Print ISSN: 0215-0411 - Online ISSN : 0215-0419
Volume: 3 , Issue: 1, Spring 2024
Special Issue
Spring 2024

Khyber Journal of Public Policy
KJPP

National Institute of Public Administration

National School of Public Policy

# Report of Policy Lab on Bridging Gaps in Agriculture Development Policies and their Implementation in Pakistan

پاکستان میں زرعی ترقی کی پالیسیوں کے اطلاق میں حائل رکاوٹوں کا خاتمہ

## Policy Analysis & Recommendations- Part-5 of 11

# Provision of Quality Seeds to Enhance Productivity

**Assessed Pakistan's seed industry, highlighting reforms needed to boost agricultural yields through high-quality seeds**

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بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

إِنَّ اللّٰه لَا يُغَيِّرُ مَا بِقَوْمٍ حَتَّىٰ يُغَيِّرُوا مَا بِأَنفُسِهِمْ

(سورة الرعد 13:11)

بے شک، اللہ کسی قوم کی حالت نہیں بدلتا جب تک وہ خود اپنی حالت کو نہ بدلے۔

Indeed, Allah does not change the condition of a people
until they change what is in themselves.
*(Surah Ar-Ra'd 13:11)*

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ظَهَرَ الْفَسَادُ فِي الْبَرِّ وَالْبَحْرِ بِمَا كَسَبَتْ أَيْدِي النَّاسِ لِيُذِيقَهُمْ بَعْضَ الَّذِي عَمِلُوا لَعَلَّهُمْ يَرْجِعُونَ

(سورة الروم 30:41)

خشکی اور تری میں فساد ظاہر ہو گیا ہے، لوگوں کے اپنے ہاتھوں کے کیے ہوئے اعمال کی وجہ سے، تاکہ اللہ انہیں ان کے کچھ اعمال کا مزہ چکھائے، شاید کہ وہ باز آ جائیں۔

Corruption has appeared on land and sea because of
what the hands of people have earned, so that
He may let them taste part of what they have done,
that perhaps they will return (to righteousness).
*(Surah Ar-Rum 30:41)*

# Provision of Quality Seeds to Enhance Productivity

Assessed Pakistan's seed industry, highlighting reforms needed to boost agricultural yields through high-quality seeds.

Research Group

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# PREFACE

Agriculture remains the backbone of Pakistan's economy, providing livelihoods to a significant portion of the population and contributing substantially to the nation's GDP. However, despite its potential, the sector faces persistent challenges related to productivity, resource management, and international trade. In response to these pressing issues, a ***Policy Lab*** simulation exercise titled **"Empowering Agriculture for Food Security and Economic Growth: Implementation Strategies in Pakistan"** was conceived, designed, and mentored by **Dr. Muqeem Islam Soharwardy**. This Policy Lab initiative aimed to generate actionable policy recommendations through an intensive, research-based simulation exercise complemented by a two-day seminar.

The ***Policy Lab*** research exercise, conducted between **14th and 18th February 2024**, involved nine specialized research groups, each focusing on critical aspects of agricultural policy. These groups simulated high-level policy interventions, functioning as dedicated task forces and committees under the guidance of subject matter experts. Their work culminated in a comprehensive set of recommendations aimed at addressing structural inefficiencies and unlocking new growth avenues in Pakistan's agricultural sector.

The a Policy Lab research groups were structured as follows:

1. **Expanding Trade Opportunities by Unleashing Pakistan's Milk Export Potential** – Focused on identifying barriers to dairy exports and proposing strategic interventions to enhance Pakistan's competitiveness in the global dairy market.
2. **Development of Pakistan's Fisheries Sector** – Examined strategies to modernize fisheries, improve sustainability, and enhance exports.
3. **Increasing Pakistan's Share in International Halal Meat Export** – Explored pathways to leverage Pakistan's strength in halal meat production for greater penetration in international markets.
4. **Provision of Quality Fertilizer to Enhance Productivity** – Investigated fertilizer supply chain challenges and policy measures to ensure the availability of high-quality inputs for farmers.
5. **Provision of Quality Seeds to Enhance Productivity** – Assessed Pakistan's seed industry, highlighting reforms needed to boost agricultural yields through high-quality seeds.
6. **Promoting Water Conservation in Agricultural Practices** – Addressed the critical issue of water scarcity by proposing conservation techniques and policy interventions for sustainable irrigation.
7. **Increasing Pakistan's Share of Fruit Exports** – Focused on expanding Pakistan's footprint in the global fruit market through improved production, value addition, and trade facilitation.

8. **Evaluation of Implementation Strategies of Food Security in Pakistan** – Analyzed the effectiveness of existing food security policies and proposed comprehensive strategies for improved implementation.
9. **Increasing Availability of Agricultural Credit** – Examined the role of financial institutions in supporting farmers and proposed mechanisms to enhance access to agricultural financing.
10. **Climate-Smart Agriculture**, Food Security, and Sustainable Land & Water Management explored innovative solutions for sustainable agriculture and resource management
11. **Agricultural Mechanization & Innovation –** Promoting modernized agriculture through mechanization, crop diversification, and precision farming.

Through rigorous research and a ***Policy Lab*** simulation, this exercise sought to foster a deeper understanding of the challenges and opportunities in Pakistan's agricultural sector. The insights and recommendations derived from these working groups will serve as a valuable resource for policymakers, stakeholders, and researchers striving to enhance agricultural productivity, food security, and economic growth in Pakistan.

We extend our gratitude to all participants, researchers, and experts who contributed to this initiative. Their dedication and intellectual rigor have resulted in a policy framework that holds the potential to transform Pakistan's agricultural landscape and position the country as a leading player in global agricultural markets.

We extend our gratitude to all participants, researchers, and experts who contributed to this initiative. Their dedication and intellectual rigor have resulted in a policy framework that holds the potential to transform Pakistan's agricultural landscape and position the country as a leading player in global agricultural markets.

It is hoped that the recommendations and findings herein will contribute to **evidence-based policymaking, institutional capacity-building, and long-term agricultural growth**, ultimately fostering **national food security and economic stability**. انشاءالله.

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*February 23, 2024*

# Executive Summary

According to global standards, 30% of seeds in circulation should be certified. The total demand for seeds for cultivation is 100,000 tonnes per year, which implies that 30,000 tonnes of certified seeds should be available annually. The Agriculture Extension Department is responsible for seed provision to growers, currently supplying 4,500 tonnes per year, equivalent to 4.5% of the total demand and 15% of the desired quantity. The private sector contributes 3% of the total demand, or 10% of the requisite quantity, while the remaining 75% of the desired quantity is fulfilled by informal and unregulated sources such as seeds saved from previous harvests and informal exchanges among farmers. This situation results in poor crop yields and productivity, significantly contributing to food insecurity in the Pakistan.

Wheat is a major staple crop in Pakistan, cultivated by 80% of farmers (Raja, Tauqir, Qureshi, & Rana, 2022). The annual demand for wheat in KP is 5 million metric tons, yet the province only produces 1.2 to 1.3 million metric tons, resulting in a shortfall of 75% (Editor, 2023). KP contributes approximately 5% to the national wheat production (AMIS, 2023). The area under wheat cultivation in KP is 779,206 hectares, with 67% being rain-fed (Khattak, 2019). The average yield of wheat in KP is 1.6 tons per hectare, compared to the national average of 2.7 tons per hectare (Joshi, Imtiaz, & Hussain, 2014), indicating substantial room for improvement. The provision of quality seeds alone can enhance total production by 15-20%, depending on the crop (Ali, 2016).

The wheat seeds available for cultivation in KP are predominantly uncertified, leading to subpar crop yields. The annual demand for wheat seeds in the province is 100,000 tons, with a replacement rate of 30%. This implies that around 30,000 tons of certified seeds should be supplied to farmers annually to enhance yields. However, only 7% of certified seeds are replaced each year, with the public sector being the major provider, followed by the private sector (Joshi, Imtiaz, & Hussain, 2014).

The Federal Seed Certification and Registration Department (FSC&RD), operating under the Ministry of National Food Security and Research (MoNFS&R), is tasked with regulating seeds of various crops under the Seed Act of 1976 and its amendment in 2015 (FSC&RD, 2023). Despite the mechanisms in place to ensure the provision of quality seeds to farmers, KP has fallen short in this regard (Rana, Gill, & Akram, 2022). Therefore, it is imperative to analyze the existing mechanisms and identify the causes of this failure to devise an action plan aimed at increasing crop yields and achieving food security.

Khyber Pakhtunkhwa (KP), a province with rich agricultural potential, faces significant barriers to maximizing its agricultural output. Despite favorable climate conditions and fertile lands, KP's agricultural productivity remains hindered due to various factors, including insufficient investments, outdated management practices, inadequate infrastructure, and the negative impacts of climate change. This has led to food security challenges and reduced agricultural productivity. One of the key factors contributing to low productivity is the lack of access to high-quality seeds, which plays a vital role in

improving crop yields. This summary discusses the current state of the agricultural sector in KP, focusing on seed quality, and offers strategic recommendations to improve seed availability and enhance agricultural productivity in the province.

**Agricultural Challenges in Khyber Pakhtunkhwa**

- **Low Productivity Due to Low-Quality Seeds**: Despite its agrarian nature, KP suffers from low crop yields, especially in wheat, the primary staple crop. The average wheat yield in KP is 1.6 tons per hectare, significantly lower than the national average of 2.7 tons per hectare. The main cause of this low productivity is the widespread use of uncertified and low-quality seeds, which negatively impacts crop performance. Certified wheat seeds are particularly scarce, with only 7% of the required amount replaced annually.
- **Seed Supply and Distribution Issues**: Although wheat accounts for a significant portion of the province's agricultural output, the region is plagued by ineffective seed distribution systems. The Agriculture Extension Department is responsible for providing seeds but falls short of meeting demand, supplying only 4.5% of the required certified wheat seeds. The remaining demand is met through informal and unregulated sources, further contributing to poor yields.
- **Shortage of Wheat Production**: KP's annual demand for wheat stands at 5 million metric tons, while the province only produces approximately 1.3 million metric tons. This results in a substantial wheat deficit, with the province relying on procurement from other regions like Punjab and market imports. The deficit highlights the urgency of addressing production gaps and improving yields to meet the province's growing demand.
- **Climate and Land Utilization Constraints**: The province's agricultural output is further constrained by challenges such as limited cultivable land and adverse climatic conditions. Approximately 67% of wheat cultivation in KP is rain-fed, contributing to lower productivity compared to irrigated lands. Additionally, a significant portion of the available land is not utilized for agriculture, including cultivable wastelands that could be transformed into productive land with the right interventions.

**Recommendations for Enhancing Seed Quality and Agricultural Productivity**

To address the issues related to seed quality and agricultural underperformance in KP, a series of targeted recommendations are proposed:

**1. Establishment of a Local Seed Certification Authority**

The Federal Seed Certification and Registration Department (FSC&RD) currently monopolizes seed certification, which leads to delays and inefficiencies in the seed supply chain. The KP government should establish its own seed certification body to streamline seed certification procedures and reduce bureaucratic delays. This would also enable faster approval and distribution of certified seeds to local farmers.

**2. Expansion of Certified Seed Supply**

KP requires 30,000 tons of certified seeds annually, but the current supply is insufficient. To meet the demand, the provincial government should invest in expanding the capacity of seed propagators and collaborate with the private sector to

increase the availability of certified seeds. This includes enhancing seed storage capacities and encouraging more progressive farmers to participate in seed production.

**3. Improve Seed Propagation Systems**

Seed propagation systems need to be optimized to ensure the availability of high-quality seeds in the province. Increased collaboration between the Agriculture Extension Department, research institutions, and private enterprises can improve the quantity and quality of certified seeds. Furthermore, introducing progressive farming techniques and increasing training programs for farmers can contribute to better seed production practices.

**4. Research and Development for High-Yielding Varieties**

Khyber Pakhtunkhwa must invest in research and development (R&D) to develop new wheat varieties that are more resilient to local climatic conditions and provide higher yields. The Agricultural Research Institute (ARI) and the Nuclear Institute of Food and Agriculture (NIFA) should play a central role in this process. Moreover, R&D efforts should focus on creating seeds that are optimized for both irrigated and rain-fed farming systems to increase overall production efficiency.

**5. Technological Advancements in Seed Distribution**

Implementing technological solutions such as mobile apps or digital platforms can improve the transparency and efficiency of seed distribution. A digital seed tracking system can help ensure that quality seeds reach farmers on time, preventing the use of uncertified or low-quality seeds.

**6. Soil and Fertilizer Optimization**

While improving seed quality is essential, other factors such as soil health, fertilizer application, and irrigation practices also play a critical role in enhancing agricultural productivity. It is essential to provide farmers with access to soil testing services and tailored fertilizer application plans. Furthermore, improving water management systems, especially in rain-fed areas, can help boost yields.

**7. Capacity Building and Farmer Education**

Farmers in KP often lack awareness regarding the benefits of using certified seeds and modern farming practices. To address this, the provincial government should invest in farmer education programs, focusing on seed quality, crop management, and innovative farming techniques. Extension services should be strengthened to provide on-ground support to farmers in adopting improved practices.Khyber Pakhtunkhwa (KP) is an agriculturally rich province with favorable climatic conditions and fertile land, yet it struggles to meet its wheat production demands, resulting in significant shortfalls. The primary factor contributing to low productivity is the widespread use of low-quality seeds, compounded by weak management and inadequate infrastructure. Wheat, as the staple crop, is crucial for the region’s food security, but KP's wheat production is far below the demand. The gap between the province's wheat production and its required consumption results in dependency on imports, which negatively impacts the local economy and food security.

Although the potential for improving agricultural yields is high, particularly by addressing the seed quality issue, KP continues to face barriers such as poor seed certification processes, insufficient seed storage, and an underdeveloped seed

distribution system. Moreover, the failure of government departments to enforce seed regulations effectively exacerbates the problem. These challenges are further amplified by the effects of climate change, which makes it critical to provide climate-resilient seed varieties to farmers to ensure long-term food security.

A comprehensive strategy must be developed to improve seed certification and enhance seed storage and distribution in the province. By addressing these gaps, KP can realize its full agricultural potential, which will help boost its economy, reduce reliance on external imports, and enhance food security for its population.

**Key Insights**

- The province has the potential to significantly increase its wheat production yield, yet it fails to meet even the national average.
- The primary issue impeding growth is the low quality of seeds, with uncertified seeds being prevalent in the market due to a weak regulatory environment and inefficient seed distribution channels.
- The agriculture department in KP has the necessary resources but is hampered by poor management practices and lack of effective monitoring.
- Climate change poses an additional threat, making it imperative to introduce more resilient seed varieties suited to the region's evolving climate.

**Action Plan**

- Decentralize seed certification to the provincial level through legislative measures, allowing the market to play a more active role while ensuring appropriate oversight by the provincial government.
- Develop seed certification and registration labs within KP to expedite the certification process, utilizing advanced technologies like speed breeding to respond quickly to the urgency created by climate change.
- Strengthen enforcement mechanisms within the provincial agriculture department to ensure the circulation of only certified seeds, thereby reducing the reliance on informal and low-quality seed sources.
- Engage the private sector by offering tax incentives and ensuring intellectual property protections to attract investment in the seed supply chain, which is crucial for meeting the growing demand for certified seeds.
- Improve management within the agriculture department by instituting a performance-based system, with clearly defined KPIs and regular administrative reviews conducted by the Minister for Food.
- Increase seed storage capacity by expanding government facilities and exploring partnerships with farmers to store certified seeds on their farms, ensuring that the supply is sufficient to meet demand.
- Foster indigenous production of certified seeds by encouraging progressive farmers to grow basic seeds, reducing the dependency on imports from other provinces and increasing self-sufficiency.
- Educate farmers on the importance of certified seeds and where to access them through outreach programs using media, social media, and mobile apps, fostering awareness and participation across the agricultural community.

**Strategic Priorities**

By focusing on two primary measures, KP can solve a significant portion of its seed supply issues:

1. Appointing the best officers to the agriculture department, establishing clear performance metrics, and offering incentives to ensure productivity is prioritized and improved.
2. Educating farmers through mobile applications, media, and social platforms to create a more informed and engaged farming community, ensuring they are aware of the certified seeds available and how to access them.

**Conclusion: Strategic Path Forward**

To overcome the agricultural challenges in Khyber Pakhtunkhwa, particularly those related to seed quality, a comprehensive approach involving government, research institutions, and the private sector is required. Addressing the gap in certified seed supply, improving the seed certification process, and investing in R&D to develop high-yielding varieties will significantly enhance agricultural productivity in the province. Additionally, strengthening seed propagation systems, optimizing soil and fertilizer use, and increasing farmer education will collectively contribute to greater food security and agricultural sustainability in KP.

By implementing these recommendations, Khyber Pakhtunkhwa can improve its agricultural output, reduce its dependency on external wheat supply, and foster a more food-secure future for the province.

## *Introduction*

Khyber Pakhtunkhwa (KP), a province in Pakistan, has long been recognized for its rich agricultural potential, with fertile lands and a climate conducive to various crops (Ministry of Finance [MoF], 2023). However, despite these natural advantages, the province faces significant challenges that hinder its agricultural development and, by extension, its food security. These challenges include insufficient investments in the agricultural sector, widespread neglect, poor management practices, inadequate infrastructure, and the adverse effects of climate change. As a result, KP continues to lag behind in terms of crop yields compared to other regions, which has a direct impact on the overall food security of the province (Bacha, 2017).

One of the primary factors contributing to low agricultural productivity in KP is the lack of access to quality seeds, which has been identified as a major obstacle to improving crop yields. Research suggests that the use of high-quality seeds can increase crop production by 15%-20%, which emphasizes the importance of addressing this issue (Joshi, Imtiaz, & Hussain, 2014). Unfortunately, low-quality seeds are widely available and accessible to farmers in the region, often due to a combination of poor seed distribution systems, limited awareness about seed quality, and the absence of effective policies to regulate seed production and supply.

This situation calls for a comprehensive investigation into the root causes of the widespread presence of low-quality seeds in KP and the factors that prevent farmers from accessing better-quality alternatives. Identifying these underlying causes will be critical for developing a strategic approach to enhancing seed quality, improving agricultural productivity, and ultimately ensuring food security in the province. In this research, we aim to explore these challenges in-depth and propose actionable solutions to enhance agricultural production by improving seed quality and addressing other related factors that contribute to the agricultural sector's underperformance. Through these efforts, we can work towards a more sustainable and food-secure future for KP.

## *Problem Statement*

Food insecurity stands as one of the most pressing contemporary non-traditional threats faced by the world as a whole, and providing quality seeds to growers is a key remedy to enhance agricultural productivity. Despite being an agrarian province, the presence of government departments, relevant institutional setups, and a legal framework, KP still struggles to provide quality seeds to farmers. This report will explore the causes and factors contributing to this phenomenon; furthermore, it will recommend policies to enhance agricultural productivity in KP over the next 5 years by ensuring the provision of quality seeds to growers.

## *Scope of the Study*

The scope of this report is confined to the examination of the current legal and institutional framework, as well as the distribution and supply mechanisms of quality wheat seeds to KP growers. Given that wheat serves as the primary staple crop for the masses, it is assumed that the model proposed herein can be adapted to provide seeds for other food crops, shared storage facilities, and applicable lessons learned. Additionally, it is assumed that other factors contributing to optimal production are favorable.

This study will propose a sustainable operational plan to ensure the availability of internationally standardized quality seeds, thereby enhancing agricultural productivity over time.

## *Literature Review*

Wheat is a major staple crop in Pakistan, cultivated by 80% of farmers (Raja, Tauqir, Qureshi, & Rana, 2022). The annual demand for wheat in KP is 5 million metric tons, yet the province only produces 1.2 to 1.3 million metric tons, resulting in a shortfall of 75% (Editor, 2023). KP contributes approximately 5% to the national wheat production (AMIS, 2023). The area under wheat cultivation in KP is 779,206 hectares, with 67% being rain-fed (Khattak, 2019). The average yield of wheat in KP is 1.6 tons per hectare, compared to the national average of 2.7 tons per hectare (Joshi, Imtiaz, & Hussain, 2014), indicating substantial room for improvement. The provision of quality seeds alone can enhance total production by 15-20%, depending on the crop (Ali, 2016).

The wheat seeds available for cultivation in KP are predominantly uncertified, leading to subpar crop yields. The annual demand for wheat seeds in the province is 100,000 tons, with a replacement rate of 30%. This implies that around 30,000 tons of certified seeds should be supplied to farmers annually to enhance yields. However, only 7% of certified seeds are replaced each year, with the public sector being the major provider, followed by the private sector (Joshi, Imtiaz, & Hussain, 2014).

The Federal Seed Certification and Registration Department (FSC&RD), operating under the Ministry of National Food Security and Research (MoNFS&R), is tasked with regulating seeds of various crops under the Seed Act of 1976 and its amendment in 2015 (FSC&RD, 2023). Despite the mechanisms in place to ensure the provision of quality seeds to farmers, KP has fallen short in this regard (Rana, Gill, & Akram, 2022). Therefore, it is imperative to analyze the existing mechanisms and identify the causes of this failure to devise an action plan aimed at increasing crop yields and achieving food security.

## *Research Methodology*

Primary and secondary data has been used, mixed method of research has been used in this study. The data was analyzed using different analytical tools such as 1) Situational Analysis,2) Institutional Framework Analysis 3) SWOT Analysis 4) EETH Analysis, 5) PESTEL Analysis, 6) Economic and Financial Analysis, 7) Legal Framework Analysis 8) International Best Practices Analysis and 9) GAP Analysis.

## *Situational Analysis*

Khyber Pakhtunkhwa, despite being an agrarian province, faces significant food shortages. Wheat serves as the staple food for the majority, meeting 60% of their dietary requirements (Shahid, 2023). KP's annual wheat production stands at 1.3 million tonnes, falling short of the demand of 5 million tonnes per year, resulting in a 74% gap. To bridge this gap, 28% of the total demand is met through procurement of 1.4 million tonnes annually from PASSCO, while the remaining 48% deficit is met by market forces.

**Demand Analysis and Projections:**

With a population of 40.85 million in KP, the UN recommends an average consumption of 124kg of wheat per person per year (FAO, 2023), translating to a total demand of approximately 5.065 million metric tonnes annually, or 13,877 metric tonnes per day. Considering KP's population growth rate of 2.38% per year, the demand is expected to rise

in the future, placing additional stress on the system as it directly correlates with population growth.

**Cultivable Land and Production Potential Analysis:**

KP's total area of 8,355,157 hectares, 22.4% (1,871,555 hectares) is cultivated land, while the remaining 77.6% (6,483,602 hectares) is uncultivated. Among the uncultivated land, 61% (3,954,997 hectares) consists of areas like built-up areas and roads, which cannot be utilized for cultivation. Additionally, 19% (1,231,884 hectares) is covered by forests, and 20% (1,296,720 hectares) is considered cultivable wasteland, presenting opportunities for conversion into cultivable land, which is evenly split between irrigated and unirrigated, each comprising 50% (935,777 hectares). However, wheat yields on irrigated land and unirrigated land stand at 2.5 tonnes per hectare and 1.2 tonnes per hectare, respectively, considerably lower than Punjab's yields of 3 tonnes per hectare for irrigated and 1.4 tonnes per hectare for unirrigated land, while the world average is 3.5 tonnes per hectare (Research, 2022). Provision of quality seeds to growers has the potential to enhance yields by 20-25%, provided other production factors such as soil quality, fertilizer application, irrigation, and sowing timing are optimized. With an area under wheat cultivation of 779,206 hectares, KP's production potential could reach 2.5 million tonnes per year if the national average yield of 3 tonnes per hectare is achieved. Currently, KP produces 1.5 million tonnes of wheat per year and has to import the remainder primarily from Punjab.

**Ground Situation:**

According to global standards, 30% of seeds in circulation should be certified. The total demand for seeds for cultivation is 100,000 tonnes per year, which implies that 30,000 tonnes of certified seeds should be available annually. The Agriculture Extension Department is responsible for seed provision to growers, currently supplying 4,500 tonnes per year, equivalent to 4.5% of the total demand and 15% of the desired quantity. The private sector contributes 3% of the total demand, or 10% of the requisite quantity, while the remaining 75% of the desired quantity is fulfilled by informal and unregulated sources such as seeds saved from previous harvests and informal exchanges among farmers. This situation results in poor crop yields and productivity, significantly contributing to food insecurity in the province.

## *Institutional Framework:*

**The Creators:**

Institutions in this category are the research institutions, which, through their experiments and studies, create new and improved varieties of crops with higher yields compared to the existing ones. The seeds produced are called Pre-Basic Seeds. In the context of KP, there are two government research institutes: The Agricultural Research Institute (ARI) and the Nuclear Institute of Food and Agriculture (NIFA).

**Interest/Motivation:**

These institutions have a high interest in developing enhanced-yielding new seed varieties that are suited to local conditions. It is their mandate and purpose. The production of the best seed varieties provides them with prestige in the national and international arena.

**Power/Influence:**

Research institutions have high power in the provision of improved quality seeds. However, they have low influence on policies, as they depend on government decisions and initiatives.

**Strategy:**
Manage Closely.
**Implementation and Monitoring of Strategy:**
The institution should be provided with sufficient human, physical, and financial resources through close collaboration to develop seed varieties that help the country achieve its food security goals.
**The Certifiers:**
Certifiers are statutory entities that certify new seed varieties produced as a result of research to determine whether they are fit for human consumption, long-term propagation, and meet scientifically determined criteria. The seed certified is called Certified Seed. The only body authorized to certify seeds for the whole of Pakistan is the Federal Seed Certification and Registration Department (FSC&RD), Islamabad.
**Interest/Motivation:**
The interest of FSC&RD is to ensure that the seed supply in Pakistan consists of certified varieties and that no sub-standard or banned seeds enter the agricultural system. Their motivation is to ensure the productivity and quality of Pakistan's agricultural produce, so that it meets international standards by certifying the quality of seeds used in agriculture.
**Power/Influence:**
FSC&RD is one of the most powerful players, as the decisions made by and for FSC&RD directly affect the productivity of agricultural produce in the country. FSC&RD has high influence over the overall system and holds a monopoly on the seed certification process.
**Strategy:**
Manage Closely.
**Implementation and Monitoring of Strategy:**
The KP government should establish its own seed certification and registration body, similar to FSC&RD, to reduce delays and red tape in seed certification and verification procedures.
**The Propagators:**
Propagators are institutions and individuals who grow the initial pre-basic certified seeds to make basic seeds. Growing basic seed is not intended for consumption but rather to ensure that sufficient seeds are available for subsequent harvests of certified seed. These basic seeds are propagated by institutions and individuals involved in the process and then provided to the masses to meet the demand for certified seeds. In KP, the Agriculture Extension Department is responsible for propagating seeds. It owns agriculture extension farms and works with progressive farmers.
**Interest/Motivation:**
Their interest lies in ensuring that enough certified seeds are available to meet the growers' demand, while converting Pre-Basic and Basic Seeds into commercially viable quantities of certified seeds.
**Power/Influence:**
Propagators have high power, as they are solely responsible for ensuring that certified seeds are available for growers. Any setback on their part can disrupt the entire certified seed supply chain.
**Strategy:**
Manage Closely.
**Implementation and Monitoring of Strategy:**

Increase the growing and storage capacity of propagators by involving more progressive farmers, expanding storage capacity, and involving private businesses in the supply chain.

**The Growers:**

Growers are wheat farmers. They have the land, resources, and motivation required to grow wheat.

**Interest/Motivation:**

The grower's interest is to achieve the maximum and optimal yield given the resources they have.

**Power/Influence:**

Growers have low influence and power in the system, as the majority of them are small landholders with minimal input into the wheat seed supply business.

**Strategy:**

Keep Informed.

**Implementation and Monitoring of Strategy:**

Growers should be educated and informed about the need for growing certified quality seeds. Additionally, they should be informed about the process of obtaining quality seeds.

**The Consumers:**

Consumers are the end users of wheat, including individuals and commercial entities.

**Interest/Motivation:**

Consumers have a high interest in the yield, productivity, and quality of wheat, as they pay for the commodity. For individuals, 60% of their diet consists of wheat, and for business entities, their success depends on wheat inputs.

**Power/Influence:**

Consumers have high power, as wheat is a political crop. Any price fluctuation or shortage directly influences the government to take remedial measures, including procurement from other provinces.

**Strategy:**

Manage Closely.

**Implementation and Monitoring of Strategy:**

The public must be educated and informed about the efficient and prudent use of wheat products. They should also be encouraged to use substitutes in their diet to reduce dependence on wheat consumption.

**The Market:**

The market consists of private individuals and entrepreneurs who engage in commercial activities for profit. Unfortunately, in KP, the market mechanism is not functioning properly, as only 2.5% of the annual certified seed demand is met by the market. Private firms are significant stakeholders in the seed supply chain, but due to weak enforcement of intellectual property laws, major international firms are hesitant to enter the Pakistani seed market (Jafri, Imran, & Asif, 2022). The seed provided by the market is mostly purchased from companies based in Punjab.

**Interest/Motivation:**

The market has low interest in meeting the demand for wheat seeds.

**Power/Influence:**

The market has low power in influencing decisions.

**The Regulators:**

Regulators are governmental bodies responsible for regulating the wheat seed supply, quality, and availability according to the law. They have the power to inspect, confiscate, prosecute, regulate, and grant or deny permission to sell certain seed varieties. In KP, the regulator is the Agriculture Extension Department, with overall supervision by the Provincial Seed Council and FSC&RD.

**Interest/Motivation:**

The interest of the regulators is to ensure that the system operates according to the law, rules, and regulations.

**Power/Influence:**

Regulators hold high power, as they ensure that the system runs according to established guidelines.

**Strategy:**

Manage Closely.

**Implementation and Monitoring of Strategy:**

Regulations should be made to reduce over-regulation and encourage the private sector to fill the gap. The role of the regulator should be more passive than active.

## *SWOT Analysis:*

**Strengths:**

- Legal backing available to the government
- Mandated activity of the ministry
- Institutional framework in place
- Pre-Basic Seed available
- Low cost of operation
- Available human resources

**Weaknesses:**

- Poor infrastructure
- Low storage capacity
- Low capacity for sorting, grading, and cleaning seeds
- Maximum coverage of cultivated area is a challenge
- Motivation and desire to work within the department

**Opportunities:**

- Huge room for growth in agriculture
- Potential respite from inflation for the masses
- Savings in provincial finances
- Potential source of economic activity generation
- Opportunity to improve the public's living standards and health
- Potential to make the province food-secure

**Threats:**

- Climate change
- Slow certification process of FSC&RD

## *EETH Analysis:*

**Enhance:**

- Legal compliance
- Perform activities with due diligence
- Improve efficiency of the institutions
- Improve the quality of Pre-Basic Seed
- Make the system self-sustaining
- Improve human skills and motivation

**Eliminate:**

- Update infrastructure
- Increase storage capacity
- Acquire machinery for sorting, grading, and cleaning
- Start from the union council level and move upwards
- Provide training and incentives

**Take Advantage:**

- Involve credible players from the private sector
- Encourage the masses to grow other food items independently
- Increase production to save even more
- Start value addition and focus on other food sources
- Give impetus to related activities
- Focus more on nutritional requirements

**Hedge Against:**

- Introduce climate change-resilient crops
- Reform the seed certification process

## *PESTEL Analysis:*

**Political:**

Wheat holds significant political importance, as shortages or unavailability of wheat can lead to political unrest. Governments are obligated to ensure food availability at affordable prices.

**Economic:**

Wheat cultivation and its products have substantial economic implications in both rural and urban societies. Activities such as seed procurement, field preparation, fertilization, harvesting, transportation, and related endeavors generate considerable economic activity. Additionally, commercially produced wheat products like naan, chapattis, biscuits, and vermicelli contribute to the economy. Wheat contributes 8.2% to the value-added activities in agriculture and 1.9% to GDP in Pakistan (MoF, 2023).

**Social:**

Wheat-derived food items hold a central place in KP society, with KP cuisine incomplete without them.

**Technological:**

In today's tech-savvy world, technology plays a vital role in implementing new initiatives. Tools such as Information Technology, Geographical Information Systems (GIS), and telecommunication can be effectively utilized in providing quality seeds to the masses. Moreover, with progress in biotechnology, there is huge potential for increasing yield through new technologies such as speed breeding, improved seed varieties, and GM crops.

**Environmental:**

With a global focus on sustainable agriculture and increasing food insecurity due to extreme events caused by climate change, the supply of improved and climate change-resilient wheat seeds is imperative.

**Legal:**

Pursuant to the Seed Amendment Act, 2015, read with Truth Labeling Rules, 1993, and the Plant Protection and Breeders Rights Act, 2016, the legal regime is very conducive for both the public and private sectors.

**Economic and Financial Analysis:**

Increased crop yield reduces the demand for land required to achieve equivalent yields (Ritchie, Rosado, & Roser, 2022). Therefore, vacant land can be repurposed for other uses, including agriculture. Currently, wheat production accounts for 1.9% of the national GDP (MoF, 2023). With a total area of 779,206 hectares under wheat cultivation in KP, quality wheat can produce 2.3 million tons annually, even at the national average yield of 29.75 tons per hectare (AMIS, 2023), meeting 46% of the total demand. This represents a 16% increase from the current production level of 30%. The wheat support price, as notified by the Economic Coordination Committee for the year 2023-2024, is Rs. 3900/40 kg (Desk, 2024), equating to Rs. 97,500/ton, excluding transportation costs dependent on imported fuel prices. KP procures 1.4 million tons of wheat from the Pakistan Agricultural Storage and Services Corporation (PASSCO), resulting in savings of Rs. 136.5 billion at the current support price. These savings can be redirected towards other public sector development programs, stimulating economic activity. Moreover, improved yields would lead to additional financial savings, increased availability of land for other agricultural activities, heightened economic activity, and overall prosperity.

## Legal Perspective and Best Practices from India, Bangladesh, China, and the USA

**Seed Regimes in India, Bangladesh, Pakistan, China, and the USA:**

**India:**

India's Seed Act of 1966, along with subsequent amendments, governs seed production and distribution. Central bodies like the Central Seed Committee (CSC) and the Central Seed Certification Board (CSCB) oversee seed quality control. Policies like the New Policy on Seed Development (1988) and the Protection of Plant Varieties and Farmers' Rights Act (2001) have encouraged private sector participation and innovation in the seed industry. India has over 500 companies contributing to its seed market, with significant investment in R&D.

**Bangladesh:**

Bangladesh's Seeds Ordinance of 1977 established regulatory bodies and introduced policies to align with international conventions like UPOV. The public sector dominates seed development, with institutions like the Bangladesh National Agricultural Research System (NARS) leading breeding efforts. However, recent legal interventions, such as the Seed Act of 2018, have been criticized for hindering private sector growth.

**Pakistan:**

Pakistan's Seed Act of 1976, amended in 2015, governs seed certification and quality control. The public sector, led by institutions like the Federal Seed Certification and Registration Department (FSCRD), plays a dominant role in seed development and distribution. Efforts to incentivize private sector participation, such as the Truth in Labeling

Seed Rules (1991), have been made, but challenges remain in attracting multinational companies to the market.

**USA:**

The USA's Federal Seed Act of 1939 ensures truth in labeling for seeds shipped across states. The country has a robust seed certification system overseen by the Association of Official Seed Certifying Agencies (AOSCA). Trade liberalization and intellectual property rights protection have spurred private sector growth, making the USA the largest seed market globally.

**China:**

China's Seed Law of 2000 (2015 revision) is a state-driven law under the Ministry of Agriculture and Rural Affairs, prioritizing rigorous testing and evaluation for quality assurance through the nonprofit organization China National Seed Trade Association (CNSTA) and self-sufficiency in agriculture. While emphasizing local suitability, it has faced challenges such as insufficient intellectual property (IP) protection and flexible enforcement due to vast geographic coverage and diverse farmer concerns. Despite efforts to ensure high standards, the regime has struggled to incentivize private sector innovation due to weak IP protection. Enforcement across diverse regions requires adaptable approaches to accommodate local needs while upholding national standards.

In summary, while each country has its own legal framework for regulating seeds, they face common challenges such as balancing public and private sector involvement, ensuring quality control, and aligning with international standards. Liberalization of trade markets, stringent regulatory regimes, and protection of intellectual property rights are key factors contributing to a vibrant seed industry.

**Comparative Analysis of legal seed regimes and enforcement**

| SNO | Area | Pakistan | Bangladesh | India | USA | china |
|---|---|---|---|---|---|---|
| 1 | Regulations | Seed Act 1976, truth labeling rules 1993, Breeder rights Act 2016 | Seed Act, 1976, Plant variety Protection Act, 2019 | Seed Act 1966, seed policy 1988, 2002 | Federal seed Act 1939 AOSCA standards | Seed law 2000, 2015 |
| 2 | Regulatory bodies | FSCRD,NSC, PARC, PSC | BARI,BADC, NARS | CSCB, NSC | AOSCA | CNSTA |
| 3 | Enforcement | limited & flexible | limited & flexible | Strict | Very strict | Strict |
| 4. | Private sector | Very low | Low | high | Dominant | low |
| 5. | IP Protection | Low | Low | high | Standard | low |
| 6 | Variety Registration | Low | Low | high | Very high | high |
| 7 | Informal seed transaction | Very high | Very high | Moderate | minimum | high |

## *Issues and challenges*

The following issues and challenges were identified during the study:

1. Agriculture is a provincial subject, yet the center is managing the most important input of agriculture.
2. Lengthy and complex procedures for seed certification and registration due to the workload and understaffing at FSC&RD.
3. Poor enforcement of laws and regulations, resulting in the proliferation of substandard seeds. Enforcement of the law is the mandate of FSC&RD, but as a federal body facing understaffing challenges, it has failed to effectively enforce the law.
4. Involvement of private players is minimal due to low incentives.
5. Poor utilization of resources by the agriculture department.
6. Low storage capacity of government god owns.
7. Poor capacity for growing certified seed within the agriculture department.
8. Dependency on companies from other provinces for seed procurement.
9. High volume of informal and traditional seed transactions.
10. Growers are the major stakeholders, yet their participation in the entire system is minimal.

## *Conclusion*

The province of Khyber Pakhtunkhwa has the potential to double its current wheat production yield. However, due to the poor quality of seed, among other factors, the province is unable to meet even the national average for wheat production. According to the analysis conducted, it is evident that the problem lies in management and capacity rather than potential. If the issues and challenges in the supply of quality seed to the growers are addressed, significant benefits can be reaped for the individuals involved, the provincial economy, and the government exchequer. The money saved could be used for other public sector development programs and avenues of economic activity to bring prosperity to the nation. With climate change-related disasters becoming increasingly common in the province, it is high time that the province develops an action plan to secure its food supply by providing climate change-resilient seeds to its farmers, as the seeds of the past are slowly losing their efficacy in the present times.

## *Recommendations*

The following recommendations are hereby made to address the issue:

1. The process of seed certification should be devolved to the province by enacting proper legislation in this regard. The legislation should be framed so that the government's role is limited to regulation, encouraging market forces to play their role.
2. To reduce the lengthy time required for seed certification and registration, provincial seed certification and registration labs should be developed. Furthermore, newer methods of seed certification, such as speed breeding, may be used to reduce time, especially in light of the urgency due to climate change.
3. Enforcement of law is the primary mandate of FSC&RD, but being a federal body facing understaffing challenges, it has failed to effectively enforce the writ of law. The provincial agriculture department's mandate should be enhanced to check the circulation of uncertified seeds, ensuring the supply of certified seeds and

discouraging the tendency to sell uncertified seeds.

4. The private sector is almost non-existent in KP. Tax incentives, along with special protection of their intellectual property rights through strict enforcement of IP laws, are essential to attract private investment.
5. The agriculture department has sufficient resources to make an impact in the current situation, yet due to poor management and lack of monitoring, the situation has not improved. To improve the situation, the best officers should be posted in the agriculture department. There must be a system of checks and balances, and their performance evaluation should be linked to KPIs. Additionally, there must be an incentive for officers working in the agriculture department. The Minister for Food should conduct regular administrative reviews to ensure that things are progressing in the right direction.
6. The major bottleneck in certified seed supply is the poor seed storage capacity of the agriculture department. Currently, the agriculture department can only store 6,000 MT of seed. Therefore, the storage capacity of government godowns must be increased by including this project in the ADP. Moreover, arrangements can be made with farmers to store certified seeds on their farms and supply them to the market on demand.
7. Indigenous production of certified seed should be encouraged to reduce dependency on imports from other provinces. Progressive farmers can be engaged to grow more basic seeds on their land to increase the production of indigenous certified seeds.
8. The private sector should be encouraged to assist the government in bridging the seed deficiency gap.
9. Informal and traditional transactions can only be reduced with the help of education and information. A farmer outreach program should be implemented to educate farmers about the importance of cultivating certified seed. Through media, social media, and mobile apps, farmers can be informed about what type of seed to buy and where to buy it.
10. Grower/farmer participation in the whole system is minimal. With the help of mobile phone applications, farmers can be involved as active and informed stakeholders in the system.

**Pareto Principle:**

The group suggests the following two measures, if implemented as per the provided Logical Framework, could solve 80% of the seed supply challenges of the province:

1. The best officers should be posted in the agriculture department. There must be a system of checks and balances, their performance evaluation should be linked to KPIs, and there must be an incentive for officers working in the agriculture department. The Minister for Food should conduct regular administrative reviews to ensure things are progressing in the right direction.
2. Educating and informing farmers through media, social media, and mobile phone applications.

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