

REVITALIZATION OF AGRICULTURE IN PAKISTAN

1. Introduction.

Thesis Statement : Pakistan's agriculture is currently struggling because of traditional farming methods, and old subsistence-based model. However, a multi-level strategy is needed to boost the economy and modernize the sector.

2. Significance of Agriculture in Pakistan's socio-economic fabric

(a) Economic pillar : Contribute to GDP

(b) Social Pillar : Livelihood for rural masses and poverty alleviation

(c) Strategic pillar : Ensuring national food sovereignty in a volatile global market.

3. The status Quo of the Agriculture sector in Pakistan

(a) current profile : land usage patterns, crop zones and the dominance of "big five" (wheat, cotton, Rice, Sugar, Maize)

(b) The challenges and their impacts : including water scarcity, climate vulnerability & old agricultural tactics.

4. Revitalization Framework : A Multi-Level Approach

4.1. Reforms in Governance and Policy

(a) Land reforms and consolidation — promoting "corporate farming" models and discourage land fragmentation

(b) Agricultural zoning — enforcement of "crop-zone" policies to grow ecological environment

(c) Institutional Reforms — give subsidies to farmers, and strengthening provincial agriculture departments

4.2. Technical and Research level Intervention

- (a). Seed Biotechnology — investing in R & D for climate-resilient and Heat tolerant genetically modified seeds.
- (b). Mechanization — provide subsidized ~~see~~ access to "Smart Machinery"
- (c). Precision Agriculture — Integrating Drone technology and GIS (Geographic Information System) for targeted pesticide and fertilizer application

4.3. Financial and Economic level Intervention

- (a). Direct Subsidy Transfer : utilizing "Kisan Card" system
- (b). Crop Insurance (Takaful) — developing mandatory insurance schemes to protect small farmers
- (c). Formal Credit Accessibility — reforms in commercial banks to increase the ratio of "Agri-loans" to small holders at low interest rates.

4.4. Education and Awareness Campaigns

- (a). Modern farmer Training — focuses on climate smart agriculture
- (b). Academic Integration — adding "agriculture" as a subject in rural school and colleges.
- (c). Scholarships for Higher Education — more technocrats would produce and shape ~~economy~~ ^{future} in better way

4.5. Infrastructure and International Upgradations — learn more about "Greenhouse farming" and learn from countries like Netherland ; Implement SDGs and adapt value-addition models.

4.6 Individual and Personal level Efforts

- (a) Water Stewardship — every individual farmer must take responsibility to save water.
- (b) Forming Small Farmer Cooperatives — farmers should cooperate and work in small groups, as it will help all and everyone gets benefits.
- (c) Encouragement of Kitchen Gardening — every family grows their own basic vegetables at home; and ultimately this brings more dollars into Pakistan.

5. Conclusion.

Agriculture has always been the backbone of Pakistan's economy and society. From the fertile plains of Punjab to the irrigated lands of Sindh and the orchards of KPK and Balochistan, farming has shaped the country's history, culture, and economic structure. At the time of independence in 1947, Pakistan inherited an agrarian economy where most people depended on farming for survival. Even today, a large part of the population lives in rural areas and earns its livelihood from agriculture and allied sectors. However, despite its importance, the agriculture sector is facing serious problems. Low productivity, water shortage, outdated technology, climate change, weak governance, and lack of modern research have slowed down growth. As a result the country struggles with food insecurity, rural poverty and rising import bills. Pakistan's agriculture is currently struggling because of old subsistence based modes; however, a multilevel strategy is needed to modernize the sector and boost the economy; through governance reforms, technological progress, financial inclusion, education, infrastructure development, international cooperation and individual responsibility.

Agriculture plays an important role in Pakistan's economy. It contributes nearly 22-23% to the Gross Domestic Product (GDP) and employs around 37-38% of the labour force. According to the Economic Survey of Pakistan (2023-24), the sector remains largest employer in the country. Major crops such as wheat, rice, cotton, sugarcane, and the maize not only meet domestic needs but also support exports. Cotton is the backbone of textile industry, which earns billions of dollars in foreign exchange every year. Rice exports bring valuable revenue, especially basmati rice to Middle eastern and European markets. Moreover, agriculture supports many related ~~sectors~~ industries such as fertilizers, pesticides, farm machinery, food processing, and transport. Thus, growth in agriculture directly boosts industrial development and economic stability. A weak agriculture sector, on the other hand, affects inflation, trade balance and employment level.

Around 60% of the Pakistan's population lives in rural areas and most depend directly or indirectly on farming. Small farmers, landless laborers, and women workers rely on seasonal crops and livestock for survival. When agricultural productivity increases, rural income increases and poverty decreases. However, when crops fail due to floods, droughts or pest attacks, poor farmers suffer the most. Economic survey of Pakistan (2023-24) mentioned that floods 2022 caused massive destruction to standing crops, livestock and agricultural infrastructure. Reports estimated that nearly 80% of agricultural losses in the affected districts were linked to flood damages and overall economic loss was over \$30 billion. Therefore a strong agricultural measures must be needed to social justice and uplift rural areas by reducing poverty. A stable agriculture sector ensures employment opportunities, reduce rural-urban migration and maintain social harmony.

In a volatile global market, food security is a strategic issue. Countries that depend heavily on food imports face serious risks during global crisis. For example, ^{during} COVID-19 pandemic, and the Russia-Ukraine War, the global food prices increased sharply. Countries like Pakistan experienced inflation and wheat shortage. Therefore maintaining self-sufficiency in ~~staple~~ staple crops like wheat and rice is essential for national sovereignty. Agriculture ensures food availability, price stability and protection from international market shocks. A revitalized agriculture sector strengthens national security and reduces dependency on foreign imports.

As per Economic Survey of Pakistan 2023-24, issued by the ministry of finance, out of the total geographical area about 79.6 million hectares, nearly "22 million hectares" are cultivated, supported by the Indus Basin Irrigation System, one of the largest irrigation networks in the world, which irrigates almost 80% of the arable land. The crop profile is heavily dominated by the "Big Five" crops, — wheat, cotton, rice, sugarcane and maize. Wheat alone occupied 9 million hectares and is a staple food crop of the country. Cotton, not only a major crop but also provide raw material for the textile industry, which contributes nearly 60% of the total exports, showing a strong forward linkage with manufacturing a trade sectors. Rice is a key export crop, while sugarcane supports the domestic sugar industry and maize is increasingly used in poultry feed and industrial production. However, despite its importance, the sector remains largely traditional. About 65% of farms are smaller than 5 acres, according to official agricultural census data, indicating heavy land fragmentation. In term of linkage pattern, agriculture has strong backward linkage with industries producing fertilizers, pesticides and farm machinery, and forward linkage with textile mills and export-oriented industries. Thus, while agriculture remains central to Pakistan's economy

its current profile reflects structural weaknesses and the sector faces multiple structural, environmental, financial and institutional challenges that directly affect economic growth and stability.

One of the most serious problem is low productivity, mainly due to the outdated farming methods, poor quality ~~of~~ seeds, excessive reliance on traditional irrigation, and weak agricultural extension services. According to the survey, Pakistan's per-acre yield of major crops remains significantly lower than the global averages. Climate Change has intensified the crisis, with raising temperature, erratic rainfall, glacial melting floods and droughts disrupting production cycles; the catastrophic floods 2022, destroyed millions of crops and ~~caused~~ ^{losses} billions of dollars. Water scarcity is another structural constraint, as Pakistan has crossed the water-stress threshold, while inefficient flood irrigation and canal losses waste substantial water resources. Land fragmentation limits mechanization and investment and discourages efficient farming practices. Overemphasis on the big five crops has led to neglect of oil seeds and pulses, increasing reliance on imports and widening the trade deficit. The cumulative impacts of these ~~challenges~~ challenges is severe: agricultural stagnation contributes to food inflation, rural poverty, unemployment, rising import bills and macroeconomic instability. Environmental degradation such as soil salinity and waterlogging reduces long-term productivity and overall economic growth ~~is~~ slows down due to weakened industrial linkage.

The persistent low ~~energy~~ productivity, climate vulnerability, institutional weakness and financial instability discussed earlier clearly show that Pakistan's agricultural crisis is structural rather than temporary. These interconnected problems cannot be solved through isolated policy decisions or short-term relief packages. Instead they demand a comprehensive and coordinated reforms strategy that addresses governance failures, technological backwardness, financial exclusion and social awareness simultaneously. Therefore revitalizing the agriculture sector requires a multi-level approach that modernizes traditional farming practices, strengthens institutions and integrates farmers into a resilient and competitive economic system.

A primary structural reform must begin with land consolidation. Severe land fragmentation, where the majority of farms are below five acre, according to official agricultural census, prevents economies of scale and discourage mechanization. Small and scattered landholdings increase production costs and reduce profitability. To overcome this, the government should introduce voluntary consolidation schemes and promote cooperative or corporate farming models. Countries like China successfully reduced fragmentation through its land-use reforms that encouraged collective efficiency without eliminating farming farmer rights. If Pakistan addresses fragmentation through structured land reforms, productivity can increase significantly, rural income can stabilize, and modernization can become viable.

Alongside land reforms, rational agricultural zoning and crop policy are essential. Pakistan continues to cultivate water-intensive crops like sugarcane in regions already facing water scarcity. According to National Water Statistics, Pakistan has crossed the water stress threshold, making inefficient crop patterns environmentally unsustainable. Strict agro-climate zoning must be implemented so that

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Mechanisms and incentives

each region grows crops suitable to its soil and water conditions. Australia and other advanced agricultural economic follow zoning policies that align production with ecological capacity. By discouraging unsuitable crops and promoting diversification into pulses and oilseeds, Pakistan can conserve water, reduce environmental degradation and lower its import duties. However, effective zoning requires capable institution and transparent governance mechanisms.

Institutional reform is therefore equal critical. Weak extension services, delayed subsidies, and poor monitoring reduce the effectiveness of agricultural policies. The Economic Survey of Pakistan (2023-2024) highlights fluctuations in agricultural growth partly due to governance inefficiencies. Provincial agricultural departments must be modernized through digital monitoring systems, performance evaluation and transparent subsidy distribution. Strong institutions create policy stability, and stability builds investor confidence, which is essential for long-term modernization.

Beyond governance reforms, technological advancement is indispensable. Pakistan's per-acre yield of major crops remains below global averages. Countries like USA and Brazil significantly increased agricultural output by investing in biotechnology and research institutions. Brazil, through its research agency EMBRAPA, transformed from a food importer into a leading exporter by developing climate-resilient seed varieties. Pakistan must increase funding for agricultural research centers and universities to develop heat-resistant and drought-tolerant seeds, especially in light of recurring floods and rising temperatures. Scientific innovation can protect yields against climate shocks and ensure long-term food security.

Machinization and precision agriculture must complement research efforts. Limited farm size and high machinery costs have slowed machinization in Pakistan. Government-supported machinery rental programs and targeted subsidies can help small farmers access modern equipment. Precision agriculture tools, including soil mapping and efficient irrigation systems, can optimize fertilizer and pesticide use, reducing costs and environmental harm. The Netherlands provides a ~~less~~ powerful example: despite limited land, it became one of ^{the} world's largest agricultural exporters through technology-driven efficiency. Pakistan can adapt such models gradually to maximize output without expanding cultivated land.

~~Financial reforms are also needed to sustain modernization. Many farmers lack access to formal credit and rely on informal information and data.~~

Machinization alone, however, is not sufficient unless it evolves into precision agriculture. Modern farming must move beyond tractors and harvesters towards intelligent, data-driven systems. Precision agriculture: integrates drone technology, Geographic Information System (GIS), satellite mapping and (AI) artificial intelligence to monitor soil health, crop conditions and moisture level in real time. Through targeted pesticides spraying and fertilizer application, farmers can reduce input costs while increasing yield efficiency. By applying fertilizers ^{only} where needed and in optimal quantities, precision farming minimize wastage and protects soil fertility. In a country like Pakistan, where input costs are rising and water resources are shrinking, such targeted interventions can transform productivity without expanding cultivated land.

Machinization must transition into smart, technology-driven agriculture is mandatory to ensure sustainable modernization. Yet technological advancement cannot succeed without financial backing. Direct subsidy transfer through digital platforms such as "Kisan Card" represents a crucial financial intervention to stabilize small-holder's incomes. Traditional subsidy regimes often suffer from leakages, elite capture, and delayed disbursement. By linking subsidies directly to verified farmers through digital identification and banking integration, the state can ensure transparency and targeted relief particularly during climate-induced shocks. Direct Bank transfer model in countries like India have demonstrated improved efficiency and reduced corruption in agricultural support scheme. For Pakistan, digitized subsidy system can lower fiscal waste while ensuring that fertilizers, seeds, and energy subsidies reach vulnerable farmers, thereby strengthening resilience at grass root level.

Crop insurance constitutes a second essential economic safeguard againsts climate volatility. Countries as china have expanded agricultural insurance coverage to protect millions of farmers from disaster-induced income collapse. In Pakistan's context, institutionalizing affordable crop insurance through public-private partnerships would prevent farmers from falling into chronic debt cycles, thereby stabilizing rural consumption and national food security.

Beside crop insurance, formal credit accessibility through commercial banks must be expanded to increase the ratio of agricultural loans to smallholders at concessional interest rates. Structured agri-loans, supported by ^{the} "State Bank of Pakistan", can incentivize banks to lend to marginalized farmers. Enhancing financial

Inclusion through mobile apps microfinance channels would allow farmers to invest in quality outputs, mechanization, and storage infrastructure. Improved credit flows therefore bridge the gap between technological opportunity and practical adoption.

For the agricultural empowerment, alongside the technical and economical upgradations, the education and awareness among masses must be needed. Many farmers, specially in the rural areas, rely on traditional knowledge and outdated methods. Modern farmer training programs focusing on the climate-smart agriculture, soil testing and balanced fertilizer use should be expanded nationwide. Government should train the farmers by introducing the free training programs and workshops can translate policy reforms into field level integration.

For upcoming generations, integration of "Agriculture" as a subjects must be required for long-term structural change. Agriculture should be introduced in rural schools and colleges as a formal subject so that students understand modern farming. This will also remove the social stigma attached to the farming and present it as a scientific and profitable profession. Practical learning through school gardens, field visits, and basic training in soil testing can build early technical awareness.

At higher level, agricultural universities and institutions should strengthen research in seed biotechnology, precision farming and climate-smart agriculture. Once schools and colleges are academically integrated with agriculture education, it becomes easier to link students to scholarships for higher studies. These scholarships can then produce skilled experts who are

Capable of leading technical, financial and policy reforms in the agricultural sector, ultimately building the human capital necessary for sustainable modernization.

Another way of improving agriculture is by working with global community. The government can send students and researchers abroad to learn the advance methods and bring this knowledge back to Pakistan. International organizations can also provide technical support, training programs and ~~funding~~ funding for infrastructure like cold storage and farm roads. By cooperating with the global world, Pakistan can modernize agriculture, reduce losses and increase exports while following sustainable practices and SDG goals.

Government reforms and international models will remain incomplete without individual and community-level participation. Water stewardship is ~~now~~ now a moral and economic necessity. As water scarcity is one of Pakistan's most pressing constraints, and efficient irrigation method such as drip and sprinkler system can reduce wastage significantly. Encouraging farmers to adopt water budgeting and conservation practice ensures sustainability beyond state intervention. Individual accountability in resource management thus complements national policy reforms.

Small farmer cooperatives present another grassroots solution. By pooling land, machinery, and financial resources, smallholders can achieve economies of scale similar to large farms. Cooperative farming models in countries like ~~in~~ Denmark have encourages bargaining power and market access for small producers. In Pakistan, organized cooperatives could facilitate bulk purchasing of input and collective marketing, thereby improving profitability and resilience.

The encouragement of small kitchen gardening and household level food production can contribute to food security and foreign exchange savings. When families grow vegetables and basic produce domestically, pressure on commercial supply chain decreases, and nutritional standards improves. Such micro-level initiatives, through modest individually, collectively reduce import dependency and strengthen community self-reliance.

Ultimately, revitalizing Pakistan's agriculture requires coordinated action at all levels — from government policies and technological innovation to education, infrastructure, and responsible practices by individual farmers. If these efforts are implemented effectively, Pakistan can secure food for its population, reduce rural poverty, stabilize its economy and increase exports. The modernization of agriculture is therefore not just an economic priority, but a national necessity for sustainable growth and prosperity in the 21st century.