

## Provision of Quality Seeds to Enhance Productivity

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Khyber Pakhtunkhwa (KP) holds significant agricultural potential but faces challenges that hinder its crop productivity and food security, including poor seed quality, lack of investment, mismanagement, and climate change. Low-quality seeds, in particular, contribute to suboptimal crop yields, with the unavailability of quality seeds decreasing agricultural output by 15%-20%. This research identifies the root causes behind the widespread presence of low-quality seeds and proposes actionable solutions to enhance production. By addressing issues in seed certification, management, and infrastructure, KP could significantly improve its agricultural productivity, especially in wheat production. Recommendations include devolving seed certification, enhancing seed storage capacity, promoting private sector involvement, and educating farmers through outreach programs. The study highlights the importance of a comprehensive action plan to secure food supplies, promote climate-resilient seeds, and ultimately drive economic prosperity for KP.

### Key words:

Agricultural potential, seed certification, food security, climate change, crop productivity.

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## *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

SN O	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, P ARC, PSC	BARI, BAD C, NARS	CSCB, NSC	AOSCA	CNST A
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
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### *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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