the PRHC, the POHC is highest in the case of medium farmers and lowest in the case of small farmers. The reason for this is the inclination of large farmers to the modern supply chains. The post-harvest activities are done well in the case of large farmers, and it was seen in farm surveys that all these activities/operations in the case of small/medium farmers are not necessarily present. Similarly, the logistics cost is lower in the case of large farmers, again, due to the economies of scale per unit logistic cost incurred for larger farmers being less than medium. It was observed that the logistic cost is lowest in the case of small farmers, the reason behind this is that the small farmers mostly sell their produce near their farms in some cases they directly sell to the consumers/retailers and no logistic cost occurred in this case.

All the aforementioned costs belong to the total variable costs (TVC), the total fixed cost (TFC), is another important variable in the maize cost of production including management costs and land rent. Likewise, TVC, the TFC is also higher in the case of small farmers as compared with the medium and large size farms. The idea of economies of scale, as explained by (Debertin, 2012), states once more that the cost per unit reduces as a company's or farm's production capacity rises. Hence the total cost is the sum of TVC and TFC which is about Rs. 86,329 /- per acre in the case of large farms and Rs. 82,099 /- per acre in the case of medium farms. For small farms, it is slightly less than the large farms, i.e., Rs. 85,510/- per acre. Concluding, large farms have less per unit cost of production as compared with small and medium farms.

The per unit yield of maize is shown to be high in the case of large farmers, and they also become a good price in the market. The reason is that most of the large farmers are inclined to modern supply chains. That is the reason the total revenue of maize production is also higher in larger farmers following medium and small in a decreasing sequence. Gross margins were calculated using the benefit-cost ratio (BCR), which is calculated as the ratio of total income to total cost. The table makes it obvious that the benefit cost ratio (BCR) is larger for large farmers than for small and medium farms. Literature (Sharif et al., 2005; Shah et al., 2010) also showed in the profitability analysis of maize fruits in Pakistan that large farmers have higher BCR value than small and medium.

Table 4. Cost of Maize production according to farm size.

Activity/Operation	Small	Medium	Large
Pre-harvest Cost (PRHC)	54,707	50,632	55,785
Post-harvest Cost (POHC)	7,868	8,742	8,035
Logistic Cost (LOGC)	935	725	1,760
Total Variable Cost (TCV)	63,510	60,099	65,579
Land rent cost (LANC)	22,000	22,000	20,750
Total Cost (TC)	85,510	82,099	86,329

Calculations of BCR by farm size

Table 5 presented the calculation for the benefit-cost ratio of the farmers according to small, medium, and large farms. The unit of production is used differently in different farms, for convenience we converted all units in 40 kilograms (1 maund) for a simple and easily understandable. The per unit yield of maize is shown to be high in the case of large farmers, and they also become a good price in the market. The reason is that most of the large farmers are inclined to modern supply chains. That is the reason the total revenue of maize production is also higher in larger farmers following medium and small in a decreasing sequence. Gross margins were calculated using the benefit-cost ratio (BCR), which is calculated as the ratio of total income to total cost. The table makes it obvious that the BCR is larger for large farmers than for small and medium farms. Literature (Sharif *et al.*, 2005; Shah *et al.*, 2010) also showed in the profitability analysis in Pakistan that large farmers have higher BCR values than small and medium.

Table 5. Benefit Cost Ratio of Maize according to farm size.

Activity [unit]	Small	Medium	Large
Yield of Maize (Y) [40kg/acre]	62.0	64.5	72.0
Price of Maize (P) [Rs/40kg]	2,220	2,210	2,232
Total Revenue (TR) [Rs]	137,599	142,698	160,777
Gross Margins (GM) [Rs]	52,089	60,599	74,448
Benefit Cost Ratio (BCR)	1.61	1.75	1.88

Profitability Analysis of Maize crop by marketing channel

For the deep understating of the maize marketing channels, the traditional marketing channel and modern marketing channels were further segregated into five different channels according to the farmer's participation. All farmers' costs were assessed based on how many of the five available marketing channels they used. Results were provided in 6 which show that minimum cost was incurred by the farmers who sell their products to the contractor category. The main reason for this is the less post-harvest cost incurred by those farmers as there are no logistic costs.

Table 6. Cost of Maize production according to Marketing Channel participation.

Activity/Operation	Channel-1	Channel-2	Channel-3	Channel-4	Channel-5
Pre-harvest cost (PRHC)	48,357	53,014	61,057	48,250	50,512
Post-harvest cost (POHC)	7,782	8,952	7,954	8,532	8,115
Logistic cost (LOGC)	-	1,450	1,870	-	1,650
Total variable cost (TCV)	56,139	63,416	70,881	56,782	60,277
Land rent cost (LANC)	24,000	21,500	20,000	22,500	21,500
Total Cost (TC)	80,139	84,916	90,881	79,282	81,777

Calculations of BCR by marketing channel

Table 7 shows the economic evaluation of the maize growers based on their involvement in the five supply networks. Due to the farmer's minimal engagement and knowledge that they had entered into a premature contract with the contractor, the category for contractors had the lowest price per unit. Farmers that work with processors to sell their produce reported the best yields of maize per acre. Large farmers' affiliation with processors is the cause of this. Only 8% of farmers had connections to processors, and these farmers used superior management techniques than the other 80%. Similar to this, farmers who are connected to processors receive the greatest prices, followed by farmers connected to grain markets via commission agents, contractors, regional beopari or middlemen, and straight sales to retailers and customers. The results of the benefit-cost ratio show that farmers who use middlemen get a minimum return of 42 rupees more than the cost of 100 rupees. Farmers that work with processors that charge more than one rupee for every rupee spent saw the highest returns.

Table 7. Benefit-cost ratio of maize crop according to marketing channel.

Activity [unit]	Channel-1	Channel-2	Channel-3	Channel-4	Channel-5
Maize Yield (Y) [40kg/acre]	59	55	65	74	79
Price of Maize (P) [Rs/40kg]	2,223	2,190	2,216	2,229	2,247
Total Revenue (TR) [Rs]	131,157	120,450	144,040	164,946	177,513
Gross Margins (GM) [Rs]	51,018	35,534	53,159	85,664	95,736
Benefit Cost Ratio (BCR)	1.64	1.42	1.58	2.08	2.17

Constraint Analysis Results

The ranking of production constraints is highly agreed upon among all respondents in a specific group, as seen by the significance level of 0.00 and Kendall's W value for that group of respondents being 0.07 for the ranking of production restrictions.

Table 8. Ranking of the production barriers to maize.

Rank	Code	Mean	Std. dev.	Kendall's mean rank	Normalization
1	H4	4.20	0.669	10.28	0.83*
2	H13	3.82	1.149	9.19	0.61*
3	H3	3.71	1.202	8.88	0.55*
4	H6	3.71	1.306	8.86	0.55*
5	H2	3.62	1.140	8.45	0.50*
6	H5	3.60	1.390	8.36	0.49
7	H12	3.48	1.340	8.24	0.42
8	H11	3.47	1.448	7.99	0.42
9	H15	3.30	1.460	7.95	0.32
10	H8	3.28	1.396	7.73	0.31
11	H9	3.27	1.445	7.72	0.30
12	H1	3.19	1.394	7.14	0.26
13	H10	2.97	1.423	7.08	0.14
14	H7	2.83	1.338	6.23	0.06
15	H14	2.73	1.318	5.89	0.00

df = 14, N = 300, chi-square = 293.595, Kendall's Wa (Coefficient of Concordance) = 0.070, Asymp. Sig. | 0.000.

Important Restrictions on Maize Marketing

The ranking of marketing constraints is shown in Figure 12. It reveals that six of the fifteen specified limits have normalized values of more than 0.50, indicating that they are major marketing restraints. The biggest obstacles to maize marketing are without a doubt a lack of packaging facilities in village and union councils, the perishable nature of the product, a lack of storage infrastructure, a lack of premium prices for proper fruit size grading, a lack of quality incentives for proper packaging, and perishable nature of the product. The marketing of maize and other associated fruits face similar challenges, according to other studies on the maize value chain (Sharif et al., 2005; Badar, 2015; Siddique and Garnevska, 2018). The significance level is 0.00 and the value of Kendall's W for ranking of marketing restrictions is 0.047, showing that there is significant agreement among all respondents in a given group regarding the ranking of the farmers' maize production constraints.

Table 9. Ranking of the Marketing restrictions on maize.

Rank	Code	Mean	STD	Mean Rank	Normalization
1	G4	4.38	0.676	10.40	1.00*
2	G5	4.35	0.681	9.90	0.98*
3	G8	4.27	0.764	9.64	0.91*
4	G1	4.22	0.729	9.63	0.88*
5	G13	4.19	0.928	9.50	0.85*
6	G7	4.05	1.019	9.04	0.75*
7	G11	3.71	1.171	7.91	0.49
8	G10	3.58	1.284	7.55	0.40
9	G14	3.57	1.237	7.44	0.39
10	G2	3.57	0.977	7.40	0.39
11	G12	3.56	1.334	7.15	0.38

12	G6	3.47	1.039	6.83	0.31
13	G15	3.34	1.370	6.25	0.21
14	G9	3.06	1.435	5.96	0.01
15	G3	3.05	1.323	5.40	0.00

Chi-square = 415.596, N = 300, df = 14, Kendall's Wa (Coefficient of Concordance) = 0.047, Asymp. Sig. 0.000.

CONCLUSIONS

Through the use of qualitative and quantitative data, the study mapped the maize value chain and examined the participation of farmers in different value chains, primarily centered on marketing actors. The results indicated that a significant proportion of farmers were associated with commission agents in grain markets, followed by those involved with local middlemen. Only a small number of farmers consumed maize locally as livestock feed. Furthermore, the paper calculated the gross margins and benefit-cost ratio (BCR) of maize production, considering both farm size and value chain participation. It was observed that larger farmers achieved higher BCR values, followed by small and medium farmers. Additionally, farmers engaged with modern supply chain actors, such as processing industries or contractors, exhibited higher BCR values compared to those involved in traditional value chains, such as local middlemen or commission agents in grain markets. Lastly, the study identified critical production and marketing constraints that need to be addressed for efficient management of the maize value chain. These findings provide valuable insights for policymakers, researchers, and stakeholders involved in the agricultural sector. By addressing the identified constraints and promoting the integration of smallholder farmers into modern value chains, it is possible to enhance the overall efficiency and profitability of maize production in the Southern Punjab region and contribute to the development of the maize industry in Pakistan.

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