



## **Investment Potential of Maize Value-Added By-Products in South Punjab**



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## **Executive Summary**

This study explores the investment potential of maize value-added by-products in South Punjab, Pakistan, a region rich in agricultural activity and poised for economic growth through agribusiness. Maize is a crucial crop in South Punjab, contributing significantly to the local economy. However, the current state of post-harvest handling and processing is outdated, leading to significant losses and underutilization of potential by-products like corn oil, starch, and animal feed. This report also highlights the opportunities for value addition within the maize value chain, which can enhance farmer income, create jobs and drive local economic development.

The demand for maize by-products is substantial both domestically and internationally. Efficient processing methods and improved quality control can help meet market needs and unlock new revenue streams. The study identifies that sustainable practices and compliance with environmental and social standards are essential for long-term viability and market acceptance. Moreover, strengthening the regulatory framework to support value addition is crucial for enhancing the competitiveness and export potential of maize by-products in global markets.

Several challenges hinder the maize value chain, including inadequate infrastructure, limited access to finance, and insufficient technical knowledge. Climate change and pest infestations further exacerbate these issues, posing significant risks to maize production. Addressing these challenges requires a multifaceted approach, including investments in modern storage facilities, advanced processing technologies, and improved logistics. Additionally, financial support through low-interest loans, grants, and crop insurance schemes can provide the necessary cushion for farmers and processors.

Government policies and institutional support play a pivotal role in fostering a conducive environment for value addition. This report recommends developing clear policies that encourage value addition, enhance quality standards, and promote sustainable agricultural practices. Increased funding for research and development, particularly in innovative maize by-products and improved crop varieties, is also essential. Collaboration among research institutions, industry stakeholders, and Government bodies can drive innovation and ensure the successful implementation of these recommendations.

In short, unlocking the full potential of the maize value chain in South Punjab requires coordinated efforts from all stakeholders. By addressing policy, infrastructure, financial support, capacity building, market development, and sustainability issues, the region can achieve significant economic growth and development. This study provides a comprehensive roadmap to navigate the challenges and opportunities in the maize value-added by-products for sustainable and inclusive social and economic progress of South Punjab region.

## 1. Introduction

South Punjab is well defined region in Punjab Province that includes Multan, Dera Ghazi Khan, and the Bahawalpur Civil Divisions. This includes 11 districts: Vehari, Multan, Lodhran, Khanewal, Bahawalpur, Bahawalnagar, Rahim Yar Khan, Rajanpur, Muzaffargarh, Layyah, and D.G. Khan.

**Figure 1: Map of South Punjab**



These districts have 42 sub-district administrative units (tehsils), 1,221 union councils, and 8,907 Mauzas. The population of South Punjab is estimated to be around 34.7 million, while Punjab's total population is 115 million. Population density in the South Punjab is presently 447 persons per Square Kilometer and population growth rate is 2.32%.<sup>1</sup>

Maize cultivation has emerged as a pivotal sector in South Punjab, Pakistan, driven by a combination of historical agricultural practices and evolving economic factors. Traditionally, South Punjab's agricultural economy has been dominated by staples such as wheat, rice, and cotton. However, with shifting environmental conditions, the need for crop diversification, and increasing demand for versatile crops, maize cultivation has gained prominence. This shift addresses the rising market demand for maize and its by-products, positioning maize as a strategic crop for the region's economic growth and food security.

### 1.1 Background and Rationale

Maize, also known as corn, is one of the most important cereal crops in the world, playing an important role in global food security, animal feed, and industrial raw materials. In Pakistan, maize is the third most important cereal crop after wheat and rice, contributing significantly to the country's agricultural economy. The cultivation of maize is widespread, with a major portion of production concentrated in the Punjab province, particularly in its southern region.

In South Punjab, maize production has seen substantial growth due to favorable climatic conditions, improved agricultural practices, and increased farmer awareness. The region's fertile lands and suitable weather conditions have made it one of the leading maize-producing

<sup>1</sup> The Bureau of Statistics, Punjab



areas in Pakistan. However, despite the significant production, the full potential of maize value addition remains untapped.

Value-added by-products of maize, such as corn oil, corn starch, corn syrup, ethanol, and animal feed, offer immense economic opportunities. These by-products not only enhance the profitability of maize cultivation but also contribute to the development of allied industries, creating employment and boosting the local economy. The rationale behind this study stems from the need to explore these opportunities comprehensively, identify the existing gaps, and propose actionable strategies to maximize the investment potential in maize value-added by-products.

The economic significance of maize value addition is multi-faceted. It can lead to increased income for farmers, reduce post-harvest losses, and promote sustainable agricultural practices. Moreover, the development of a robust value-added industry can help in diversifying the agricultural economy, reducing dependency on primary crops, and enhancing food security. This study aims to provide a detailed analysis of the investment potential in maize value-added by-products in South Punjab, highlighting the critical factors that can drive growth and sustainability in this sector.

## **1.2 Scope and Objectives of the Study**

The scope of this study is geographically limited to South Punjab, Pakistan, encompassing the major maize-producing districts in the region. The study covers the entire maize value chain, from production and harvesting to processing, value addition, and marketing of by-products. It also examines the regulatory and institutional frameworks supporting the maize industry and identifies challenges and opportunities within the value chain.

The primary objectives of the study are as follows:

1. Analyze maize production in South Punjab.
2. Evaluate harvesting and post-harvest handling practices.
3. Examine processing and value addition methods.
4. Assess market demand for maize by-products.
5. Identify environmental and social impacts.
6. Review regulatory and institutional frameworks.
7. Identify challenges and opportunities in the value chain.
8. Provide recommendations based on the findings to increase production and enhance value addition.

By addressing these objectives, the study aims to provide a comprehensive understanding of the investment potential in the maize value-added by-products sector in South Punjab. The findings and recommendations are intended to guide stakeholders, including farmers, processors, investors, policymakers, and development agencies, in making informed decisions to foster sustainable economic growth in the region.

## **2. Maize Crop: An Overview**

In South Punjab, maize is particularly important due to its adaptability to various climatic conditions and its role in supporting both the local economy and food security. This section provides an overview of maize production, key producing districts in South Punjab, and the harvesting and post-harvest handling practices that impact maize quality and marketability.

## 2.1 Maize Production

Maize is one of the most significant cereal crops in Pakistan, playing an important role in the country's agriculture sector. It is cultivated extensively due to its adaptability to climatic conditions and soil types. Maize production in Pakistan is divided into two cropping seasons; Rabi (spring) and Kharif (summer). The Kharif season is the primary maize-growing season, contributing to a larger portion of the total production.<sup>2</sup>

In South Punjab, maize is a vital crop, contributing significantly to the region's agrarian economy. The area's favorable climatic conditions, including adequate rainfall and suitable temperatures, support high maize yields. According to recent agricultural statistics, South Punjab produces a substantial percentage of Pakistan's total maize output, making it a key player in the national maize market.

Some of the key points about maize production in the region are given as below;

- **Area and Yield:** Maize is cultivated on a significant area in south Punjab, with the total area under maize cultivation being around 0.974 million hectares, yielding 3.707 million tons of grain per year with an average yield of 3805 kg/ha.<sup>3</sup>
- **Importance:** Maize is considered the "King of Silage Crops" and is a crucial crop for cereal production. It is primarily a rainfed crop, planted shortly before the monsoon arrives and harvested once the monsoon has passed.
- **Regional Variations:** The districts of Bahawalpur, Bahawalnagar, Multan, and Rahim Yar Khan in South Punjab are more sensitive to a 2-month drought during the growing season of spring maize, which is typically sown in February-March and harvested in early June.<sup>4</sup>
- **Drought Impact:** Autumn maize, which is grown in all districts of Punjab, including South Punjab, is more susceptible to meteorological drought compared to spring maize. The districts of Dera Ghazi Khan, Bahawalpur, and Multan are identified as more drought-stressed for autumn maize.
- **Regional Significance:** Maize is an important crop in South Punjab, contributing to the region's food security and agricultural economy. It is used as food, feed, and industrial crop, with around 60% of maize grain used in poultry/animal feed industry, 30% in wet milling, 6% as food, and 4% as seed or other purposes.<sup>5</sup>

## 2.2 Maize Producing Districts in South Punjab

South Punjab comprises several districts that are renowned for maize production. These districts are characterized by their extensive agricultural activities and significant contributions to the regional and national maize output. The top five maize producing districts in South Punjab are Lodhran, Multan, Vehari, Khanewal and Bahawalnagar. These districts have consistently shown high yields and production levels over the years.

The districts in South Punjab that are significant producers of maize include:

- **Lodhran:** Lodhran is a key district in South Punjab for maize production, with a production of 84.66 thousand tons of maize in 2021-22.

<sup>2</sup> <https://aari.punjab.gov.pk/>

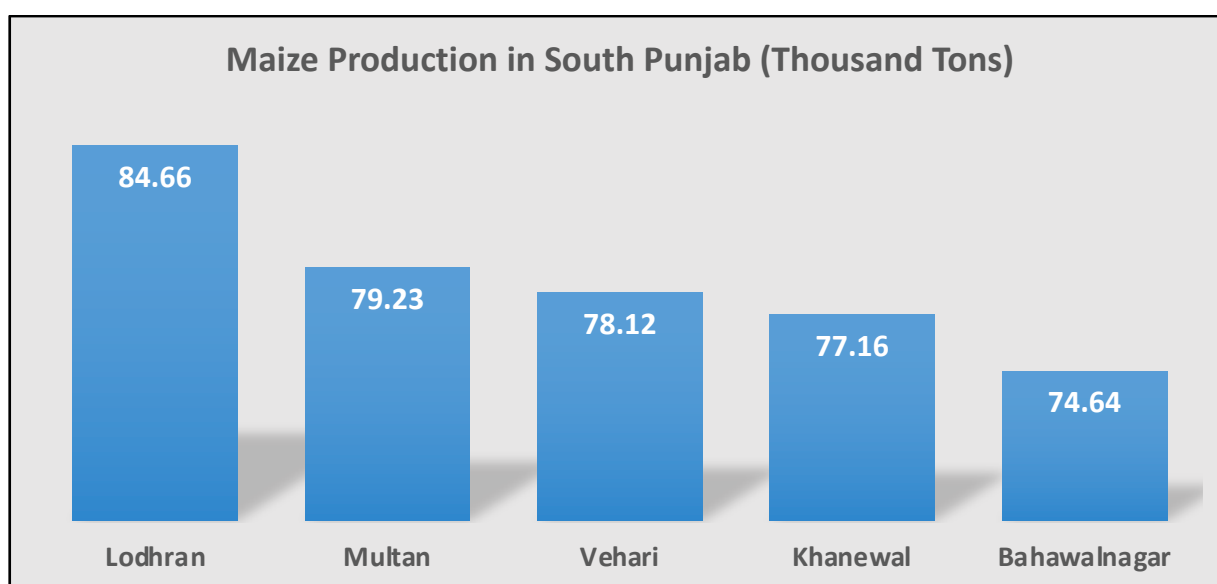
<sup>3</sup> <https://crs-agripunjab.punjab.gov.pk/system/files/Maize%20forecast%20punjab.pdf>

<sup>4</sup> <https://iwaponline.com/jwcc/article/13/1/113/83806/Impact-of-meteorological-drought-on-agriculture>

<sup>5</sup> [https://aari.punjab.gov.pk/crop\\_varieties\\_maize\\_millet](https://aari.punjab.gov.pk/crop_varieties_maize_millet)

- **Multan:** Known for its high yields for maize, Multan is a major contributor to maize production in South Punjab. In 2021-22, it produced 79.23 thousand tons of maize.
- **Vehari:** Vehari is another district in South Punjab that contributes substantially to maize production, with a production of 78.12 thousand tons of maize in 2021-22.
- **Khanewal:** Khanewal is also a significant producer of maize in South Punjab, with a production of 77.16 thousand tons of maize in 2021-22.
- **Bahawalnagar:** Bahawalnagar is another key district in South Punjab for maize production, with a production of 74.64 thousand tons of maize in 2021-22.

### **Top Five Maize Producing Districts in South Punjab (2021-22)**



Source: <http://www.amis.pk/Agristatistics/DistrictWise/Maize.html>

### **2.3 Harvesting and Post-harvest Handling**

Harvesting and post-harvest handling are critical stages in the maize value chain, influencing the quality and marketability of the final product. Efficient practices in these stages ensure minimal losses and maintain the nutritional value of maize.

#### **a). Harvesting**

Maize harvesting in South Punjab typically involves both manual and mechanized methods. Manual harvesting is labor-intensive and involves hand-picking the cobs, while mechanized harvesting uses combine harvesters to increase efficiency and reduce labor costs. The timing of the harvest is crucial to ensure that the maize is at the right moisture content to prevent post-harvest losses.

#### **b). Drying**

After harvesting, maize cobs are often left in the field to dry naturally under the sun. This process reduces the moisture content to safe levels for storage. In some cases, mechanical dryers are used to expedite the drying process, especially during adverse weather conditions.

### **c). Shelling**

The dried maize cobs are then shelled to separate the kernels from the cobs. Shelling can be done manually using hand tools or mechanically using maize shellers. Mechanical shelling is more efficient and helps in reducing the time and labor involved.

### **d). Storage**

Proper storage is essential to prevent spoilage and maintain maize quality. Traditional storage methods include the use of granaries and silos, where maize is kept in a dry and pest-free environment. Modern storage solutions often involve hermetic storage bags and silos equipped with temperature and humidity control systems to extend the shelf life of maize.

### **e). Transportation**

Efficient transportation networks are vital for moving harvested maize from farms to processing units and markets. In South Punjab, well-developed road infrastructure and transport services facilitate the timely delivery of maize, reducing post-harvest losses and ensuring that the product reaches the market in good condition.



By implementing effective harvesting and post-harvest handling practices, farmers in South Punjab can enhance the quality and market value of their maize, contributing to increased profitability and sustainable agricultural development in the region

## **2.4 Distribution and Marketing**

### **a). Distribution Channels**

The distribution of maize and its by-products in South Punjab involves several channels to ensure products reach both local and international markets. The key distribution channels are as following:

- **Local Markets:** Small-scale farmers and processors sell directly to consumers in local markets. This includes grain markets and retail shops.
- **Wholesale Markets:** Larger quantities of maize and by-products are sold to wholesalers who distribute them to retailers, food processors, and export markets.
- **Cooperatives:** Farmer cooperatives play a vital role in aggregating produce from small-scale farmers, providing them with better bargaining power and access to larger markets.



- **Export Markets:** Processed maize products like starch, oil, and DDGS (Dried Distillers Grains with Solubles) are exported to international markets, leveraging South Punjab's strategic location and infrastructure.

#### **b). Marketing Strategies**

Effective marketing strategies are crucial to promote maize and its by-products which include;

- **Branding and Packaging:** Attractive packaging and strong branding help differentiate products in the market and increase acceptability as well.
- **Quality Assurance:** Emphasizing high-quality standards and certifications can enhance marketability, especially in international markets.
- **Market Diversification:** Exploring new markets and diversifying product offerings can mitigate risks associated with market fluctuations.
- **Digital Marketing:** Utilizing online platforms and social media to reach a broader audience and promote products.

### **2.5 Key Stakeholders in the Maize Value Chain**

#### **a). Farmers**

Farmers are the primary stakeholders, responsible for cultivating and harvesting maize. They can be categorized into small-scale, medium-scale, and large-scale farmers. Small-scale farmers often face challenges such as limited access to resources and markets, while large-scale farmers are better equipped with technology and infrastructure.

#### **b). Processors**

Processors convert raw maize into value-added products. They range from small local mills to large industrial processors. Their role is critical in enhancing the economic value of maize and ensuring a steady supply of diverse maize products to the market.

#### **c). Traders and Distributors**

These stakeholders facilitate the movement of maize products from producers to consumers. They include wholesalers, retailers, and export agents who ensure that products reach both local and international markets efficiently.

#### **d). Government and Regulatory Bodies**

Government institutions and regulatory bodies oversee the maize value chain, ensuring compliance with standards and providing support through policies and initiatives. They play a crucial role in fostering a conducive environment for maize production and processing.

#### **e). Research and Educational Institutions**

Universities and research institutions contribute by developing new technologies and best practices for maize cultivation and processing. They also provide training and capacity-building supports to farmers and processors.

#### **f). Financial Institutions**

Banks and other financial institutions provide necessary funding for farmers and processors. Access to credit and financial services is vital for the growth and modernization of the maize value chain.

### **g). Non-Governmental Organizations (NGOs)**

NGOs support small-scale farmers and processors by providing technical assistance, training, and advocacy. They often work to improve livelihoods and promote sustainable agricultural practices.

### **h). Consumers**

Consumers, both domestic and international, drive demand for maize and its by-products. Their preferences and purchasing power influence the market dynamics and value chain strategies.

## **3. Value-Added By-Products of Maize Having Investment Potential**

The maize crop is not just a staple food but also a versatile raw material for various value-added by-products. In South Punjab, the potential for developing these by-products can significantly boost the local economy by creating new business opportunities and improving the livelihoods of farmers and processors.

### **3.1 Maize By-Products: Types and Utilization**

Maize can be processed into a wide range of by-products, each serving different industries and purposes. Key maize by-products include;

#### **a). Corn Oil**

Corn oil is extracted from the germ of the maize kernel. It is commonly used for cooking, salad dressings, and margarine. Industrial applications include biofuel production and use as a carrier for drugs and cosmetics.

#### **b). Corn Starch**

Corn starch is derived from the endosperm of the maize kernel. It has various uses in the food industry (as a thickener, stabilizer, and emulsifier), and in non-food industries (such as paper, textiles, and adhesives). It is also used in pharmaceuticals and biodegradable plastics.

#### **c). Animal Feed**

By-products like corn gluten feed, corn gluten meal, and distillers' dried grains with solubles (DDGS) are high-protein feeds for livestock, poultry, and aquaculture. They provide essential nutrients and improve animal growth and productivity.

#### **d). Corn Syrup**

Corn syrup, produced from corn starch, is a sweetener used in beverages, confectionery, and baked goods. High-fructose corn syrup is a common ingredient in processed foods and drinks.

#### **e). Ethanol**

Maize is a primary source for ethanol production through fermentation. Ethanol is used as a biofuel additive to gasoline, reducing carbon emissions and enhancing energy security.

#### **f). Cornmeal and Corn Flour**

Cornmeal and corn flour are staple food ingredients used in making bread, tortillas, snacks, and other food items. They are integral to traditional and contemporary cuisines in many regions.

**g). Corn Bran**

Corn bran, a by-product of milling, is rich in fiber and used in animal feed, dietary supplements, and as a filler in the food industry.



**3.2 Processing Methods for Value Addition**

The processing of maize into by-products involves various sophisticated methods to enhance their value and utility:

**a). Wet Milling**

Wet milling separates maize into its components (starch, protein, fiber, and germ) through steeping, grinding, and centrifugation. This method is used to produce corn starch, corn oil, and high-fructose corn syrup.

**b). Dry Milling**

Dry milling grinds maize kernels into flour and grits without soaking. It is less complex and capital-intensive than wet milling. It produces cornmeal, corn flour, and various food ingredients.

**c). Extrusion**

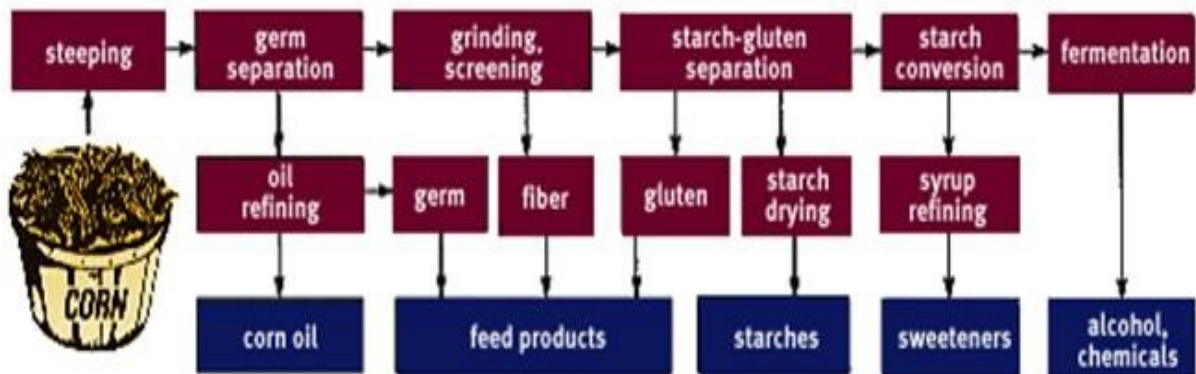
Extrusion involves forcing maize dough through a shaped opening at high pressure and temperature. It is used to produce snacks, breakfast cereals, and pet food. This method enhances the nutritional value and shelf life of maize products.

**d). Fermentation**

Fermentation converts maize starch into ethanol and CO<sub>2</sub> using yeast. The process also yields DDGS, a valuable animal feed. Ethanol production supports renewable energy goals and provides a high-value by-product.

**e). Oil Extraction**

Corn oil is extracted from the germ using mechanical pressing or solvent extraction. The resulting corn oil is used in cooking, biofuels, and industrial applications.



### 3.3 Potential Opportunities in Maize Value Addition in South Punjab

Expanding the range of maize-based products offers significant opportunities for value addition in South Punjab. Food products such as cornflakes, cornmeal, corn syrup, and snacks have a growing market both domestically and internationally. Additionally, the production of high-quality animal feed, including silage for dairy animals, can address the needs of the poultry and livestock industries. Biofuel production is another promising avenue. Maize can be used to produce bioethanol, a sustainable and renewable energy source that can help reduce dependence on fossil fuels and contribute to energy security. Furthermore, maize-based industrial products, such as starch and its derivatives (e.g., glucose, dextrin), are in high demand across various industries, including food, pharmaceuticals, textiles, and paper manufacturing. The growing environmental concerns also create a potential market for biodegradable plastics made from maize starch.

Nutraceuticals and pharmaceuticals represent another area of opportunity. Maize can be processed into nutraceutical products, such as dietary supplements and functional foods, which are gaining popularity for their health benefits. Additionally, maize-based ingredients can be utilized in the production of pharmaceuticals, including tablets, syrups, and other medicinal products. There are significant export opportunities for maize and its by-products. By improving processing techniques and meeting international standards, South Punjab can become a key exporter in the global market. The demand for organic products is also increasing, and South Punjab can tap into this market by producing and certifying organic maize products.

### 3.4 Domestic and International Market Demand for Maize By-Products

The demand for maize by-products is robust both domestically and internationally, driven by their wide-ranging applications.

#### a). Domestic Market Demand

- **Food Industry:** Corn starch, corn flour, and cornmeal are in high demand for various food products, including snacks, baked goods, and confectionery.
- **Animal Feed:** The livestock and poultry industries require large quantities of high-protein maize by-products like DDGS and corn gluten meal.
- **Biofuels:** Potential of Ethanol production is growing as Pakistan seeks to enhance its renewable energy sources.



## **b). International Market Demand**

- **Export Opportunities:** Maize by-products such as corn starch, corn oil, and DDGS have strong demand in international markets, including North America, Europe, and Asia.
- **Quality and Standards:** Meeting international quality standards and certifications can enhance the competitiveness of South Punjab's maize by-products in the global market.
- **Rising Health Consciousness:** Increasing demand for healthy and organic food products boosts the market for maize-based ingredients.
- **Environment Friendly Products:** The growing emphasis on sustainability and eco-friendly products drives demand for biodegradable plastics and biofuels derived from maize.

## **4. Compliance Requirements/Segregations**

Understanding and adhering to compliance requirements is crucial for the sustainable development of the maize value chain in South Punjab. These requirements encompass environmental, social, and community impacts, alongside the implementation of mitigation and sustainability measures to ensure long-term viability and acceptability.

### **4.1 Environmental Impacts of the Maize Value Chain**

The maize value chain, from cultivation to processing, has significant environmental impacts that need careful management.

#### **a). Cultivation Impacts**

- Intensive maize farming can lead to soil erosion, loss of fertility, and degradation due to overuse of chemical fertilizers and pesticides.
- Maize is a water-intensive crop, and excessive irrigation can lead to depletion of local water resources and affect groundwater levels.
- Monoculture practices reduce biodiversity, affecting local ecosystems and wildlife.

#### **b). Processing Impacts**

- Maize processing generates organic waste, including husks, cobs, and other residues, which, if not managed properly, can contribute to pollution.
- Processing facilities consume significant amounts of energy, contributing to carbon emissions and climate change.
- The use of chemicals in processing (e.g solvents for oil extraction) can result in pollution if not properly handled.

### **4.2 Social and Community Impacts**

The maize value chain has profound social and community impacts that need to be addressed to ensure equitable development.

#### **a). Employment and Livelihoods**

- Maize cultivation and processing create employment opportunities, particularly in rural areas, enhancing livelihoods and reducing poverty.

- Ensuring fair wages, safe working conditions, and the elimination of child labor are essential for sustainable community development.

**b). Community Health**

- The use of pesticides in maize farming can have adverse health effects on farmers and local communities. Proper training and safety measures are crucial.
- Maize is a staple food, and its by-products contribute to local diets. Ensuring food safety and nutritional quality is important for community health.

**c). Economic Development**

- By participating in the maize value chain, local farmers and entrepreneurs can significantly enhance their incomes, contributing to overall economic development.
- Facilitating access to markets for small-scale farmers and processors can help integrate them into the broader economy and reduce inequalities.

### **4.3 Mitigation and Sustainability Measures**

To mitigate the negative impacts and promote sustainability in the maize value chain, the following measures need to be implemented:

**a). Sustainable Farming Practices**

- **Soil Conservation:** Techniques such as crop rotation, cover cropping, and no-till farming can prevent soil erosion and maintain soil health.
- **Efficient Water Use:** Implementing drip irrigation and rainwater harvesting can optimize water use and reduce pressure on local water resources.
- **Integrated Pest Management (IPM):** Using biological pest control methods and reducing chemical pesticide use can protect both the environment and human health.

**b). Waste Management**

- **Recycling and Composting:** Organic waste from maize processing can be composted and used as fertilizer, reducing pollution and improving soil fertility.
- **Energy Efficiency:** Adopting energy-efficient technologies and renewable energy sources in processing facilities can lower carbon emissions and operational costs.

**c). Community Engagement and Development**

- **Training and Education:** Providing training on sustainable farming and processing techniques to farmers and workers can improve productivity and sustainability.
- **Health and Safety Programs:** Implementing health and safety programs to protect workers from pesticide exposure and other occupational hazards is essential.

**d). Regulatory Compliance**

- **Environmental Regulations/Certification:** Adhering to national and international environmental regulations, such as the Environmental Protection Act, ISO 14000 latest standard and fair trade can ensure sustainable practices.

**e). Support Programs and Initiatives**

- **Government Programs:** Leveraging Government support programs for sustainable agriculture and rural development can provide financial and technical assistance.

- **NGO Partnerships:** Collaborating with non-governmental organizations can enhance community development efforts and provide additional resources for sustainability projects.

#### **f). Monitoring and Evaluation**

- **Impact Assessment:** Regularly conducting environmental and social impact assessments can help identify areas for improvement and ensure compliance with sustainability goals.
- **Continuous Improvement:** Implementing a continuous improvement process to adapt and refine sustainability practices based on monitoring and feedback.

### **5. Challenges – Issues**

The maize value chain in South Punjab, while holding significant potential, faces numerous challenges that impede its development and efficiency. These challenges span across various stages of the value chain, from production to processing, distribution, and marketing. Addressing these issues is crucial for maximizing the economic benefits of maize and its by-products.

#### **5.1 Challenges in the Maize Value Chain**

##### **a). Agricultural Challenges**

- **Climate Variability:** South Punjab experiences significant climate variability, including extreme temperatures, erratic rainfall, and frequent droughts. These conditions affect maize yields and lead to crop losses, making farming unpredictable and risky.
- **Soil Degradation:** Intensive maize farming practices, such as continuous monocropping and over-reliance on chemical fertilizers and pesticides, have led to soil degradation. Reduced soil fertility and increased erosion threaten sustainable maize production.
- **Water Scarcity:** Maize is a water-intensive crop, and the region faces water scarcity due to over-extraction of groundwater and inefficient irrigation practices. This scarcity limits the expansion of maize cultivation and affects crop health and yields.
- **Pest and Disease Management:** Farmers face challenges in managing pests and diseases that can severely affect maize crops. Lack of access to effective pest control measures and resistance to pesticides exacerbates these issues.

##### **b). Technological and Infrastructural Challenges**

- **Limited Access to Modern Technology:** Small-scale farmers often lack access to modern agricultural technologies and machinery, which limits their productivity. This includes access to improved seed varieties, precision farming tools, and efficient irrigation systems.
- **Inadequate Storage Facilities:** Post-harvest losses are significant due to inadequate storage facilities. Poor storage conditions lead to spoilage, pest infestations, and reduced quality of maize, affecting the overall supply chain.
- **Processing Infrastructure:** The region lacks sufficient processing infrastructure to convert raw maize into value-added by-products. This limits the ability to capitalize on the economic potential of maize and reduces profitability for farmers and processors.

### c). Financial and Market Challenges

- **Limited Access to Credit:** Small and medium-scale farmers and processors often face difficulties in accessing credit and financial services. High-interest rates, lack of collateral, and complex loan procedures hinder their ability to invest in modern farming practices and processing technologies.
- **Market Access and Linkages:** Farmers and small processors struggle with limited access to markets due to inadequate transportation infrastructure, lack of market information, and weak linkages between producers and buyers. This affects their ability to sell produce at fair prices and reach larger markets.
- **Price Volatility:** Maize prices are highly volatile due to fluctuations in supply and demand, both locally and internationally. Price instability creates uncertainty for farmers and processors, impacting their income and investment decisions.

### d). Regulatory and Policy Challenges

- **Inconsistent Policies:** Inconsistent and poorly implemented agricultural policies hinder the development of the maize value chain. This includes unclear land tenure systems, inadequate support for small-scale farmers, and fluctuating subsidies and incentives.
- **Regulatory Compliance:** Farmers and processors face challenges in complying with environmental, safety, and quality standards. Lack of awareness and resources to meet regulatory requirements limit their market access and competitiveness.

### e). Social and Community Challenges

- **Lack of Training and Education:** Many farmers and processors lack the necessary training and education to adopt modern agricultural and processing practices. This limits their productivity and ability to innovate.
- **Gender Inequality:** Women play a significant role in the maize value chain, particularly in cultivation and processing. However, they often face discrimination and lack access to resources, training, and decision-making processes, which limits their contributions and potential.
- **Rural-Urban Migration:** Economic challenges and lack of opportunities in rural areas lead to migration of the rural workforce to urban centers. This results in labor shortages and reduced agricultural productivity.

### f). Environmental Sustainability Challenges

- **Environmental Degradation:** Unsustainable farming practices contribute to environmental degradation, including deforestation, loss of biodiversity, and pollution. These practices threaten the long-term sustainability of the maize value chain.
- **Climate Change:** Climate change poses significant risks to maize production through increased frequency and intensity of extreme weather events, changing rainfall patterns, and rising temperatures. Adaptation to climate change is a critical challenge for the region.

## 6. Regulatory Framework

A robust regulatory framework is essential for the sustainable development of the maize value chain in South Punjab. This framework encompasses government policies, regulatory



requirements, and support programs that aim to enhance productivity, ensure quality, and promote economic growth while addressing environmental and social impacts.

## **6.1 Government Policies and Initiatives**

The Government of Pakistan has implemented several policies and initiatives to support the agricultural sector, particularly maize production. The Punjab Spatial Strategy 2047 aims to transform the agricultural sector by focusing on high-value-added crops and increasing productivity. This strategy includes initiatives such as:

### **a). Agricultural Policy Framework**

- **Strategy for Agricultural Development:** The Strategy aims to accelerate agriculture growth and reduce rural poverty, achieve self-reliance in essential food commodities, expand exports and galvanise agro business potential, and (v) improve quality of growth by adopting a strategy which is pro-poor, pro-small farmer and pro-environment.
- **Punjab Agriculture Policy 2018:** Punjab has its own agricultural policy titled “Punjab Agriculture Policy 2018” that aligns with national goals and addresses region-specific challenges and opportunities. The main aim of this policy is to transform the agricultural sector in Punjab by enhancing productivity, ensuring food security, and promoting sustainable practices. The policy focuses on modernizing agriculture through technological innovation, efficient water management, and improved infrastructure. This policy includes provisions for crop diversification, sustainable farming practices, and market development.

### **b). Research and Development**

- **Agricultural Research Institutes:** Institutions like the Pakistan Agricultural Research Council (PARC) and provincial agricultural research centers conduct research on improving maize varieties, pest management, and sustainable farming practices.
- **Extension Services:** Extension services provide farmers with access to the latest agricultural knowledge, technologies, and best practices through training programs and advisory services.

### **c). Infrastructure Development**

- **Irrigation Projects:** The Government invests in irrigation infrastructure to ensure a reliable water supply for agriculture. Projects include the construction and maintenance of canals, dams, and water storage facilities.
- **Rural Development Programs:** Initiatives such as the Prime Minister’s Agriculture Emergency Program aim to improve rural infrastructure, including roads, storage facilities, and market access.

## **6.2 Regulatory Bodies and Key Regulations**

The regulatory environment for the maize value chain includes laws and regulations that govern various aspects of maize production, processing, and marketing. Key regulatory areas include:

### **a). Quality Standards and Certifications**

- **Pakistan Standards and Quality Control Authority (PSQCA):** PSQCA sets standards for maize and maize-based products to ensure quality and safety. Compliance with these standards is mandatory for producers and processors.

- **Food Safety Regulations:** The Punjab Food Authority (PFA) enforces food safety regulations to ensure that maize products meet health and safety standards.

**b). Environmental Regulations**

- **Environmental Protection Act:** This Act, administered by the Environmental Protection and Climate Change Department of Punjab, mandates environmental impact assessments (EIA) for agricultural and processing activities. It aims to minimize environmental degradation and promote sustainable practices.
- **Water Management Regulations:** Laws governing water usage and management, such as the Punjab Irrigation and Drainage Authority Act, regulate the efficient use of water resources in agriculture.

**c). Labor and Social Regulations**

- **Labor Laws:** Labor regulations ensure fair wages, safe working conditions, and the prohibition of child labor in the agricultural sector. The Punjab Minimum Wages Act sets minimum wage standards for agricultural workers.
- **Social Welfare Programs:** Programs like the Benazir Income Support Program (BISP) provide financial assistance to low-income families, including those involved in agriculture.

**d). Market and Trade Regulations**

- **Agricultural Marketing Laws:** Regulations such as the Punjab Agricultural Produce Markets Ordinance govern the operation of agricultural markets, ensuring fair trade practices and protecting farmers' interests.
- **Export Regulations:** The Trade Development Authority of Pakistan (TDAP) facilitates export of agricultural products, including maize, ensuring compliance with international trade standards, market access and diversification.

### **6.3 Support Programs and Incentives**

To bolster the maize value chain, the Government and other organizations offer various support programs and incentives:

**a). Financial Support**

- **Agricultural Credit Schemes:** Financial institutions, with Government support, provide credit facilities to farmers at subsidized interest rates. Schemes like the Agricultural Credit Guarantee Scheme facilitate access to loans for small and medium-sized farmers.
- **Crop Insurance Programs:** Insurance schemes protect farmers against crop losses due to natural disasters, pests, and diseases, providing financial stability and encouraging investment in maize cultivation.

**b). Incentives for Modernization**

- **Subsidies and Grants:** The Government provides subsidies on agricultural inputs such as seeds, fertilizers, and pesticides to reduce the cost burden on farmers. Grants are also available for the adoption of modern farming equipment and technologies.
- **Tax Exemptions:** Tax incentives are offered to encourage investments in the agricultural sector, including exemptions on agricultural machinery and equipment.

### **c). Training and Capacity Building**

- **Farmer Training Programs:** Programs conducted by agricultural extension services and NGOs offer training on modern farming techniques, sustainable practices, and value addition processes.
- **Capacity Building for Processors:** Workshops and training sessions for processors focus on improving processing techniques, quality control, and compliance with standards.

### **d). Market Development Initiatives**

- **Market Information Systems:** Government and private sector initiatives provide farmers with access to market information, including prices, demand trends, and trade opportunities, helping them make informed decisions.
- **Export Promotion Programs:** TDAP and other organizations facilitate the export of maize products through trade fairs, international marketing campaigns, and support for meeting export standards.

## **7. Institutional Support**

Institutional support plays a crucial role in the development and sustainability of the maize value chain in South Punjab. Various institutions, including Government bodies, research organizations, financial institutions, and non-governmental organizations (NGOs), contribute to enhancing productivity, ensuring quality, and promoting economic growth. This section provides an overview of the key institutions involved and the types of support they offer.

### **a). Government Institutions**

#### **i. Ministry of National Food Security and Research (MNFSR)**

The MNFSR is responsible for formulating national policies related to food security, agriculture, and research. It oversees programs aimed at increasing maize production, improving seed varieties, and enhancing pest management. The ministry provides funding for agricultural research and development projects, including those focused on maize. It also offers grants to support the adoption of modern farming techniques and technologies.

#### **ii. Punjab Agriculture Department**

The Punjab Agriculture Department offers extension services to farmers, providing them with the latest information on best practices, pest control, and efficient use of resources. These services include training programs, field demonstrations, and advisory services. The department administers various subsidy programs to reduce the cost of agricultural inputs such as seeds, fertilizers, and pesticides. It also provides incentives for adopting sustainable farming practices.

#### **iii. Pakistan Agricultural Research Council (PARC)**

PARC conducts extensive research on maize, focusing on developing high-yield and disease-resistant varieties, improving crop management practices, and enhancing value addition processes. PARC collaborates with international research organizations, universities, and private sector entities to advance agricultural research and innovation.

#### **iv. Agriculture Mechanization Research Institute (AMRI), Multan**

The Agricultural Mechanization Research Institute (AMRI) in Multan is playing a key role in advancing agricultural mechanization research and development for various crops, including

maize. AMRI is actively working to develop, test, and promote appropriate mechanization solutions for the maize crop in order to boost productivity and production for the farmers in South Punjab. AMRI developed a tractor-mounted corn picker machine to reduce manual picking losses and increase efficiency in maize harvesting. This mechanization aspect aims to result in higher yields and better returns for farmers. Intending to introduce new mechanization technologies for corn picking to reduce losses at the farm level. This will help uplift maize production in the major maize growing areas in South Punjab.

#### **b). Financial Institutions**

##### **i. State Bank of Pakistan (SBP)**

The SBP facilitates access to credit for farmers through various schemes, including the Agricultural Credit Guarantee Scheme, which provides loans at subsidized interest rates. These schemes help farmers invest in modern farming equipment and technologies.

##### **ii. Commercial Banks and Microfinance Institutions**

Commercial banks and microfinance institutions offer tailored loan programs to meet the needs of small and medium-sized farmers and processors. These programs include short-term and long-term loans for purchasing inputs, machinery, and building processing facilities.

##### **iii. Financial Literacy Programs**

Many financial institutions provide financial literacy programs to educate farmers about managing finances, accessing credit, and planning investments effectively.

#### **c). Research and Educational Institutions**

##### **i. Universities and Agricultural Colleges**

Universities and agricultural colleges conduct academic research on various aspects of maize production, processing, and value addition. They also engage in field trials and pilot projects to test new technologies and practices. These institutions offer degree programs, short courses, and workshops to train the next generation of agricultural professionals and equip them with the knowledge and skills needed to advance the maize value chain.

##### **ii. National Agricultural Research Center (NARC)**

NARC focuses on developing innovative technologies and practices for maize cultivation and processing. It facilitates the transfer of these technologies to farmers and processors through extension services and partnerships.

#### **d). Development Agencies**

Development agencies such as the United Nations Food and Agriculture Organization (FAO), USAID, and the World Bank provide technical assistance and funding for projects aimed at enhancing the maize value chain. These projects often focus on capacity building, infrastructure development, and market access.



## **e). Private Sector and Industry Associations**

### **i. Agribusiness Companies**

Agribusiness companies provide support to maize farmers through contract farming arrangements, where they supply inputs, technical assistance, and guaranteed market access. This support helps farmers improve productivity and income stability.

### **ii. Research and Innovation**

Private companies invest in research and development to create new maize varieties, improve processing techniques, and develop value-added products.

### **iii. Industry Associations**

Industry associations such as the Pakistan Crop Protection Association (PCPA) and the Pakistan Agricultural Coalition (PAC) advocate for favorable policies, provide networking opportunities, and facilitate knowledge sharing among stakeholders in the maize value chain.

## **8. Recommendations**

To maximize the investment potential of maize value-added by-products in South Punjab, the following key recommendations are proposed:

### **a). Strengthening Policy and Regulatory Framework**

- Encourage value addition with specific policies, tax incentives, and subsidies.
- Implement stringent quality controls and certification processes.
- Provide incentives for environmentally friendly farming techniques.

### **b). Boosting Research and Development**

- Fund research focused on innovating maize by-products and improving crop management.
- Support breeding programs for high-yield, disease-resistant maize suited to local conditions.

### **c). Enhancing Infrastructure and Technology**

- Invest in modern storage facilities to reduce losses.
- Facilitate access to modern processing equipment and techniques.
- Upgrade transportation networks to improve market access.

### **d). Financial Support and Incentives**

- Offer low-interest loans and tailored financial products.
- Implement insurance schemes to protect against losses.
- Provide financial support for equipment and technology adoption.

### **e). Capacity Building and Training**

- Enhance services to deliver best practices and resource management information.
- Organize workshops on sustainable practices and value addition techniques.
- Facilitate the formation of cooperatives for resource sharing and market access.

**f). Market Development and Promotion**

- Provide real-time market data to inform decisions.
- Launch campaigns to promote by-products domestically and internationally.
- Simplify procedures and support quality compliance for exports.

**g). Environmental and Social Sustainability**

- Encourage sustainable farming and resource use.
- Ensure fair labor practices and empower marginalized communities.
- Involve local communities in decision-making.

**h). Institutional Collaboration and Coordination**

- Encourage collaboration to leverage resources and expertise.
- Enhance the capabilities of local institutions.

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