Provision of Quality Fertilizer to Enhance Productivity

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Abstract:

Fertilizers, derived from natural or synthetic sources, are critical for augmenting soil fertility and enhancing crop productivity by supplying essential nutrients like nitrogen, phosphorus, and potassium. In Pakistan, the fertilizer sector faces multiple challenges, including outdated policies, limited regulation, monopolistic practices, and insufficient coordination between federal and provincial governments. These issues, coupled with fluctuating gas supplies and rising fertilizer costs, hinder the sector's contribution to agricultural growth and economic development. To address these challenges, reforms are essential, including updating the Fertilizer Policy 2001, promoting cost-effective imports, deregulating the sector, and providing targeted subsidies to small farmers. Additionally, adopting advanced fertilization technologies, enhancing soil testing, and improving market transparency through digital solutions can ensure sustainable fertilizer use. Given agriculture's 22% contribution to GDP and its vulnerability to climatic shocks, strengthening the fertilizer sector is crucial for ensuring food security and economic stability in Pakistan.

Key words:

Fertilizer policy, soil fertility, agricultural growth, sustainable practices, Pakistan economy

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Introduction

Fertilizers are any material of natural or synthetic origin that is applied to soil or plant tissue to supply plant nutrients and contain chemical elements that improve the growth and productivity of plants. Fertilizers augment the natural fertility of the soil. In total, plants require 16 different elements as nutrients, including carbon, nitrogen, potassium, phosphorus, magnesium, and calcium. The absence or decreased supply of any of these nutrients negatively affects plant growth. Conversely, excessive amounts of these nutrients cause imbalances and hence decrease crop yield. Modern fertilizer technology involves estimating crop nutrient needs and diagnosing soil nutrient deficiencies. Soil fertility is imperative in determining the type of fertilizer required to increase crop yield. Different types of diseases in plants and crops, like chlorosis (a general pale yellow color indicating a deficiency of sulfur and nitrogen), occur due to a deficiency of essential nutrients.

Many resources for fertilizers exist, including natural and industrially produced ones. Modern agriculture relies on three main macronutrients as integral parts of effective fertilizers: (a) nitrogen (N), (b) phosphorus (P), and (c) potassium (K), which are applied by farmers through dry, pelletized, or liquid application processes, either manually or using agricultural equipment.[7] Natural fertilizers have historically been derived from organic sources like compost, animal manure, and human manure. Manure needs to be stored carefully to minimize nutrient loss and must be applied to the appropriate crop at the proper time, with a suitable combination, such as phosphorus, to maximize the benefits of nitrogen and potassium, which are natural components of manure. Synthetic phosphorus fertilizers, such as calcium phosphate derived from phosphate rock, include more soluble compounds like superphosphate and triple superphosphate preparations. Synthetic potassium fertilizers, namely potassium chloride and potassium sulfate, are obtained from potash mineral deposits. Commercially available mixed synthetic fertilizers contain a combination of more than one of the three basic nutrients[8].

Fertilizers – National Economy: Overall, in GDP, the agriculture sector contributes 22%, the manufacturing industry 13%, and the services sector 52%. Fertilizers contribute 3.9% to the overall GDP, ensuring the growth of the agricultural sector[9]. However, in the last couple of years, the country has experienced climatic shocks that have adversely affected agriculture. This sector's productivity is highly sensitive to the frequency of adverse climatic events such as floods and droughts, along with abnormal heat waves, rain,

[7] Mubrak Ali, F. A. (2015). Ag Econ Research in Agriculture & Applied Economics

[8] **https://www.britannica.com/topic/fertilizer**

[9] Pakistan Bureau of Statistics

and glacial melt. More severely, prolonged precipitation patterns increase river and inland water levels, resulting in flash and seasonal river and urban flooding, commonly experienced in the recent past. Thus, flood hazards remain highly susceptible to other climatic factors, significantly affecting the socio-economic and politico-cultural domains and ultimately impacting fertilizer consumption.

Problem Statement

The inadequate provision of quality and balanced fertilizers to farmers remains a significant challenge hindering agricultural productivity, prompting inquiries into the efficacy of current policy, legal, and institutional frameworks governing demand, supply, and pricing mechanisms. Moreover, an introspective analysis is required to explain the relationship between financial incentives provided to the fertilizer industry and the intended relief for farmers. This research aims to conduct a critical analysis of the principal mechanisms controlling the provision of quality fertilizers to farmers and to suggest practical policy interventions to mitigate the hindrances in fertilizer supply, ensuring agricultural productivity and ultimately contributing to solving the problem of food security in Pakistan.

Scope of the Study

- To critically examine the existing policy, legal, and institutional frameworks governing the demand, supply, and pricing mechanisms of fertilizers in Pakistan.
- To evaluate the competitiveness and incentives offered to the fertilizer industry, as enshrined in the Fertilizer Policy 2001, and to assess the intended benefits for farmers.
- To suggest practical policy interventions to ensure the provision of balanced and quality fertilizers, mitigate hindrances in fertilizer supply, enhance productivity, and ultimately contribute to solving the problem of food security in Pakistan.

Primary Data

Primary data sources were obtained through three main channels: Google Forms, Zoom meetings, and personal interviews with fertilizer dealers. Google Forms were employed to collect structured data from a range of participants, allowing for the efficient gathering of quantitative information on various aspects of the research topic. Additionally, Zoom meetings were utilized as a platform for conducting in-depth interviews and focus group discussions, enabling the collection of qualitative insights and perspectives from key stakeholders. By utilizing these three data collection methods, we

were able to triangulate our findings, enhancing the validity and reliability of our research outcomes.

i. Perception survey (Farmers' feedback)
ii. Zoom Meetings
iii. Personnel meeting with Fertilizers Dealers

Perception survey

Data gathered via Google Forms revealed pertinent insights into the challenges and perceptions surrounding fertilizer provision. The responses showed that a majority—80.8% of participants—identified "availability" and "overpricing" as the primary concerns, while 19.2% cited "overpricing" alone as an issue. Moreover, all 26 respondents confirmed not receiving fertilizers from dealers at government-notified prices. Additionally, a substantial portion (69.2%) reported experiencing delays in obtaining fertilizers from dealers within the stipulated period. When evaluating satisfaction levels with fertilizer outcomes on crop production, 46.2% expressed dissatisfaction, while 53.8% reported satisfaction. Regarding awareness of government initiatives such as the Khad Hisab app and soil testing by the agriculture department, 46.2% stated they were uninformed, highlighting potential gaps in disseminating critical agricultural information. These findings underscore the need to address issues related to availability, pricing, and timeliness of delivery, as well as to enhance awareness of government resources among stakeholders to optimize fertilizer utilization and improve agricultural productivity.

Zoom and telephonic interviews

Zoom meetings and telephone interviews were conducted with the Additional Secretary/Director General of Agriculture in Punjab, the Secretary of Agriculture in Khyber Pakhtunkhwa (KP), the former Secretary of Agriculture in KP, and the Principal Secretary to the Chief Minister of KP. The discussions focused on the existing policy, legal, and institutional frameworks aimed at ensuring a steady supply of fertilizers, the reasons behind the decreased fertilizer supply in Pakistan from 2022 to 2023, the government's efforts to raise farmers' awareness of the balanced use of fertilizers, the challenges faced by farmers in obtaining quality fertilizers, and the role of the private sector (manufacturers and dealers) in ensuring fertilizers are readily available to farmers. Stakeholders reached a consensus that the current policy framework for guaranteeing fertilizer supply is inadequate, with issues such as gas shortages and excessive federal government control contributing to the decrease in supply. It was noted that government entities have introduced various initiatives to enhance the fertilizer sector using IT-based apps but have struggled to regulate the monopolistic demand-supply chain for fertilizers.

Personal interactions with Fertilizers Dealers

Based on a survey carried out in different areas of Peshawar with major fertilizer dealers, it was revealed that 60% of dealers said they receive stock based on demand from fertilizer companies. All dealers mentioned that the

agriculture department conducts random testing of fertilizer samples provided by manufacturers.

Sixty percent of dealers stated that they do not receive fertilizers at government-notified rates. Seventy percent of dealers believe that the government subsidy for fertilizers does not benefit farmers. When asked about the government's price regulation mechanism for fertilizers, 60% of dealers stated that meetings are held with local administration, the agriculture department, fertilizer associations, and random inspections are conducted by relevant government departments. These findings underscore the dire need to address issues related to availability, pricing, subsidy distribution to farmers, and enhancing awareness of government resources among stakeholders to optimize fertilizer utilization and improve agricultural productivity.

Literature Review

Pakistan Economic Survey: The Pakistan Economic Survey provides valuable insights into the country's fertilizer industry, which plays a crucial role in the agricultural sector. The survey highlights the importance of fertilizer in increasing crop productivity and improving soil fertility. It also discusses the challenges faced by the industry, such as rising input costs and fluctuating international prices of raw materials. The survey emphasizes the need for policy interventions to promote sustainable fertilizer use and ensure food security in Pakistan. Overall, the Pakistan Economic Survey sheds light on the significance of the fertilizer sector in driving economic growth and development in the country.

National Fertilizer Development Center: The National Fertilizer Development Center (NFDC) in Pakistan is a key institution responsible for promoting and developing the fertilizer industry in the country. The center plays a vital role in conducting research, providing technical assistance, and implementing policies to enhance the efficiency and sustainability of the fertilizer sector. NFDC's initiatives focus on improving fertilizer production, distribution, and usage practices to support the agricultural sector and ensure food security. The center also collaborates with government agencies, industry stakeholders, and international organizations to address challenges and opportunities in the fertilizer industry. Overall, NFDC's efforts contribute significantly to the growth and development of Pakistan's agricultural sector and economy.

Critical Analysis

Policy / Legal / Institutional Framework

The agriculture sector's sustainable growth is vital for Pakistan's food security and rural development, serving as a major source of employment and foreign exchange earnings.

Contributing 22.7 percent to GDP and employing 37.4 percent of the labor force, it plays a crucial role in protecting the environment and enhancing production systems to boost farm income, lower consumer prices, and diversify food supplies for a potential export surplus.

Federal: Currently, the Fertilizer Policy 2001 is the principal document regulating government investments in the fertilizer industry, as well as the import and local manufacture of fertilizers in Pakistan. It encourages both new and existing investors in the fertilizer industry on an equal basis to enhance local production. Various types of concessions are provided, such as discounts on fuel gas prices, duty-free imports of rock phosphates, and duty-free imports of raw materials required for NPK production. The concessions also include exemptions on the import and local manufacture of equipment and machinery for new fertilizer plants. However, the selling price of fertilizers remains deregulated, allowing free market forces to operate and determine fertilizer prices (Economic Survey of Pakistan, 2022-23). The Fertilizer Policy 2001 was initially implemented through the Ministry of Food and Livestock, Government of Pakistan. However, after the 18th amendment and the devolution of agriculture to the provinces, it is now being implemented through the Ministry of Industries and Production. The Fertilizer Review Committee, chaired by the Secretary of the Ministry of Industries and Production, with Provincial Agricultural Secretaries as its members, coordinates issues such as the fixation of gas prices for the fertilizer industry and the provision of data to the National Fertilizer Development Centre (NFDC). The Government of Pakistan (Planning & Development Division) established the National Fertilizer Development Centre (NFDC) in 1977. It is a multi-disciplinary research and development organization operating under the administrative control of the Ministry of National Food Security and Research. NFDC coordinates various disciplines, such as economic planning, pricing and subsidies, privatization and deregulation, manufacturing, and exports, based on data from the concerned stakeholders. It advises the government at all levels and the fertilizer industry on the latest research studies to enhance and ensure sustainable agricultural growth. The National Fertilizer Corporation of Pakistan (Pvt Ltd), a state-owned enterprise established in 1973, is responsible for ensuring the availability of fertilizers throughout the country. It also maintains an adequate stock of fertilizers to overcome artificial shortages and carries out research and development activities. To fill the supply and demand gap for fertilizers, the Trading Corporation of Pakistan (TCP) imports urea. After the successful privatization of all NFC production plants in 2008, National Fertilizer Marketing Limited (NFML), another state-owned enterprise (established in 1976), has been assigned the role of supplying imported urea across the country at a uniform price. NFML operates six main warehouses across the country to store bulk imports of fertilizers, ensuring their availability to farmers.

On the R&D side, the Pakistan Agricultural Research Council (PARC), in collaboration with USAID, is implementing a Rs. 4.5 million project to enhance fertilizer efficiencies, called the "Fertilizer Right Project." Similarly, the National Fertilizer Corporation Institute of Engineering & Technology in Multan and Faisalabad is also conducting research in the field of fertilizers.

Provinces: At the provincial level, after the devolution of agriculture through the 18th Amendment, the Secretary of the Agriculture Department, assisted by the Director General and divisional directors along with deputy directors at the divisional and district levels, constitute the organizational framework. In Punjab, fertilizer dealers are not registered with the provincial agriculture department; however, in other provinces, dealers are duly registered. The provincial agriculture department collects fertilizer samples from the market for testing to ensure quality. The Punjab Essential Articles Control Act of 1973, along with the Punjab Fertilizer Control Order of 1973, the Profiteering and Hoarding Act, and the Price Control Act, form the legal framework to ensure supply, uniform pricing, and to prevent hoarding or overpricing of fertilizers. The Provincial Essential Commodity Act (PECA) places fertilizer production and marketing under the direct regulatory purview of the federal government. At the provincial level, the Punjab Fertilizer (Control) Order of 1973 further strengthens the power of federal regulators by making provincial management of fertilizer subservient to PECA. In Khyber Pakhtunkhwa (KP), the Farm Services Act of 2012 is in effect, where a management committee of farmers, assisted by the Agriculture Officer of the Agriculture Department, ensures dealers' prices are passed on to the farmers.

Critical Analysis of Policy/Legal/ Institutional Framework (Focus on stakeholders' involvement and Implementation)

i. Lack of competition / monopoly in the manufacturing sector (PACRA, 2022)
ii. Dominating role of the federal government with no role for provinces in the distribution to dealers and then farmers after the 18th Amendment (Marwat, 2024)
iii. No provincial quota based on need – direct distribution to dealers (Chattha, 2024).
iv. Pilferage or leakage in the supply of fertilizers (industrial usage) from main depots to dealers (Israr, 2024)
v. Overpricing, hoarding, and profiteering by dealers and manufacturers – black market for fertilizers (Marwat, 2024)
vi. Depleting gas reserves of the country
vii. Lack of effective and standardized price fixation mechanisms – currently, free market forces largely determine supply, influenced by big manufacturers
viii. Economic condition of farmers – affordability issues for poor farmers exacerbated by price hikes and shortages

ix. Lack of registration of dealers with the agriculture department in Punjab (no effective tracking of fertilizer distribution) – potential for hoarding[10]

The following legal and policy framework for fertilizer supply and demand is under implementation:

i. Punjab Essential Articles (Control) Act ,1973
ii. Punjab Fertilizers (Control) Order,1973
iii. Price Control and Prevention of Profiteering and Hoarding Act, 1977
iv. Fertilizer Policy 2001
v. Khyber Pakhtunkhwa Horticulture Policy 2010
vi. Khyber Pakhtunkhwa Farm Services Act, 2012
vii. Khyber Pakhtunkhwa Agriculture Policy 2015-25

Situational Analysis of current mechanisms of Fertilizers demand and supply

The demand for fertilizers is primarily driven by the agricultural sector, which is a significant contributor to the country's economy. It is influenced by factors such as crop prices, government policies, weather conditions, and technological advancements. Farmers' purchasing power, access to credit facilities, and the availability of subsidies also play a crucial role in determining fertilizer demand. On the supply side, the availability of fertilizers in Pakistan is influenced by factors such as production capacity, imports, distribution networks, transportation infrastructure, and government regulations. Fertilizer manufacturers play a key role in ensuring a steady supply to meet the demand from farmers. The government of Pakistan plays a significant role in regulating the fertilizer industry through policies related to pricing, subsidies, import/export regulations, and quality control measures.

Demand is identified through farmers to fertilizer dealers, and then the manufacturing industry produces fertilizers according to this demand. Major manufacturers in Pakistan include FFC, Fatima Fertilizers, Pak Arab Fertilizers, FF Bin Qasim, and ENGRO. The major government institutions that regulate them are TCP, NFML, and NFDC, with overall governance by the Ministry of Industries and Production.

Currently, domestically produced supply is marketed by private sector processing companies through their registered dealer networks (Ali et al., 2015). Typically, fertilizer manufacturers supply products to dealers with a recommended maximum price, which includes the dealer's profit margin.

[10] Pakistan Economic Survey 2022-23

Dealers procure fertilizer stocks usually on a cash basis, but sometimes against a bank guarantee, and sell the product through their sales agent networks at prices determined by the supply and demand situation. The existence of a competitive market is, however, subject to government intervention, which is sometimes ad-hoc and sometimes more structural. For example, during periods of short supply, according to interviewed dealers, the DCs call a meeting of all fertilizer dealers in a district to agree upon a price, even though deviations from this set price became the norm. More broadly, regulators have almost never been able to smooth out the supply or keep prices at reasonable levels whenever shortages have occurred, despite the authority vested in regulators, mainly due to mismanagement of imports controlled by NFML (Nadeem Tariq, pers. comm.).

In Pakistan, the agriculture sector relies on domestic production for 86% of its fertilizer needs, importing the remaining 14%. Despite a slight decrease in fertilizer imports, overall availability increased marginally by 0.5% in FY2022. Urea off-take remained steady, but DAP off-take decreased due to high international prices. To alleviate this, the government subsidized DAP by Rs 1,000 per bag. Looking ahead, Kharif 2022 is projected to have 3,508 thousand tonnes of urea available, with an expected off-take of 3,364 thousand tonnes. Similarly, DAP availability is estimated at 705 thousand tonnes, against an expected off-take of 907 thousand tonnes, with the shortfall to be met through private sector imports.[11]

- **Production**: Pakistan's average fertilizer production (2019-22) was 8.8 million MT, with a 3% increase in 2022.
- **Imports**: The average fertilizer imports (2019-22) were 1.7 million MT, with a 23% decline in 2022 (due to price hikes, local currency devaluation, and lower DAP off-take in 2022).
- **Off-Take**: The average fertilizer off-take (2019-22) was 10.4 million MT, with a 1% increase in 2022 (due to floods and high international DAP prices)[12].

Fertilizers Consumption Provinces - Urea Up-take (2022-23)

- Urea uptake remained at 67.7% in Punjab, 24.4% in Sindh, 4.4% in KP, and 3.5% in Balochistan.
- During Kharif 2022, the total urea availability was 3,460 thousand tonnes (3,158 thousand tonnes of domestic production and 103 thousand tonnes of imports).
- The total urea uptake was about 3,137 thousand tonnes, leaving an inventory of 294 thousand tonnes for Rabi 2022-23.

[11] Economic Survey of Pakistan, 2023

[12] National Fertilizers Development Center

Situation analysis of fertilizers demand and supply in Pakistan

- Agriculture sector relies on domestic production for 86% of its fertilizer needs, importing the remaining 14%.
- Overall domestic production of fertilizers during Jul-Mar FY2023 decreased by 8.3% over the same period of FY2022.
- Import of fertilizer also decreased by 26.2%, therefore, total availability of fertilizer decreased by 11.2% during Jul-Mar FY2023. Total offtake of fertilizer nutrient witnessed decrease by 15%.[13]
- **Production:** The average fertilizer production in Pakistan (2019-22) was 8.8 million MT, with a 3% increase in 2022.
- **Imports:** The average fertilizer imports (2019-22) were 1.7 million MT, with a 23% decline in 2022 due to price hikes, local currency devaluation, and lower DAP off-take in 2022.
- Off-Take: The average fertilizer off-take (2019-22) was 10.4 million MT, with a 1% increase in 2022 due to floods and high international DAP prices.
- During Kharif 2022, the total urea availability was 3,460 thousand tonnes (3,158 thousand tonnes of domestic production and 103 thousand tonnes of imports).
- The total urea uptake was about 3,137 thousand tonnes, leaving an inventory of 294 thousand tonnes for Rabi 2022-23.[14]

Current Relevance (Imports allowed, Gas subsidies withdrawn)

The Government of Pakistan has finalized an agreement with private fertilizer manufacturers for the sale of 220,000 metric tons of urea fertilizer worth $100 million, imported from Azerbaijan. The agreements also stipulate that the private manufacturing companies will implement basket pricing, whereby the price of imported urea and locally manufactured urea will be combined to determine a single price for sale. After completing this process, the urea shortage in the country will end. Sources indicate that the price of urea per sack will increase by Rs200 through private distribution, while the price of locally produced urea will also be aligned with it. According to sources, each manufacturer will determine the price independently, but a bag of urea will be available to farmers for Rs3,800 to Rs4,000 (The News, February 14, 2024).

According to the Prime Minister's Office (PMO), the cabinet meeting, chaired by caretaker Prime Minister Anwaarul Haq Kakar, approved all decisions of the Economic Coordination Committee of the Cabinet, including the decision to increase gas tariffs.

[13] National Fertilizers Development Center
[14] Pakistan Economic Survey 2022-23

Later, the Petroleum Division issued a notification regarding the increase in gas prices, and the government met the deadline set by the International Monetary Fund (IMF) to share the notification before February 15. The notification stated that the gas tariff for Engro Fertilizers Company Limited and Fauji Fertilizers Bin Qasim Limited Karachi has been increased by 715 percent (DAWN, February 16, 2024).

Realistic / Idealistic Objectives

- **Intention of Policy (Idealistic Perspective):** Free market forces are intended to determine fertilizer prices as per the policy, with incentives for the manufacturing sector at the cost of farmers (Monopoly or Oligopolistic market).
- Fertilizer Policy 2001 allows gas at concessionary rates for a period of 20 years, ending in July 2021.
- Five players occupy 95% of the market (FFC, FFBL, Engro, and Fatima Group).[15]
- The fertilizer sector is charged a GIDC of PKR 300/mmbtu (feed gas) and PKR 150/mmbtu for fuel gas as per Fertilizer Policy 2001.
- A Supreme Court decision in 2022 ordered the recovery of PKR 453 billion as arrears of GIDC from defaulters in the fertilizer sector (Express Tribune, September 25, 2022).

- **Output of Policy (Realistic Perspective):** Allowing imports of fertilizers (Torkham carriage) from CARs (Khan, 2024).
- Imported LNG to meet urea demand.
- Gas tariff for the fertilizer industry.
- Gradual removal of subsidies for the fertilizer industry (Chattha, 2024).
- Regulation of prices to prevent overpricing, hoarding, and monopoly in the manufacturing sector (Pricing to be on the agenda of FRC).
- Direct/targeted subsidies for poor/smaller farmers (Marwat, 2024).

Future Oriented Aspects

- Updating the Fertilizer Policy, 2001.
- Fertilizer distribution: Addressing the current needs of provinces and benefiting farmers.
- The need to adopt the latest technology and practices.
- Dwindling gas reserves of the country (imported LNG to meet urea demand or allowing cost-effective imports).
- Food security: An important future aspect of national security.

Impact Assessment Analysis

- The Russian–Ukraine conflict and Chinese export restrictions increased international DAP prices by 192% in 2022, forcing farmers to substitute DAP with other options (Source: World Bank).

[15] PACRA, 2022

- Decreased access inhibits productivity and poses a risk to food security.
- The presence of heavy metals (carcinogenic) and chemicals like benzene, xylene, etc., has harmful human and environmental effects.
- Depleting gas reserves present an energy crisis, which will ultimately reduce input to the fertilizer industry and may precipitate a natural food crisis[16].

Stakeholders Analysis – Provision of Fertilizer to Farmer

Keep Satisfied

- Big manufacturers of the fertilizer industry
- Fertilizer Dealers

Manage Closely

- Government Departments
- Ministries like MoIP, MoFS, TCP, NFML, regulatory bodies like NFDC, and the Fertilizer Review Committee
- Provincial governments (Agriculture departments)
- District governments/DCs

Monitor

- Farmers' Association

Keep Informed

- NGOs like BaKhabar Kissan (BKK), media
- Researchers, academia, and technology developers
- Environmentalists and food strategists

SWOT -1 (Govt. of Pakistan)

Strengths:

- Subsidies to the fertilizer industry
- Subsidies to farmers
- Strong dealership and distribution network
- Public-private partnership in fertilizer manufacturing

Weaknesses:

- Supply chain issues
- Inefficiencies in the implementation of policies related to fertilizers
- Lack of awareness among farmers
- GIDC challenge
- Devaluation of the PKR currency

Opportunities:

- R&D
- Technology adoption like digital solutions (Apps, Social & Electronic media for Farmers awareness, Soil Fertility)

Threats:

[16] (https://jnasp.kinnaird.edu.pk/wp-content/uploads/2022/07/2.-Noor-Ul-Huda-JNASP-850-859.pdf)

- Global price fluctuations
- Climate change and safety issues
- Depleting gas reserves

SWOT - 2 (Farmers)

Strengths:
- Availability of land and raw materials
- Low-cost skilled and unskilled labor
- Adaptability to changing environmental adversities, such as floods
- Valuable traditional knowledge and practices

Weaknesses:
- Overdependence on chemical fertilizers causing soil degradation and reduced soil fertility
- High fertilizer prices, leading to affordability issues for small farmers
- Lack of awareness about the right fertilizer for the right crop in the right dose at the right time (4Rs)

Opportunities:
- Adoption of modern technology, such as precision farming, mobile apps for market information, and drip irrigation to reduce fertilizer costs
- Direct incentives to farmers instead of fertilizers industries

Threats:
- Global price fluctuations (fuel and fertilizer prices)
- Climate change and safety issues for farmers

SWOT - 3 (Manufacturing Sector)

Strengths:
- Monopolistic or oligopolistic dominance
- Strong government support
- Influence over policies and prices

Weaknesses:
- Energy dependence
- Dependence on imported raw materials, such as potash

Opportunities:
- Exploring technology upgrades
- Investment in diversifying products according to crop and soil types (new/low-emission fertilizer mixes)

Threats:
- Depleting gas reserves in the country
- Environmental regulations disrupting the market

PESTLE

Political: Government policies, regulations, and subsidies play a significant role in the fertilizer industry in Pakistan. Political stability and relations with other countries can also impact the import and export of fertilizers.
Economic: Economic conditions, such as inflation rates, exchange rates, and GDP growth, can affect the affordability and demand for fertilizers in Pakistan. The availability of credit facilities for farmers and overall market conditions also influence the industry.
Social: Factors like population growth, changing dietary preferences, and awareness of sustainable agriculture practices can impact the demand for fertilizers in Pakistan. Social trends and cultural practices related to farming also play a role.
Technological: Advancements in technology, such as innovative fertilizers, precision agriculture techniques, and digital tools for farming, can drive efficiency and productivity in the fertilizer industry in Pakistan.
Legal: Compliance with government regulations, quality standards, and environmental laws is crucial in the fertilizer industry. Legal frameworks related to land ownership, water usage, and chemical usage also affect the industry.
Environmental: Environmental concerns, such as water pollution, soil degradation, and climate change, influence the adoption of sustainable and eco-friendly fertilizer practices in Pakistan. Compliance with safety and health regulations is also a concern.

SOAR Analysis

Strengths:

- Pakistan's strategic location, agricultural potential, government support, skilled workforce, technical expertise of the manufacturing sector, a strong distribution network, and strong government support to the fertilizer and farming sectors.

Opportunities:

- Leveraging R&D/technology like precision agriculture, digital farming tools, and smart fertilization. • Embracing sustainable and environmentally friendly agricultural practices, new fertilizer formulations, and crop-specific solutions.

Aspirations:

- Leading the global fertilizer market, providing affordable and effective fertilizers to enhance crop yields, ensuring food security, environmental sustainability, and economic growth. • Collaboration and partnership with stakeholders, including international organizations, provinces, farmers, and the manufacturing sector, to boost exports.

Results:

- Increased market share and profitability, enhanced food security and agricultural productivity, and improved efficiency and sustainability in fertilizer production and application.

GAP Analysis

Desired State:

- Removing gas and other subsidies and encouraging a competitive market.
- Fertilizer sector – practical deregulation and devolution to the provinces.
- The standard price fixation mechanism should be part of the FRC agenda.
- More direct incentives should be provided to small farmers instead of large incentives to the manufacturing sector.

Current State:

- Monopoly of major manufacturers
- Dominant role of the Federal Government
- Depleting gas reserves in the country
- Overpricing, hoarding, and profiteering by dealers and manufacturers
- Economic condition of farmers – affordability issues for poor farmers

Analyzing the Gaps:

- Limited adoption of advanced technologies, such as precision tools and digital farming solutions, in the fertilizer sector.
- Challenges in ensuring the availability of affordable and high-quality fertilizers at subsidized rates for smallholder farmers.
- Environmental concerns related to fertilizer use, such as nutrient runoff, soil degradation, and water pollution, need to be addressed through sustainable practices[17].
- Action plans, such as removing gas and other subsidies, deregulation, standard price fixation mechanisms, R&D adoption, and direct incentives, will reduce the gap and help achieve the desired state of balanced and quality fertilizer provision.

Economic and Financial Analysis

[17]https://divercitytimes.com/commodity/dap#:~:text=DAP%20Price%20Annual%20World%20Bank,estimated%20by%20the%20world%20bank.&text=In%20the%20previous%20year%2C%202022,%2D40.38%25%20decrease%20in%20price. https://economictimes.indiatimes.com/industry/indl-goods/svs/chem-/-fertilisers/rise-in-global-prices-of-dap-fertilisers-affecting-viability-may-need-higher-subsidy-or-mrp-fai/articleshow/105756497.cms?from=mdr

- The cost/price breakdown shows that the largest contributor to the industry's direct cost is raw material, and fertilizer manufacturing costs depend on gas prices and taxes. Market analysis shows that FFC leads production and off-take in the market. Moreover, FFBL is the only local producer of DAP. Urea accounts for 75% of the country's fertilizer production, approximately 36% in the last five years (CY17-21).
- During the 9MCY22, the sector's gross margins declined to approximately 33%.
- Increase in the cost of imported raw materials (global political and trade factors, local currency devaluation).
- Cessation of 10-year concessional gas tariff rate agreements between the Government of Pakistan and ENGRO and Fatima Fertilizer increased feedstock rates for these two large sector players.
- Kissan Package in 2023: A special subsidized financing facility by the Government of Pakistan for farmers impacted by the floods in 2022.
- Financing facility of up to PKR 200,000 offered to small, landless farmers/tenants in flood-affected areas cultivating 5 acres of irrigated land or 10 acres of rain-fed land.
- Financing facility of up to PKR 500,000 offered to all landholding and new small farmers.
- Domestic banks provided PKR 1.78 trillion to farmers during 2023.
- A 25% increase compared to loans extended in 2022.

Financial Impact Analysis

- The price of locally produced DAP in Pakistan is PKR 12,815 (Peshawar market).
- The average world price of DAP (FOB) is 595 USD/MT, which is PKR 9,165 per 50 kg bag (conversion rate: 1 USD = 279 PKR).
- In India, the DAP price is 1,359 Indian Rupees per 50 kg bag (or 4,550 PKR per 50 kg; 1 Indian Rupee = 3.37 PKR).
- Deductions: The DAP price in Pakistan compared to the global fertilizer market and Indian market is very high, indicating the need for incentivizing local farmers in Pakistan[18].

[18] SOURCE: PACRA and NFDC

Perform a comparative analysis involving two developed and two developing countries. Fertilizer producing countries.

Comparative Analysis (2 Developed Countries)

Russia:

- The largest fertilizer-producing country in the world (sales of 20.65 billion USD in 2022).
- The Russian invasion of Ukraine exacerbated fertilizer prices, which affected fertilizer trade due to trade restrictions.
- Fertilizer prices have returned to levels prior to the invasion.
- Reasons for success include Russia's abundant reserves of key materials used in fertilizer production, such as natural gas, phosphate rock, and potash, as well as strong infrastructure for fertilizer production and transportation (providing a competitive advantage in the global fertilizer market).

Canada:

- The second-largest fertilizer-producing country globally (sales of 13.73 billion USD in 2022).
- Canada provides 12% of the world's fertilizer.
- Fertilizer is manufactured in Western Canada and safely transported to domestic, U.S., and international markets via rail, truck, or sail routes.
- 95% of Canadian potash is exported internationally.
- 45% of nitrogen products are shipped to the U.S.

Comparative Analysis (2 Developing Countries)-

India:

- Exports of fertilizers by India were 130.43 million USD in 2022, compared to 2.56 million USD in 1999.
- Reasons include large domestic production due to abundant natural gas and rock phosphate, as well as subsidies on fertilizer prices.
- Competitive advantages also include proximity to key markets in Asia and Africa, along with competitive prices.

Bangladesh:

- The annual demand for fertilizers in Bangladesh is 6 million MT.
- 80% of the demand is met through imports.
- Bangladesh's fertilizer imports in 2021 were $1.7 billion.
- It is the 12th biggest global fertilizer importer.

Address technological challenges related to implementation

Application of traditional agricultural technology:

The term technology refers to the application of knowledge and tools accurately to achieve desired goals and economic objectives.

In this context, the desired goal is the achievement of enhanced agricultural productivity, which requires the application of innovative and modern agricultural technology. In Pakistan, the majority of farmers use traditional agricultural technology, which results in low land productivity.

Lack of awareness and poverty of farmers:

Lack of awareness and poverty prevent farmers from understanding modern agricultural technology that can increase land productivity. Poverty also hinders farmers' access to modern technology. Small landholdings are another significant impediment to the adoption of modern technology.

Examine administrative and human resources issues pertaining to implementation

The agricultural sector in KP often receives limited budget allocations, which can constrain the implementation of agricultural programs and projects. Insufficient funding may hinder efforts to invest in infrastructure development, research and development, extension services, and capacity building.

Many areas in KP lack basic agricultural infrastructure, such as irrigation systems, roads, storage facilities, and market access points. The inadequate infrastructure can impede the timely delivery of agricultural inputs, hinder market access for farmers, and increase post-harvest losses.

Access to modern agricultural technologies, machinery, and inputs may be limited in many rural areas of KP. Providing farmers with access to improved seeds, fertilizers, pesticides, and farm machinery can enhance productivity and efficiency. However, technological adoption may be hindered by factors such as affordability, awareness, and infrastructure constraints. Effective coordination and collaboration among various government departments, research institutions, non-governmental organizations (NGOs), and other stakeholders are essential for the successful implementation of agricultural initiatives. Ensuring coherence in policies, programs, and resource allocation can optimize efforts and minimize duplication of activities.

Cause-Effect Analysis

Based on the above discussion, the following are the main causes of impaired supply of quality fertilizer and low production:

i. Outdated fertilizer policy of 2001
ii. Monopoly of the manufacturing sector
iii. Lack of technology adoption / R&D
iv. Price and market dynamics
v. Safety and quality issues
vi. Lack of effective coordination among stakeholders

Identification of Issues and Challenges

Political Stability

1. Outdated Fertilizer Policy of 2001
2. Overarching role/control of the Federal Government in regulating the fertilizer industry and lack of effective devolution of the subject despite the 18th amendment
3. Huge subsidies to the manufacturing sector at the cost of farmers, with no effective enforcement mechanisms and no direct benefit to farmers
4. Lack of effective coordination between the federation and provinces on key issues
5. Lack of effective and standardized price fixation mechanisms and implementation—currently, free market forces determine prices, influenced by big manufacturers
6. Overpricing, hoarding, and profiteering by dealers and manufacturers—black market of fertilizers
7. Lack of effective mechanisms for the equitable distribution of fertilizers in provinces on a need basis—currently, it is market-driven
8. Quality issues with fertilizers
9. Imbalanced use of fertilizers
10. Cross-border smuggling of fertilizers
11. Dwindling and depleting gas reserves in the country
12. Environmental effects of fertilizers
13. Occupational hazards and safety issues for workers in the fertilizer industry
14. Lack of effective and coordinated awareness mechanisms for farmers
15. Lack of effective and directed/targeted subsidies for farmers
16. No registration of dealers in Punjab (litigation in LHC - struck down by the court on technical issues)
17. Pilferage in the supply of fertilizers from manufacturers to the market (lamination industry, etc.)
18. Lack of R&D for the manufacture of low-cost, low-emission, high-output fertilizers (8% of the total budget allocation of the Agriculture Department, KP)
19. Complex price dynamics in the international market (dollar parity, international trade aberrations, e.g., Russia–Ukraine conflict, ban on exports by China)
20. Monopoly of a few manufacturing companies with no effective competition due to huge incentivization by the Federal Government

Two International best practices

Prescription Fertilization Mapping

- Commonly used in the United States, Canada, Australia, Brazil, and EU countries

- Use of technology such as GPS, GIS, remote sensing, and sensors mounted on tractors or drones (for measuring soil properties like pH, nutrients, and chlorophyll)
- It involves steps such as data collection, data analysis, map creation, prescription development, and equipment integration

Nano-Technology in Fertilizers

- Use of nanoparticles and materials to enhance the efficiency and effectiveness of nutrient delivery to plants
- The US is a leader in nanotechnology R&D
- It involves techniques like nano-coating, nano-sensors, and nutrient delivery systems
- Future prospects

Operational Plan (Practical and Sustainable – 5 Years Plan)

Year 1 (Measure and strategize)

- Removal of gas subsidies from the industrial sector and provision of LNG
- Allow the import of high-quality fertilizers through economic carriageways to meet demand
- Amendments to the Fertilizer Policy of 2001 to ensure enhanced/direct credits to small farmers

Year 2 (Infrastructure Development)

- Stakeholders' consultation
- Devolving and deregulating the fertilizer sector to provinces
- Opening the market
- Expanding the subsidies program to increase the farmer base

Year 3 (Product Diversification)

- Explore product diversification—special fertilizers
- Impact analysis of subsidy programs and review/improvement

Year 4 (Self-sustenance)

- Gradual removal of subsidies from the farming sector after the financial stabilization of local farmers
- Explore opportunities for vertical integration, such as partnering with related stakeholders to enhance competitiveness

Year 5 (M&E)

- Comprehensive review of the overall performance of the fertilizer sector to assess achievements
- Make necessary adjustments to the operational plan

Conclusion

i. The challenges faced by the fertilizer sector in Pakistan require urgent attention to ensure sustainable agricultural practices and support for farmers.
ii. Issues such as outdated policies, lack of effective regulation, inadequate coordination between federal and provincial authorities, and the monopoly of a few manufacturing companies hinder the availability of fertilizer at economical rates.
iii. The absence of fair pricing mechanisms, quality control, equitable distribution, targeted subsidies for farmers, and the lack of technology adoption are negatively affecting agricultural output.
iv. Keeping in view futuristic aspects like dwindling gas reserves, the Fertilizer Policy of 2001 needs to be updated, allowing cost-effective imports, more direct subsidies to farmers, and practical devolution of the fertilizer sector to provinces. Deregulation is also required.

Recommendations

1. Removal of gas subsidies from the industrial sector and provision of LNG (fuel and feed supply)—allow an open market and free competition to end the monopoly.
2. Allow the import of high-quality fertilizers through economic carriageways to meet demand.
3. Standard price fixation mechanism—on the agenda of FRC.
4. Amendments to the Fertilizer Policy of 2001 to ensure enhanced/direct credits to small farmers.
5. Devolving and deregulating the fertilizer sector to provinces (practical devolution post-18th amendment)—effective coordination and liaison between federal, provincial, and district governments to develop a clear policy on demand/supply.
6. Need-based distribution to provinces instead of dealers.
7. Invest in R&D for new fertilizer technologies like precision fertilization and decision support systems to investigate and increase soil fertility.
8. Enhance soil and fertilizer testing to minimize and balance fertilizer use.
9. Improve market transparency through the use of monitoring and evaluation IT-based systems, such as a fertilizer app for tracking supply in the market/price updates, which will prevent hoarding, overpricing, and cross-border smuggling.

10. To reduce risks in the fertilizer industry workforce, steps such as ongoing hazard assessments, thorough worker training, optimal PPE usage, regular health check-ups, and health insurance coverage should be implemented through appropriate legislation and enforcement.
11. Acquisition of the latest fertilization technologies—collaboration with leading fertilizer-producing countries.
12. Increasing production and self-sustenance—exploring export possibilities.

Comprehensive Implementation Design (2 x Logical Framework Matrix)

Use of technology by Farmers

	Description	**Indicators**	**Means of verification**	**Risks**
Goal	To ensure access and use of technology by farmers to increase productivity	Crop yield per hectare	Comparative analytical tools for calculating yield (Tehsils, Districts and provinces) in technology compliant areas	Ineffective compliance and execution of the plan
Purpose	Updating agricultural practices	Overall increase in yield with balance fertilizers Soil fertility results	Survey of farmers	Inertia and non-compliance by farmers/ Agriculture departments
Output	Precision agriculture techniques to improve agriculture output	Testing samples of soil to check desired level of better nutrient levels	Use of Apps to check technology compliance District administrations spot checks	Conservative and traditional approaches blocking use of technology
Activities	Awareness of farmers on use of technology like Decision support systems and GIS/GPS etc. Promoting R&D to increase efficient fertilizer mixes with low emission	KPIs for research institutes Performance audit of research institutes Field Data by Agriculture Ext Department to measure adoption of technology by farmers	Spot surveys of farmers about feedback on use and benefits of technology use.	Resistance and back lash/ Unionism in case of stricter enforcement

Timely access of standard / balanced fertilizer

	Description	**Indicators**	**Means of verification**	**Risks**
Goal	Provision of Quality Fertilizer to enhance Productivity	Stock availability as per demand of farmers Crop yield per hectare	Verification of stock as per record by the Agriculture departments	Highly impactful manufacturing sector Manufacturer -Dealer nexus
Purpose	Smooth supply of low cost and quality fertilizer in markets in timely manner	Soil fertility results Market Prices of fertilizers	Random soil and fertilizer samples District wise agriculture output	Disruptions in demand and supply/ price dynamics
Output	Balanced fertilizer availability in quality and quantity	Fertilizer off-take Demands of provinces/Farmers Inventory of fertilizers in country GIS based output and nutrient analysis	Provision of mobile labs to verify nutrition standard. District administrations spot checks	Price hikes, hoarding and profiteering
Activities	End Gas Cess Gas Tariff Price regulation to be part of FRC agenda Allow imports and LNG as fuel for manufacturing sector Long term concessional agreements for LNG and Potash	Fiscal impact analysis Cost-auditing and performance auditing of manufacturers	GIS tracking of supply Stakeholders consultation and analysis Spot surveys of farmers, manufacturers and dealers	Resistance/ back lash

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