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Food Security: A Critical Analysis of Wheat Procurement, Transportation, and Storage Challenges in Punjab, Pakistan

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Abstract

This research aims to analyze food insecurity in Pakistan, with a specific focus on wheat crop within the Punjab province. It investigates the key issues, their causes, and proposes potential solutions to improve the overall effectiveness and efficiency of wheat procurement, transportation, and storage systems in Punjab. The study employed a mixed-methods approach incorporating field observation, data analysis, and questionnaires administered to district food controllers regarding the smuggling of wheat crop. Wheat procurement by the Punjab government was thoroughly analyzed and an overview of the wheat value chain is presented based on interviews with key informers, site visits, and observation. A cost-benefit analysis (CBA) was conducted to evaluate the viability of implementing grain storage silos in Punjab. The project is financially viable with a payback period of 5-6 years. Moreover, a survey of field officers was carried out to determine the scope and the determinants of wheat smuggling from Punjab. The findings of this research provide valuable information to policymakers, government agencies, and stakeholders in designing effective interventions to enhance food security and to address the specific challenges faced in the wheat sector of Punjab, Pakistan.

***Keywords*:** cost-benefit analysis (CBA), food insecurity, governance, market dynamics, policy interventions, pricing policies, Punjab, socio-economic factors, storage systems, wheat smuggling

Introduction

Food security continues to be the proverbial Medusa's head for the Punjab province which despite being the backbone of country's agriculture, continues to struggle with food sovereignty. Wheat, the staple food for the majority of Pakistanis, is central to food security (Ahmad & Farooq, 2010; Khan et al., 2021). Punjab contributes the lion's share to wheat production with more than 16.29 million hectares each year accounting for over 76%

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of the overall output (Ahmad et al., 2021; Iftikhar & Mahmood, 2017). Any disruption in wheat supply can have devastating effect on a population that is already residing at subsistence level, lacking sufficient social security nets (Mhlanga & Ndhlovu, 2020). For farmers in Punjab, wheat is the major cash and subsistence crop during the Rabi (Winter) cropping season (Ullah et al., 2022). In such context, government policies can have far reaching consequences with even a single misstep leading to anarchy and instability (Vu, 2024).

The aim of this research is to thoroughly examine and evaluate the issues and obstacles faced in the processes of procuring, transporting, and storing wheat in Punjab. By assessing the shortcomings, inefficiencies, and underlying factors that contribute to these challenges, the study seeks to identify and enunciate the key issues, their causes, and potential solutions to improve the overall effectiveness and efficiency of wheat procurement transportation, and storage paradigm in Punjab. The paper, in particular, looks at the following key aspects: Analyzing existing literature to understand factors contributing to food insecurity in Pakistan. Conducting a thorough analysis of procurement, transportation, and storage phase of the wheat cycle, drawing insights from interviews, site visits and observations. Performing Cost-Benefit Analysis of Grain Storage Silos to evaluate their financial viability, studying wheat smuggling and its characteristics during the transportation phase.

Background

Article 38 (d) of the Constitution of Pakistan forms the foundation for the concept of food security in Pakistan and serves as a guiding principle for policymakers. It highlights the responsibility of the government to ensure that every citizen has access to an adequate and nutritious diet regardless of their socio-economic background or adverse personal circumstances. It reads,

> The State shall provide basic necessities of life, such as food, clothing, housing, education and medical relief, for all citizens, irrespective of sex, caste, creed or race, as are permanently or temporarily unable to earn their livelihood on account of infirmity, sickness or unemployment. (Article 38 (d) Constitution of Pakistan, 1973)

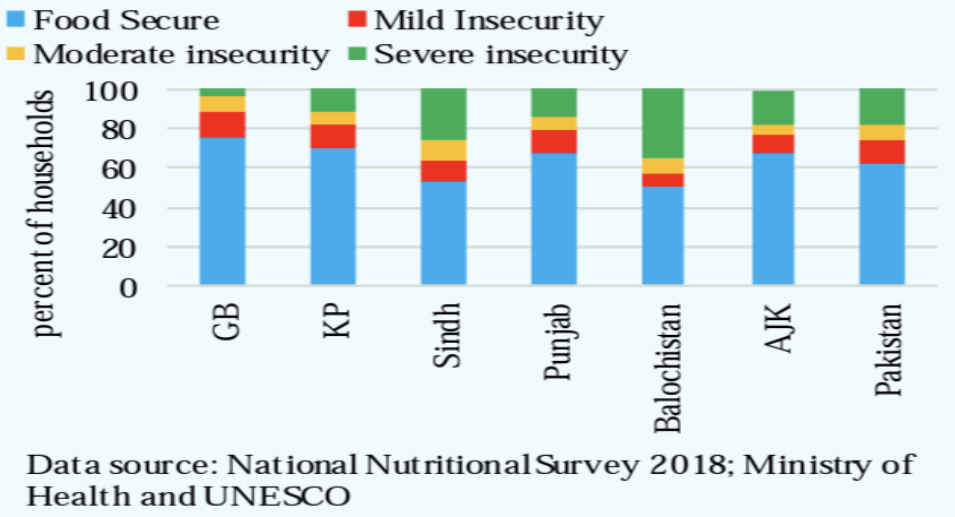
Even though Pakistan is an agrarian country with agriculture contributing 22.9% to the GDP and employing 37.4% of the population, it has been unable to fulfill this constitutional responsibility (Government of Pakistan, 2023). During the last few years, adverse climatic conditions including the massive 2022 floods brought on by climate change, and global conflicts disrupting food markets, have made the situation even more precarious (Otto et al., 2023).

Current State of Food Security in Pakistan

The State Bank of Pakistan (2020) noted in its special report on agriculture that despite ranking 4th in milk production, 8th in wheat, and 10th in sugarcane production, 37% of the country's population is food insecure (State Bank of Pakistan, 2020). Almost half of the children under 5 years are stunted while the country ranks 99th in the Global Hunger Index in the year 2022. The table below shows household food insecurity in different regions of Pakistan.

Figure 1

Food Insecurity across Regions of Pakistan

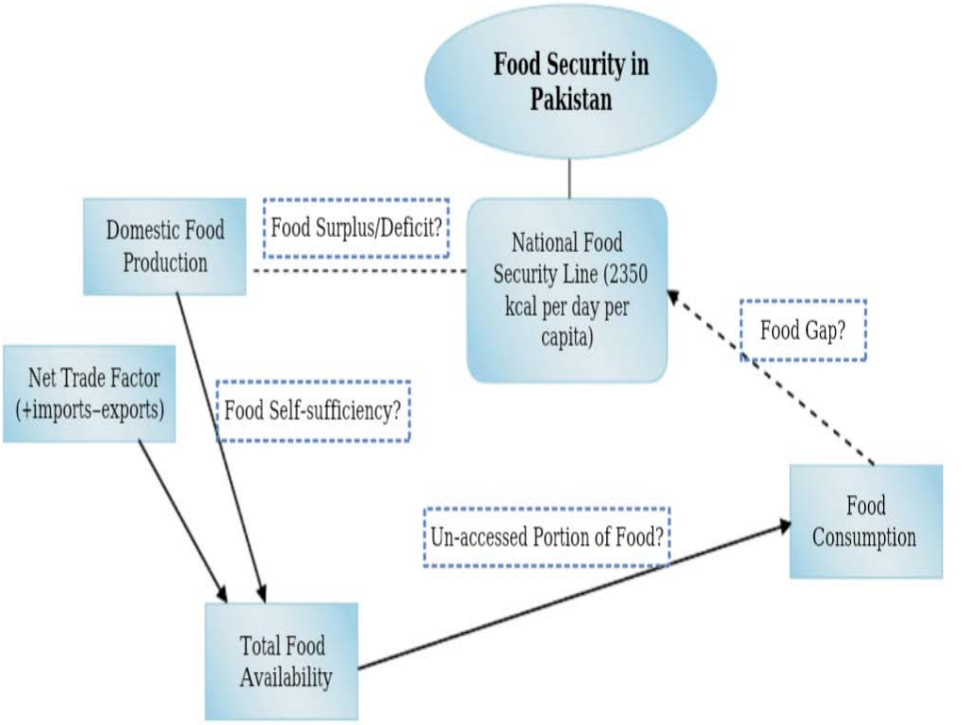


In line with this data, Hussain and Routray (2012) shed light on the underperformance of the agriculture sector and found that Pakistan is producing less than 40% of its actual potential due to inefficient utilization of available land and water resources, inadequate supply of inputs and inefficient formal credit system. However, despite being below its potential,

the country is near self-sufficiency in most of the staple food commodities. There is a gap between food availability and production because a sizeable portion of the food produced cannot be utilized due to physical and economic causes. Physical reasons include post-production losses, the smuggling of food products across borders, and the ineffective design of food distribution and procurement networks while economic causes include unstable prices, a weak marketing strategy, and rising inflation rates. Pakistan, hence, faces a complex food security paradigm characterized by the coexistence of significant agricultural potential and high levels of food insecurity. The figure (2) below shows a schematic representation of the food security paradigm in Pakistan. The total food availability depends on net trade factor and the domestic production of the crop and food self-sufficiency if the domestic food production is equal to the consumption. There is a Food Gap if the food consumption is less than the national food security line defined at 2350 calories per day per capita.

Figure 2

Schematic Diagram of Food Security in Pakistan



Food Security viz-a-viz Wheat Crop

During 2022-23, wheat was cultivated on 9,043 thousand hectares Q contributing 8.2 % to value added agriculture and 1.9% to GDP. The production of wheat stood at 27.634 million tons compared to 26.208 million tons last year, indicating a growth of 5.4 in wheat production. Minimum Support Price (MSP) was increased to Rs 3900/40kg for 2023 crop season (Government of Pakistan, 2023)

There are two main crop seasons in Pakistan: Kharif season, with a sowing period from April to June and harvest from October to December, and the Rabi season, which begins in October to December and ends from April to May. Wheat, lentils, tobacco, rapeseed, barley, and mustard are Rabi crops; rice, sugar cane, cotton and maize are Kharif crops (Miller et al., 2021).

Research Questions

The research questions guiding this study are as follows:

1. What are the underlying factors contributing to the increasing food insecurity in Pakistan, particularly in Punjab?
2. How do factors such as ineffective governance, market dynamics, pricing policies, and socio-economic factors contribute towards food security?
3. How can the gap between demand and supply of wheat be reduced in Punjab?
4. What specific policy interventions, considering smuggling and storage systems, can be implemented to address food security effectively?

Literature Review

Factors Contributing to Food Insecurity

Ineffective Governance

Food insecurity in Pakistan is influenced by various factors, including ineffective governance, market dynamics and pricing, and socio-economic challenges (The World Bank, 2015). These factors intersect and contribute to the persistent issue of inadequate access to sufficient and nutritious food for a significant portion of the population. Understanding these factors is

crucial for devising effective strategies to alleviate food insecurity and ensure food sovereignty for all.

One of the primary factors contributing to food insecurity in Pakistan has been identified as ineffective governance and lackluster policymaking. The country faces challenges such as corruption, lack of transparency, and poor coordination, hindering the establishment of an efficient food procurement and distribution system. Governance issues not only impede the effective functioning and growth of the agricultural sector but also exacerbate food insecurity among vulnerable and marginalized populations (Rashid et al., 2023).

Rana's (2020) study sheds light on the shortcomings of the procurement process in Pakistan. The author highlights the heavy administrative costs imposed by the procurement system, rendering it ineffective for small farmers. The administrative hurdles and complexities involved create barriers for small-scale farmers, limiting their access to essential resources and support. Consequently, these farmers struggle to boost their agricultural productivity and contribute to food security.

Corruption and rent-seeking behaviors further exacerbate the inefficiencies and misallocation of resources within the agricultural sector. Goldenberg (2014) emphasizes the detrimental impact of corruption on resource distribution, leading to suboptimal utilization of available resources. Mismanagement and inequitable distribution hinder the development of effective agricultural programs and support for small-scale farmers, who play a crucial role in ensuring food security.

The challenges of ineffective governance are particularly evident in Punjab, a major agricultural region in Pakistan. Inefficient procurement planning and distribution of wheat often result from governance issues, disrupting the supply chain and leading to shortages and uneven distribution of essential food crops. This situation disproportionately affects vulnerable populations particularly in peripheral areas of the province who heavily rely on wheat as a staple food (Bashir & Schilizzi, 2015).

Pricing Policies and Market Dynamics

Market dynamics and pricing policies also significantly contribute to food insecurity in the country. Fluctuating prices, inadequate market infrastructure, and the absence of effective market information systems create market inefficiencies (Ahmad & Farooq, 2010). Farmers struggle to

obtain fair prices for their produce, which perpetuates income disparities and economic instability within the agricultural sector. These challenges hinder farmers' ability to invest in their agricultural practices, ultimately impacting overall food production and availability.

Untargeted subsidies in the agricultural sector have been identified as another factor exacerbating food insecurity in Pakistan. Ahmad and Farooq (2010) highlight that these subsidies impose a significant burden on the exchequer, primarily benefiting the flour mills industry. The limited benefits that trickle down to consumers do not effectively address the underlying issue of food insecurity. Shahzad et al. (2019), on the other hand, argue for the implementation of input subsidies rather than purchasing subsidies. They suggest that providing subsidies for inputs such as seeds and fertilizers would benefit both producers and consumers while enhancing the international competitiveness of Pakistani wheat.

Socio-Economic Factors

Socio-economic factors also play a significant role in perpetuating food insecurity by limiting the availability and access to nutritious food supply as well as its utilization. Poverty, income inequality, and limited resources pose significant challenges for impoverished households in Pakistan in their quest for food security. The World Bank (2015) emphasizes that poverty and limited access to nutrition and healthcare are major contributors to food insecurity with the inability of vulnerable populations to afford nutritious food perpetuating a cycle of poverty and malnutrition. Even in years when Pakistan achieves self-sufficiency and net surpluses in food crops, food security remains precarious due to structural inequalities that impede access to adequate nutrition.

Research conducted by Mahmood et al. (2016) highlights the relationship between landholdings and food security. The study found that the size of landholdings significantly affects food security outcomes. Approximately, 45% of rural landless individuals and over 30% of cultivators who rely on the market as net buyers of food staples constitute 62% of the rural population. This reliance on the market for food needs further underscores the importance of addressing socio-economic disparities to improve food security outcomes.

Government of Pakistan (2021) in its annual report states that the high population growth rate in Pakistan further compounds the challenges of

food insecurity with a population growth rate of 1.8%, the country faces immense pressure on food resources. However, agricultural growth has lagged population growth behind, leading to an imbalance between food production and demand creating a textbook example for neo-Malthusians. The insufficient investment in the agricultural sector has likely exacerbated this issue, hindering the development of sustainable and resilient food systems.

In addition to ineffective governance, market distortions, and socio-economic factors outlined above, the implementation of food security policies is a critical factor to consider. Bashir and Schizzili (2015) emphasize the need for further research and improved policy implementation to enhance their effectiveness. Many well-intentioned policies have failed to achieve their desired outcomes either due to poor implementation on the ground or for being far too theoretical and not tailored to the ground realities. The Auditor General's (2022) report highlights the issue of circular debt in wheat procurement, adding another layer of governance challenges to the food security landscape. These complexities further underscore the need for effective governance mechanisms, transparency, and accountability in the food security paradigm (Sohail, 2023).

To tackle the multifaceted issue of food insecurity in Pakistan, an imaginative, comprehensive and integrated approach is necessary. This approach should encompass addressing ineffective governance, improving market dynamics and pricing policies and focus on reducing socio-economic disparities, and implementing effective food security policies. Familiarity with and cognizance of these factors can help policymakers work towards creating a sustainable and resilient food value chain that ensures access to nutritious and adequate food supply for all segments of the population (Ishaq et al., 2018).

Methodology

The study employed a mixed-methods approach to conduct a comprehensive analysis of the factors contributing to food insecurity in Punjab province. The analysis consisted of three key parts:

Procurement Phase

Conducted an analysis of the Wheat Crop Cycle through key informant interviews and site visits and assessed the challenges and inefficiencies in the procurement phase of the wheat crop cycle.

Transportation Phase

A survey was conducted among district food officers to gather information on wheat smuggling activities to provide insights into the methods, scale, and drivers of smuggling.

Storage Phase

A cost-benefit analysis was conducted to assess the potential benefits of implementing grain storage silos as a solution to the storage challenges in the wheat sector.

Data Collection

To address the research questions, a mixed-methods approach was employed. The data collection process involved both qualitative and quantitative methods to gather relevant information for a comprehensive analysis.

Quantitative data for analyzing the costs and benefits of grain storage silos was collected from the Food Department Punjab and from the Agriculture Department by going through feasibility studies as well as program evaluation reports. Statistical data from various sources, including Agriculture Department and Bureau of Statistics collected and analyzed to provide information on wheat production, demand-supply dynamics, market trends, and post-harvest losses. In addition, Director Food, Food Department Punjab was given a questionnaire (Annex-2) regarding storage infrastructure, capacity utilization, maintenance practices, and the financial implications of implementing storage silos.

Qualitative data was collected via the following methods: Conducted *Questionnaires* using purposive sampling technique amongst the District Food Controllers of the Punjab province on smuggling of wheat from the province. Data was collected from 10 District Food Controllers with a focus on the border districts. The questionnaires gathered quantitative and qualitative data on smuggling incidents, challenges, and the impact of anti-smuggling interventions.

Semi-structured interview was conducted with the Director Food, Punjab to examine and explore their perspectives on the underlying factors contributing to food insecurity and potential policy interventions. District food controllers provided insights into the challenges faced and the effectiveness of existing storage systems

Cost-Benefit Analysis (CBA)

In conducting the Cost-Benefit Analysis (CBA) for the implementation of grain storage silos in Punjab, the following formulas and approaches were utilized:

Cost Estimation

Construction Costs: The estimation of construction cost was based on factors such as the total construction area, the type of silo structures, and prevailing construction rates per square meter.

Operational Costs: These costs included expenses such as labor wages, maintenance personnel, electricity, equipment, and administrative overheads. The operational costs were estimated on an annual basis.

Maintenance Costs: The costs associated with regular maintenance and repairs of the storage silos were estimated based on industry standards and expert consultations.

Other Costs: Any additional expenses related to land acquisition, permits, licenses, and other regulatory requirements were also considered.

Benefit Estimation

Reduced Post-Harvest Losses: The reduction in post-harvest losses was estimated based on historical data and expert opinions. The value of the reduced losses was determined by calculating the monetary equivalent of the saved wheat being calculated.

Revenue Income: The improvement in grain quality, resulting in higher market prices or reduced rejections, was assessed based on market data and expert insights.

Increased Storage Capacity: The additional storage capacity provided by the silos was quantified by calculating the difference between the current storage capacity and the projected capacity after implementing the silos. The value of increased storage capacity was determined by estimating the

savings from reduced storage costs or potential revenue from increased storage utilization.

Enhanced Food Security: The value of enhanced food security, such as reduced dependence on imports, improved availability of wheat, and stable market prices, was estimated based on economic indicators and expert opinions.

Financial Analysis

Net Present Value (NPV): The NPV was calculated by discounting the estimated costs and benefits over the project's lifespan using an appropriate discount rate. A positive NPV indicated a financially viable project.

Internal Rate of Return (IRR): The IRR represented the discount rate at which the NPV of the project became zero. A higher IRR indicated a more financially attractive investment.

Payback Period: The payback period signified the time required for the project's net cash inflows to recover the initial investment. A shorter payback period indicated faster cost recovery.

Sensitivity Analysis

Sensitivity analysis was conducted to assess the impact of uncertainties or variations in key assumptions on the project's financial feasibility. This analysis involved evaluating the project's outcomes under different scenarios, such as changes in construction costs, grain prices, or operational expenses.

Results and Discussion

Wheat Crop Cycle in Punjab

The wheat crop cycle in Pakistan is a complex system involving various stages and multiple stakeholders. To address the challenges and enhance the efficiency, equity, and sustainability of this cycle, it is critical to discuss each stage in detail.

Wheat Procurement

Food department is the main agency that carries out wheat procurement with the dual objectives of providing minimum support price and subsidized wheat for consumers. The Punjab government sets an annual target which it meets through procurement by the Food Department. The Pakistan

Agricultural Storage and Supplies Corporation (PASSCO) procures wheat for the Federal government and has its own exclusive earmarked area in the province from which it procures wheat. The procurement process of the Food Department is tedious and exacts a heavy administrative burden which can prove too costly for small farmers. The procurement process begins with the patwari's (revenue officer) list which often excludes tenants and small farmers. The Food Department issues gunny bags (bardana) based on these lists for which the farmers pay a deposit in the bank. Farmers can supply their wheat only in officially issued bardana which bears a number recorded against the farmer's name. The issuance of bardana becomes a locus of control and patronage, as the Food Department is preferred due to the higher price they offer (Rana & Malik, 2021). The farmers deliver, and unload filled gunny bags at designated procurement centers on scheduled dates and are compensated with Rs. 09 per 100 kg for this labour. The farmer's payment is calculated and recorded in the Wheat Centre's system and a payment slip known as Form 2 is prepared which is submitted to the bank the next day. Once the consolidated statement is received by the designated bank, farmer can receive payment.

While this process is designed to regulate procurement but in practice, it places a substantial administrative burden on the farmer and effectively excludes small farmers who resort to sell their surplus to intermediaries. Local traders, (arthi/beoparis) purchase directly from the farm and use their own bardana, arrange for loading, transportation and unloading while paying in cash. The intermediaries, in essence, take advantage of the arduous procurement process and maintain their profit at the intersection of procurement and market price. If the procurement process was less cumbersome, majority of the small farmers would prefer selling directly to the government. The arthi/beopari, maintaining stocks throughout the year and selling off-season, not only represent a vast underground economy but also act as a key player in managing the local food market of an area (Auditor General of Pakistan, 2022).

Wheat Transport

During the harvest season and periods of wheat shortage, bans on the transportation of wheat are frequently imposed. Only the movement authorized by Punjab Food Department is allowed, which transports wheat from one centre to the other. The need for this restriction occurs because there is a surplus of production in Southern and Western districts while

consumption is concentrated in metropolitan areas. Since a large number of mills are located in Rawalpindi division, which produce very little wheat, a large volume of wheat has to be moved from surplus districts. Transportation operations are expensive and large quantities are involved as shown in the table below. Private contractors, hired by the Punjab Food Department under their transport policy, handle these transportation activities. On average around 8-10 lac metric tons are transported from various centers to Rawalpindi and Lahore divisions at a cost of approximately Rs 90-100 per maund. This cost is borne by the Food Department (The World Bank, 2015). The table below gives the cost for wheat operations; it should be noted that the cost is given for movement of wheat from the division to its destination.

Table 1

Cost of Transport from Each Division

Division	2015-16	2016-17	2018-19
		Amount Rs	
Faisalabad	39,900,000	195,400,000	254,100,000
Bahawalpur	439,100,000	484,800,000	630,200,000
DG Khan	446,300,000	450,800,000	586,000,000
Multan	752,900,000	273,000,000	354,800,000
Sahiwal	194,900,000	182,200,000	236,900,000
Sargodha	121,400,000	131,100,000	170,400,000
Gujranwala	0	0	0
Rawalpindi	0	0	0
Lahore	0	0	0
Total	1,994,400,000	1,717,300,000	2,232,500,000

Wheat Storage

The Punjab Food Department (PFD) operates various storage facilities to store agricultural produce, including covered godowns, concrete silos, bins, and open-field storage under plastic sheets known as Gunjis. The total storage capacity of the PFD is 2.2 million metric tons (MMT), while the remaining quantity is stored using Gunjis in open fields. The table below shows the wheat storage capacity of the Punjab Food Department as of 2023.

Table 2
Storage Capacity of Various Storage (source: Punjab Food Department)

Storage Type	Number	Capacity (MMT)	Number	Capacity (MMT)	Total Capacity (MMT)
H.T.GODOWNS	1,768	1.59	1.6	0.01	1.6
SILOS	31	0.12	0.12	-0.12	0.12
BINS	4,269	0.15	0.19	0.04	0.19
BULKHEAD	1	0.01	0.07	0.06	0.07
BINI SHELL	216	0.35	0.35	-0.35	0.35
Total Standard Capacity		2.22		0.11	2.33

In a remarkable display of ostrich policy, the Government of Punjab does not officially recognize any loss of wheat held in storage, regardless of the storage method or duration. Officially dubbed the 'Zero-Loss Policy', it is a policy that it quite unfair to the farmers since, in practice, the losses are covered by 5% weight discount at the time of procurement. Millers, too, have to sacrifice 5% from the recorded weight when purchasing from the government. Irrespective of the fact that these losses are passed on to the producers and consumers, there is still economic loss for the province. A study by Food and Agriculture Organization of the United States (2010) has estimated the losses as follow in ganjis:

Table 3
Storage Losses from Ganjis

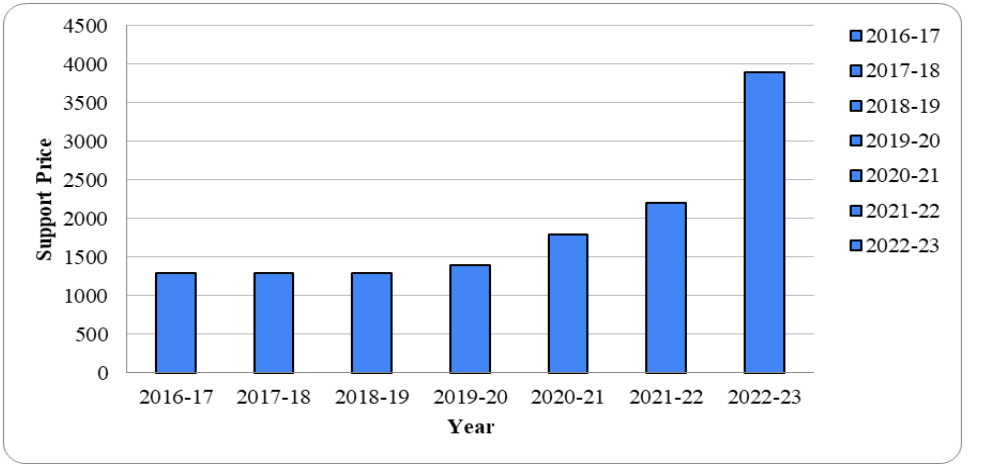
Particulars	No. of bags in *ganji*	No. of bags lost at 3–6 months	No. of bags lost at 6–12 months
Inner layer	2 337	-	-
Outside layer	1 000	-	-
Bottom layers	266	133	266
Total bags	**3 603**	**133**	**266**
Percentage	**100**	**3.7**	**7.4**

Source: IFC, 2010.

Pricing Mechanisms and Market Access

Figure 3

Support Price (Wheat)



Fair pricing policies are crucial for ensuring equitable returns for farmers. The table below shows the support price for the last five years. The minimum support price policy encourages farmers to produce more wheat, but it imposes a significant economic burden on the Punjab government. Shahzad et el. (2019) found that the higher wheat minimum support price (MSP) has made the country lose its competitiveness in the international market, as the cost of wheat production in Pakistan is much higher than in India. Due to higher input costs, the government is forced to raise the minimum support price which creates a financial strain on the exchequer along with rent seeking opportunities for the actors.

Table 4

Support Price by Year

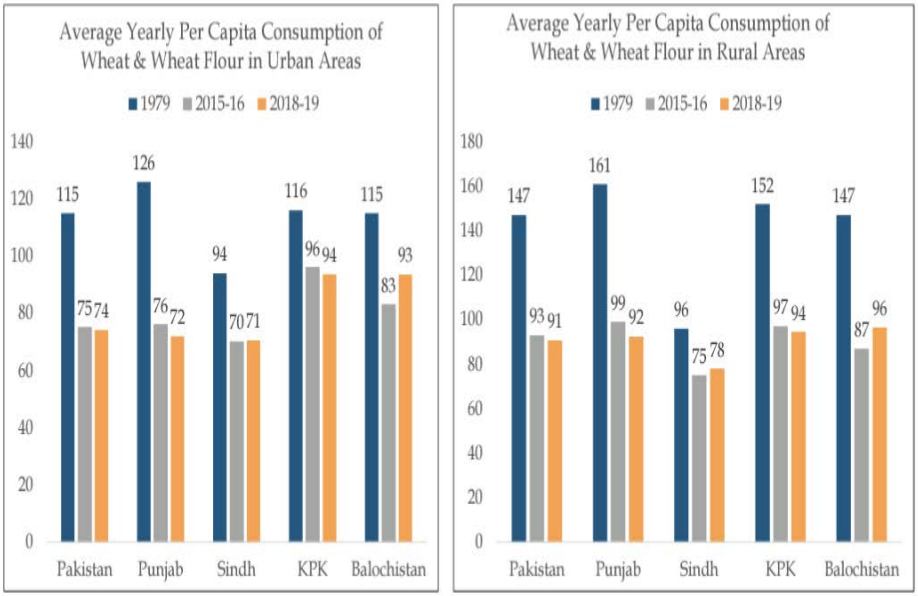
Year	Support Price (Rs)
2016-17	1300
2017-18	1300
2018-19	1300
2019-20	1400
2020-21	1800
2021-22	2200
2022-23	3900

Flour Mills and Consumers

The second objective of the food policy in Punjab is to ensure the availability of wheat flour at affordable prices for urban consumers while maintaining price stability which is done through tightly regulated wheat market. There are 1219 flour Mills in the Punjab, with a majority of them located in the northern part of the province, which have a milling capacity of 280,000 tons per day against a domestic demand of 40,000 per day (PSM). Mill owners frequently enjoy rents from the sale of subsidized flour yet price stability is still far off.

Figure 4

Wheat Consumption by Region



Wheat Smuggling

The complex dynamics of the wheat market, coupled with price distortions caused by various factors such as geopolitical events and natural disasters, have led to a sizable amount of wheat being smuggled across provincial borders to Afghanistan. This illicit trade often occurs in connivance with authorities and poses a serious threat to the government's

efforts to ensure price stability and food accessibility in the province. The main routes for smuggling are given in the table below:

Table 5

Main Smuggling Routes from Punjab

Smuggling to KPK		Smuggling to Sindh	
Name of the Post with District	Movement towards	Name of Post with District	Movement towards
Mulla Mansoor Attock	Peshawar	Shahwali District Rajan pur	Guddu barrage, Kashmore, Sakhar, Karachi
Dajal Bhakar	DI Khan	Kot Sabzal District RY Khan	Karachi and Sindh
Chashma Barrage Mianwali	DI Khan	Dauwala District R.Y khan	Interior Sindh. Baluchistan
Rimin DG Khan	DI Khan		

Survey Results

The table below shows the summary of the data collected for the various districts and provides valuable insights into the issue of wheat smuggling. While each district presents unique characteristics and approaches in addressing this problem, there are common issues that can help better address the issue.

Table 6

Results of the Survey Administered

District	Rahim Yar Khan	Multan	Dera Ghazi Khan	Lahore	Rawalpindi	Attock	Rajanpur
Border Checkpoints	2	0	3	0	8	14	6
Dedicated Team for Monitoring	Yes	No	No	No	Yes	No	Yes
Increase in Smuggling During Specific Time Periods	No	No	Yes	No	Yes	Yes	Yes
Changes in Smuggling Methods	No	No	No	N/A	No	No	No
Collaboration with Neighboring Districts or Agencies	Yes	No	Yes	No	Yes	Yes	Yes
FIRs from JJune 2022 to June 2023	206	23	306	15	108	224	156

The reported increase in wheat smuggling during specific time periods such as during the harvest season or during times of acute shortage. Dera Ghazi Khan, Rawalpindi, Attock, and Rajanpur have highlighted this trend, indicating the need for targeted interventions and heightened surveillance during those periods to effectively address the issue. In contrast, Rahim Yar Khan, Multan, and Lahore have not reported significant increases, suggesting that the smuggling activities in these districts might be more consistent throughout the year.

It is interesting to note that no significant changes in smuggling methods have been reported across all districts. One of the most commonly used techniques by wheat smugglers is the utilization of fake permits, often obtained through collusion with the food department or the deputy commissioner's office. This enables them to transport wheat across districts without encountering major obstacles.

In Rawalpindi district, a notable case was reported where hospital ambulances were used for smuggling operations to the neighboring regions. Additionally, non-commercial transport vehicles have also been observed to be commonly employed by wheat smugglers. These findings highlight the need for targeted countermeasures to address these prevalent smuggling methods. Focusing on combating the issuance and usage of fake permits, as well as strengthening monitoring and inspection procedures at checkpoints, can significantly disrupt smuggling operations.

Collaboration with neighboring districts or other agencies plays a crucial role in combating wheat smuggling. Several key agencies, including the Federal Investigation Agency (FIA), Punjab Police dedicated anti-smuggling unit, Customs Department, and food departments of neighboring provinces, are actively involved in addressing this issue. These agencies work together to investigate smuggling activities, share information, and gather intelligence to effectively combat wheat smuggling. Among the districts analyzed, Rahim Yar Khan, Dera Ghazi Khan, Rawalpindi, Attock, and Rajanpur have reported successful collaboration efforts.

The number of FIRs (First Information Reports) filed in relation to wheat smuggling serve as a significant indicator of the severity of the problem and the level of enforcement activities undertaken by the authorities. Based on the reported figures, districts bordering Khyber Pakhtunkhwa have reported a higher incidence of wheat smuggling

compared to districts bordering Sindh or Baluchistan which suggests that geographical proximity and border dynamics play a role in the prevalence of smuggling activities.

The cross-border nature of the smuggling route adds complexity to enforcement efforts, and this requires close coordination between the relevant state actors. The porous nature of the border between Pakistan and Afghanistan poses significant challenges in combating smuggling, as it provides ample opportunities for smugglers to transport the wheat across the border without detection. Another factor contributing to wheat smuggling is the volatility of the wheat market. Fluctuations in wheat prices can create opportunities for smugglers to exploit the price differentials between the markets and earn substantial profits from this illegal trade. These market dynamics together with the challenges posed by the porous border create an ever-present lure of illegal cross-border trade, making it imperative for the government to implement robust enforcement strategies and enhance cooperation at both national and international levels.

Cost Benefit Analysis for Grain Storage Steel Silos

One of the key challenges in food security is the lack of modern grain storage silos in the province, with a significant portion of the produce going stale before reaching the market. If this quantity of wheat can be saved from spoilage, there would be no need to import wheat, and the country could potentially earn foreign exchange through exports. The results of the Cost-Benefit Analysis (CBA) for the implementation of grain storage silo with a capacity of 5000 tons in Punjab province are as follows:

Table 7

Cost Estimation for Storage Silo

Cost	PKR (in Millions)	Basis
Land	17.6	Total land requirement for the project has been estimated to be 2 acres with each acre being Rs. 8.8 million.
Building and Construction	102.08	Total covered area is 30,000 sq. ft. @ Rs. 3400/sq. ft.
Machinery & Equipment	14.08	Grain handling and Utility Equipment.
Management Equipment	5.28	Office and management equipment.
Registration & Licensing	3.52	Regulatory licenses.

Cost	PKR (in Millions)	Basis
Other Pre-operating Expenses	9.68	Promotion material, utility connection and admin. Expenses.
Operational Expenses	3.70	Utility bills, fumigation, maintenance costs, marketing etc. for 1 year.
Salaries	2.11	3 months salaries.
Total	158.05	

Cost Estimation

Construction Costs: The estimated cost of constructing the storage silos was Rs.142.56 million. This cost includes various components such as land acquisition, building and construction, machinery and equipment, management equipment, and registration and licensing fees.

Operational Expenses: The operational expenses for the first year of operation were projected to be Rs.13.38 million. This includes promotion material, utility connection, admin. expenses, utility bills, fumigation, maintenance costs, marketing etc. during the initial phase.

Salaries: The budget for salaries during the first year of operation was estimated to be Rs. 8.44 million, covering the wages of staff involved in the daily operations of the grain storage silos.

Depreciation: Depreciation of the building and equipment is estimated to be 10%.

Operational Cost for 10 years: The Operational cost for first year is Rs. 21.82 million. By giving an increment of 10% in each year, the operational cost for 10 years will be 347.75 million. Year wise bifurcation is given as under:

Table 8

Operational Cost for 10 years

Cost Projection	PKR (in Millions)
Year 1	21.82
Year 2	24.00
Year 3	26.40
Year 4	29.04
Year 5	31.95

Cost Projection	PKR (in Millions)
Year 6	35.14
Year 7	38.66
Year 8	42.52
Year 9	46.77
Year 10	51.45
Total	347.75

Benefit Estimation

Reduced Post-Harvest Losses: By implementing the grain storage silos, it was projected that post-harvest losses could be reduced from 10% to 1%, resulting in a monetary equivalent of saved 500 tons of wheat valued at approximately Rs.2 million per year.

Improved Grain Quality: The improved grain quality was estimated to improve from 3% impurities to 1% which would be beneficial for the consumers.

Revenue Income: The storage capacity provided by the silo was projected to result in revenue income of approximately 100% utilization. Projected profits are given by assuming 65% utilization in the first year, 85% in the second year and full utilization in the next seven years. Assumption for calculating the revenue is Rs. 30 per 40 kg. Revenue for first two years is calculated as under:

Revenue for year 1 = (5000000*30/40*12)/1000000*0.65 = Rs. 29.25 million

Revenue for year 2 = (5000000*30/40*12)/1000000*0.85 = Rs. 45.90 million

Revenue projection for next 8 years can be calculated by giving an increment of 20% over the revenue of previous year. Hence the revenue for 10 years is given in the following table.

Table 9

Revenue Projection for 10 Years

Revenue Projection	PKR (in Millions)
Year 1	29.25
Year 2	45.90
Year 3	55.08
Year 4	66.10

Revenue Projection	PKR (in Millions)
Year 5	79.32
Year 6	95.18
Year 7	114.21
Year 8	137.06
Year 9	164.47
Year 10	197.36
Total	983.92

The Net Present Value for the profit of next ten years is projected to be Rs. 112.21 million at present value.

Table 10

Cost and Revenue Projections for 10 Years for Grain Silos

Profit Projections	Cost (in Million)	Revenue (in Million)	Profit (in Million)
Year 1	21.82	29.25	7.43
Year 2	24.00	45.90	21.90
Year 3	26.40	55.08	28.68
Year 4	29.04	66.10	37.05
Year 5	31.95	79.32	47.37
Year 6	35.14	95.18	60.04
Year 7	38.66	114.21	75.56
Year 8	42.52	137.06	94.54
Year 9	46.77	164.47	117.69
Year 10	51.45	197.36	145.91
Total	347.75	983.92	636.16
Present Value @15%	156.61	398.01	241.40
Net Present Value of Project at Year 10			112.21

Enhanced Food Security: The steel silos shall lead to enhanced food security, including reduced dependence on imports and stable market prices.

Financial Analysis:

Net Present Value (NPV): The NPV of the project, calculated by discounting the estimated costs and benefits over a 10-year lifespan at a

discount rate of 15%, was Rs. 112.21 million indicating that the project was financially viable over its lifespan.

Internal Rate of Return (IRR): The IRR of the project was calculated to be 23% making it an attractive investment. The table below presents the cash flows for the project life.

Table 11

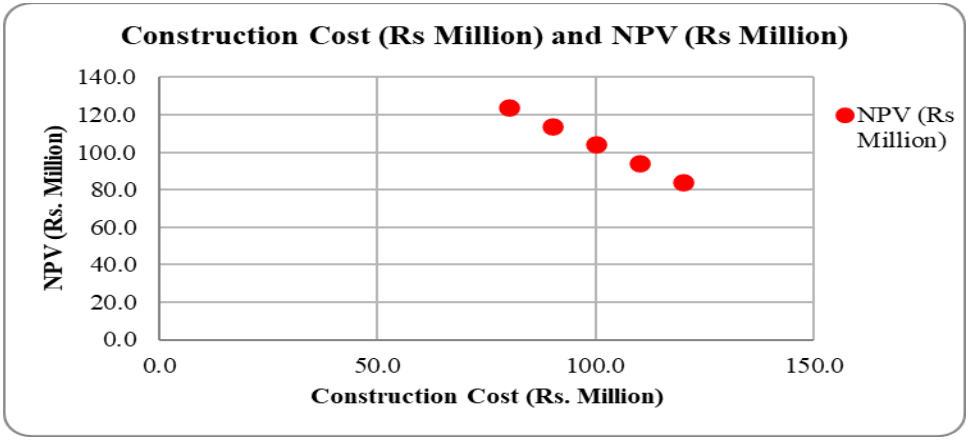
Internal Rate of Return

Year	Cash Flow (Rs. Million)
Year 0	-158.05
Year 1	7.43
Year 2	21.90
Year 3	28.68
Year 4	37.05
Year 5	47.37
Year 6	60.04
Year 7	75.56
Year 8	94.54
Year 9	117.69
Year 10	145.91
Internal Rate of Return	0.23

Scenario 1: Increased Construction Costs

Figure 5

Scenario 1 - Increased construction costs



Sensitivity Analysis

Sensitivity analysis assessed the impact of variations in the following two key assumptions - change in construction cost and the scenarios demonstrate the sensitivity of the project's financial viability to changes in utilization rate of the silos. Higher construction costs and lower utilization rates have adverse effects on the project's profitability, as expected. The results are shown in the tables and graphs below.

Table 12

Construction Cost and NPV

Construction Cost (Rs Million)	NPV (Rs Million)
80.0	134.1
90.0	124.1
100.0	112.21
110.0	104.1
120.0	94.1

Scenario 2: Change in Utilization Rate:

Figure 6

Scenario 2 - Increase in Construction Cost

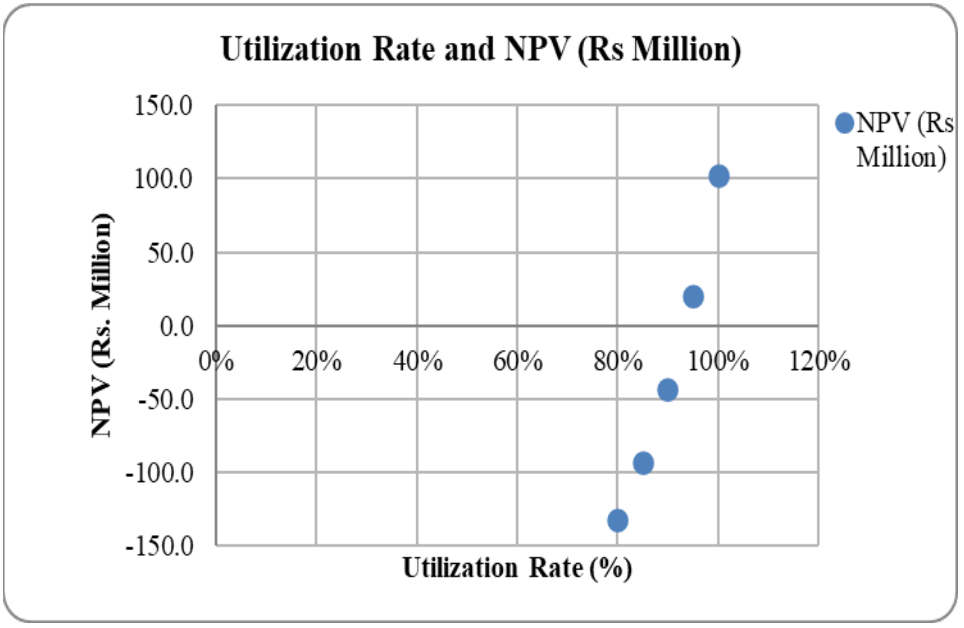


Table 13

Utilization Cost and NPV

Utilization Rate (%age)	NPV (Rs Million)
100%	112.21
95%	30.72
90%	-33.14
85%	-83.12
80%	-122.23

Policy Recommendations

Procurement Phase

Streamlined Procurement Process

The procurement process may be liberalized and streamlined so that the Food Department can procure wheat from whosoever presents his stock at the centre with no quotas. Not only will this reduce the cost of record keeping and verification, it will also make the process more accessible for the small farmer who will have a less cumbersome process to face. This will also reduce opportunities for rent seeking and patronage networks which exclude the poor from the procurement process.

Minimum Support Price

Minimum support price plays a vital role for both the consumers as well as the producers. In the short run, without price support, the production of wheat crop could fall precariously. Subsidy reforms are tricky business which can have unforeseen consequences as highlighted by Amid (2007) where several cases of subsidy reforms provoking popular unrest are documented.

Punjab may also subsidize wheat inputs, especially fertilizers and seeds, to reduce production costs as is the case in neighboring India which has focused more on subsidizing inputs than minimum support prices. A reduction in input costs could increase productivity, reduce output prices and in turn profitability for the farmers without losing competitiveness of Pakistani wheat.

Staggered Wheat Procurement

Staggering procurement from May to October could reduce cost of storage and interest charges incurred by the Food Department. The Food

Department could incentivize procurement later in the season through a premium. This approach would lead to private sector investment in storage facilities including godowns and silos, fostering improved storage capacity. It would also help develop storage capacity in the private sector, including at farm storage solutions. With less wheat to clear in the harvest season, it could bring price stability and benefit small farmers.

Wheat Transportation

The transportation of wheat from Western and Southern regions is a costly and a heavily regulated affair. The Food Department may consider passing on this activity to the Floor Mills that obtain wheat from them. This shift could lead to a reduction in the inefficiencies associated with the government sector.

Wheat Anti-Smuggling Policy

The interviews of the District Food Controllers and field visits, the following steps are recommended:

1. Restriction of movement of wheat to adjoining borders districts of Afghanistan by federal agencies.
2. Close liaison and data sharing amongst provinces and federal agencies on movement of wheat.
3. Establishment of monitoring posts for real time information on movement of wheat to other provinces from Punjab using advanced surveillance technologies.
4. Use of technology in form of geo-tracking and tagging to ensure that the wheat reaches its destination.
5. Strengthening regulatory framework with a detailed implementation plan developed well in advance of harvest season.

Wheat Storage

Enhancing Storage Systems

Investments in modern storage infrastructure, such as grain storage silos, warehouses, and cold storage facilities, are essential to minimize post-harvest losses and improve the shelf life of perishable food items.

Scrapping Zero Loss Policy

'Zero-Loss policy' has also led to an ambivalent attitude towards improving grain storage. This zero-loss policy needs to be scrapped and replaced with strategies to improve grain storage and raise storage capacity. The loss recording system for government wheat storage should recognize allowable losses depending on the type of storage and its length**.**

For-Rent Grain Silos

As shown by the Cost Benefit Analysis of Rental Grain Silos, the Punjab Government may either through private sector or through its own developmental budget, invest in For-Rent Grain Silos. The government had planned to establish steel silos through public-private partnership, however, there has been little interest in the project with only two silos under construction.

Consumers and Floor Mills

Open Auction for Floor Mills

Food Department may consider issuing wheat through open auction at market rates rather than on arbitrary quotas on capacity. This will help PFD recover some of the costs of its wheat operations. This may help recoup some of the costs borne by the Food Department in the wheat operations ease and incentivize mill owners to procure larger quantities from farmers at the harvest time.

Targeted Subsidies

The distortions in the wheat market by government intervention are likely to have only a marginal impact on the most marginalized. There needs to be a targeted subsidy on wheat flour using existing social security nets such as the Benazir Income Support Program. Another option could be a mechanism on the lines of food stamps which allows poor households to obtain wheat and other edibles at low cost from utility stores.

Conclusion

Addressing food insecurity in Punjab requires a comprehensive and multi-pronged approach that tackles the underlying factors exacerbating the problem including ineffective governance, market dynamics, pricing policies, and socio-economic challenges. These factors intersect,

contributing to the persistent issue of inadequate access to sufficient and nutritious food for a significant portion of the population.

The wheat cycle in Punjab is riddled with inefficiencies and there is a need to simplify the procurement process by reducing the government footprint with the Food Department intervening only strategically and sparingly. The wheat value chain in Punjab involves various stakeholders, including farmers, traders, millers, and government departments, most importantly, the Food Department, which play different roles in the production, distribution, and storage of wheat.

Investment in modern storage infrastructure is crucial for food security. The results of the cost-benefit analysis suggest that investment in modern storage silos is a financially viable business model that can enhance food security, reduce dependence on imports, and stabilize market prices in Punjab. The results showed that the project has a positive net present value (NPV) of Rs. 54.98 million with an internal rate of return of 22% and a payback period of 5.4 years indicating its potential to generate financial returns within a short timeframe. The study also conducted a sensitivity analysis to assess the impact of variations in key assumptions which showed that higher construction costs and lower utilization rates have adverse effects on the project's profitability.

There has been a dearth of research on illegal movement of food grains in Punjab. The results of the survey of District Food Officers in Punjab showed that they do not have a cohesive policy for mitigating smuggling beyond the imposition of section 144 or suspending food grain licenses. In the short-term, there is a need for an effective anti-smuggling policy that takes into account the common modalities of smuggling alongside greater co-operation between different government bodies and utilizes technology for combating illegal movement of wheat from the country. While in the long term, market interventions and pricing policies along with targeted subsidies may be designed to ensure fair market access, stable prices, and improved food affordability without causing distortions in the grain market.

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