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CULTIVATING RESILIENCE

HEALTH, EQUITY, AND SUSTAINABILITY IN AGRICULTURE

The #1 source for in-depth analyses, expert opinions, and cutting-edge research on topics such as sustainable farming practices, global food security, agricultural policies, market trends, and technological innovations.

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July Focus: Empowering Agriculture through Skills, Policies, and Innovation

This issue highlights essential articles on skills development programs, health policy reforms, and climate-resilient farming. We call on all stakeholders to prioritize agriculture for a sustainable future that empowers communities and respects the planet.

Muhammad Khalid Bashir

7/1/2025

As the month of July unfolds, we at *The Agricultural Economist* take this opportunity to reflect on the profound interconnectedness of people, planet, and progress. The theme of this edition, "Empowering People, Preserving Planet: Skills, Health, and Sustainability for a Resilient Future," calls attention to the multifaceted role agriculture plays not only as a provider of food, but as a foundation for human development, ecological balance, and inclusive economic transformation.

July brings with it a rich tapestry of global observances that intersect with agriculture in meaningful ways. World Population Day (July 11) reminds us of the pressing need to ensure food and nutritional security for growing populations, especially in rural communities. World Youth Skills Day (July 15) emphasizes the importance of agricultural education, digital literacy, and vocational training in preparing the next generation of farmers, researchers, and agri-entrepreneurs.

The Nelson Mandela International Day (July 18) calls for inclusive and equitable approaches to land, labor, and resource rights, values deeply rooted in agricultural justice. Environmental observances like the International Day for the Conservation of the Mangrove Ecosystem (July 26) and World Nature Conservation Day remind us that sustainable agriculture is integral to preserving biodiversity, protecting watersheds, and combating climate change.

Finally, World Hepatitis Day (July 28) underscores the public health dimensions of agriculture highlighting how food systems, water safety, and rural healthcare access contribute to broader disease prevention and community well-being.

The Youth Factor in Agricultural Transformation

With more than 60% of Pakistan's population under the age of 30, the youth are not merely future leaders, they are present-day drivers of agricultural change. As traditional farming systems face increasing pressure from climate variability, market volatility, and technological disruption, the participation of young people has become more critical than ever. World Youth Skills Day serves as a timely reminder of the importance of equipping rural youth with the knowledge, tools, and opportunities they need to succeed in a rapidly evolving agri-food landscape.

However, youth engagement must go beyond vocational training. True transformation requires a shift in mindset toward innovation, sustainability, and entrepreneurship. Skills in digital agriculture, regenerative farming, precision technologies, data analytics, and climate adaptation must be integrated with values of stewardship, equity, and community development. Education systems, extension services, and rural development programs must evolve to deliver this holistic learning experience.

This issue features inspiring examples of young agri-entrepreneurs who are breaking barriers and redefining agriculture from launching agri-tech start-ups and organic food businesses to pioneering water-saving techniques and advocating policy reform. Their journeys reflect the power of mentorship, access to finance, and supportive ecosystems in unlocking youth potential.

To harness the youth dividend in agriculture, coordinated action is needed across government, academia, and the private sector. Only then can we turn rural challenges into engines of inclusive growth. In celebrating the energy, creativity, and commitment of youth, we also lay the foundation for a resilient and food-secure future.

Public Health as a Productivity Imperative

Agriculture and public health are deeply interconnected, yet this linkage is often overlooked in development discourse. As World Hepatitis Day reminds us, millions, especially in rural and marginalized areas, continue to suffer from preventable diseases due to unsafe water, inadequate sanitation, and limited access to healthcare. These public health deficits directly affect the productivity and resilience of agricultural communities.

A healthy farming population is essential for food security and economic development. When agricultural workers fall ill, the impact goes beyond personal suffering, it results in labor shortages, declining yields, disrupted value chains, and income losses for entire households. Recent studies published in *The Agricultural Economist* illustrate that health shocks in rural settings often lead to prolonged absenteeism, costly borrowing for treatment, asset sales, and intergenerational poverty traps.

To address these challenges, health must be prioritized as a pillar of agricultural policy. This means expanding health insurance coverage to include informal and seasonal agricultural laborers, enhancing workplace safety using protective gear and training, and investing in clean water and sanitation

infrastructure in farming communities. It also involves mainstreaming nutrition education and preventive health messaging into agricultural extension programs, ensuring that farmers not only grow food but also understand and access healthy diets.

By integrating health and agriculture into policy, we can build a more resilient and productive rural economy. Public health is not a separate sector, it is a productivity imperative, foundational to achieving sustainable development and human dignity in agricultural landscapes.

Population, Pressure, and Opportunity

World Population Day compels us to grapple with both the pressure and potential of demographic change. Pakistan's rising population strains food systems, water resources, and employment markets yet it also presents an opportunity. With the right policies, this demographic trend can be a dividend. Educated, healthy, and skilled youth can drive agricultural innovation, support rural enterprises, and reverse urban migration by revitalizing local economies.

To achieve this, population growth must be met with parallel investments in family planning, women's empowerment, land rights, and climate-resilient infrastructure. The intersection of population dynamics and agricultural policy must no longer be ignored in development planning.

Climate Justice and Conservation

This month's observances also bring attention to nature conservation and ecosystem protection, especially through the International Day for the Conservation of the Mangrove Ecosystem. Pakistan's mangroves and forests are under severe threat from climate change, sea-level rise, and unsustainable land use. Yet, these ecosystems are critical not only for biodiversity but also for coastal livelihoods, fisheries, and climate resilience.

Agriculture must embrace its role as a steward of the environment. This means transitioning to agroecological practices, restoring degraded land, promoting biodiversity on farms, and reducing chemical runoff. The conservation of nature is not an externality, it is integral to long-term agricultural sustainability.

Leadership, Equity, and Mandela Legacy

Nelson Mandela International Day reminds us of the principles of justice, equity, and service. In the context of agriculture, this translates into promoting land equity, ensuring access to resources for marginalized communities, and fostering inclusive value chains. Mandela's legacy challenges us to make agriculture a vehicle of peace, dignity, and empowerment, particularly for those who have been left behind.

A Call to Action

As we spotlight articles in this issue, from skill development programs and health policy reforms to climate-resilient farming and youth-led innovation, we urge all stakeholders to act decisively. Governments must prioritize agriculture in their development agendas, civil society must continue pushing for accountability and inclusion, and academia must bridge the research-policy-practice gap.

Let us view July not just as a month of observance, but as a call to build an agricultural future that empowers people, respects the planet, and secures prosperity for generations to come.

Warm regards,

Muhammad Khalid Bashir

Managing Editor

The Agricultural Economist

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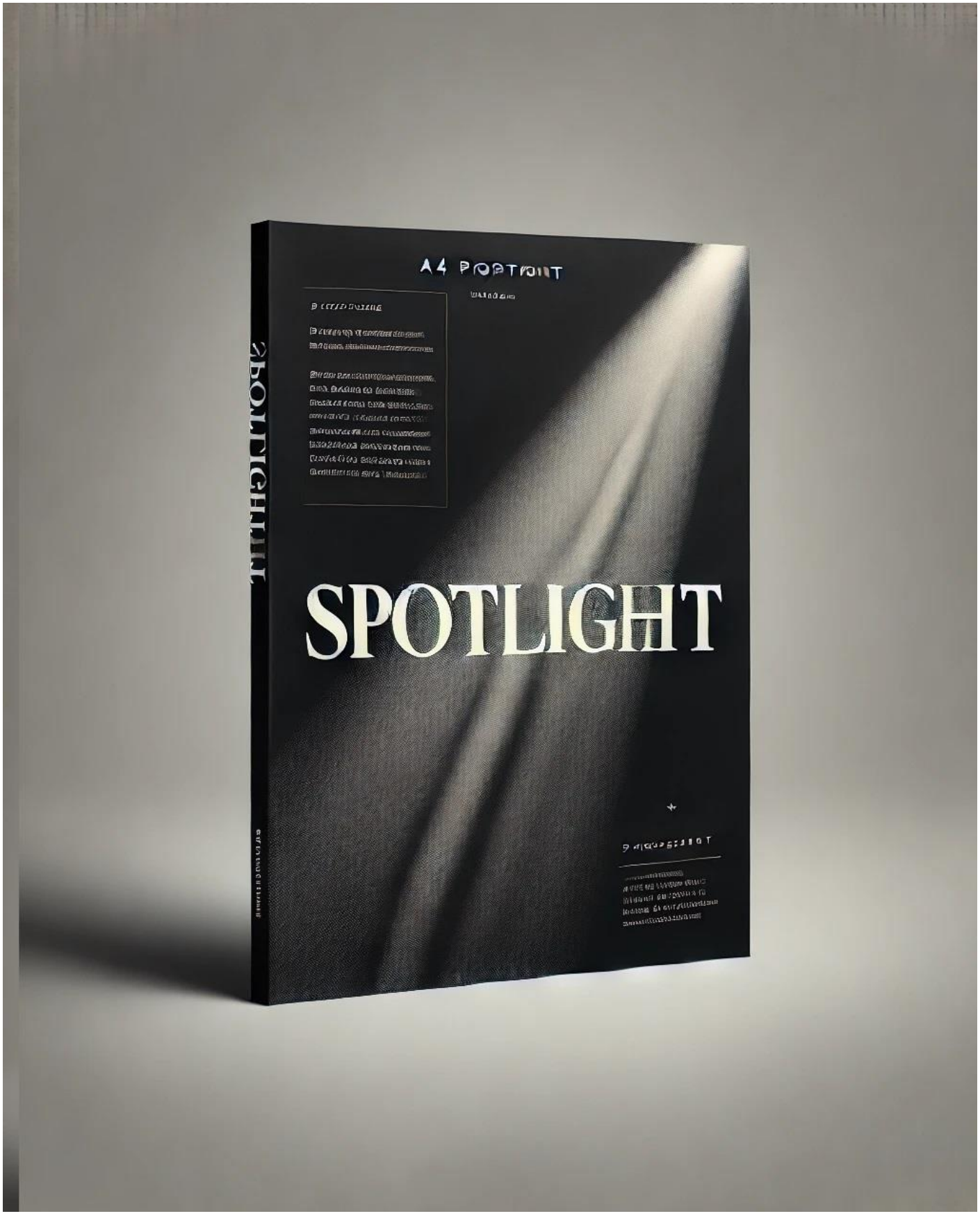

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Challenges & Opportunities of Pakistan's Agricultural Exports

Pakistan's agricultural exports play a crucial role in foreign exchange earnings and rural employment. However, the dual economy structure and low productivity in traditional sectors hinder broader economic growth.

Nimra Nawaz

7/3/2025

This study examines the impact of agricultural exports on Pakistan's economic growth within a dual economy framework, combining macroeconomic insights with the grassroots realities of farmers, rural laborers, and urban industrial workers. Employing a human-centered lens, it explores how trade policies, market access, and technological innovations shape the country's growth trajectory while highlighting sectoral disparities. Drawing on empirical data from 2010 to 2024, the analysis reveals that although agricultural exports contribute significantly to foreign exchange earnings and rural employment, their overall impact on long-term economic growth remains modest due to structural bottlenecks, policy fragmentation, and low value addition.

In developing economies, export-led growth strategies have historically been endorsed by classical economists like Smith (1776) and Ricardo (1817), emphasizing comparative advantage. Pakistan, an agrarian economy, relies heavily on agricultural exports such as rice, cotton, and fruits, which account for approximately 21% of the GDP and engage nearly 45% of the labor force (Economic Survey of Pakistan, 2024). However, the persistence of a dual economy, characterized by a high-productivity industrial sector and a low-productivity agricultural sector, has led to uneven development and income inequality (Lewis, 1954).

The study highlights the need for a paradigm shift in agricultural trade policy to unlock inclusive growth. Strategic priorities should include increasing investment in agri-processing infrastructure, promoting digital agriculture, diversifying export markets, and integrating smallholders into global value chains. Moreover, reducing post-harvest losses, improving certification systems, and enhancing supply chain logistics are critical for making agricultural exports more competitive.

Ultimately, bridging the agricultural-industrial productivity gap requires coherent, inclusive, and forward-looking policy measures that prioritize rural transformation. By aligning trade policy with human development goals, Pakistan can harness agricultural exports not just as a source of revenue but as a catalyst for sustainable, equitable growth.

Understanding the Export-Led Growth Paradox and the Dual Economy Trap

Despite contributing over $8.1 billion annually to Pakistan's foreign exchange earnings (SBP, 2024), agricultural exports have delivered only volatile and inconsistent gains to GDP growth. This phenomenon, referred to as the *export-led growth paradox,* reflects how global price fluctuations, supply chain disruptions, and limited domestic value addition undercut the transformative potential of agricultural trade. While short-term export revenues rise, long-term impacts on employment, productivity, and structural development remain limited. This is especially true when export surges are concentrated in a few raw commodities with low processing levels, such as rice and cotton.

These challenges are deeply rooted in Pakistan's dual economy structure, a concept articulated by Lewis (1954), where two coexisting sectors operate at vastly different levels of productivity and capital intensity. On the one hand, the modern sector, dominated by urban-based, capital-intensive industries like textiles and garments, contributes over 60% of national exports. On the other, the traditional sector, largely composed of smallholder farms under 2 hectares, remains labor-intensive, under-capitalized, and marked by declining marginal returns.

This structural imbalance fuels persistent rural-to-urban migration, wage disparities, and underemployment. While agriculture employs 63% of the rural population, its productivity has stagnated at just 1.5% annual growth (FAO, 2023). This indicates a significant resource misallocation, where human capital remains trapped in low-productivity settings due to lack of investment, mechanization, and financial inclusion.

Furthermore, while agricultural exports serve as a foreign exchange multiplier, their inability to catalyze broader industrialization highlights a missed opportunity for sectoral convergence. Without forward linkages to agro-processing, packaging, or logistics industries, export gains do not translate into value-added growth. Thus, to resolve this paradox, Pakistan must reorient its export strategy to address dual economy disparities, enhance rural productivity, and ensure equitable integration of traditional sectors into modern value chains.

Trends, Challenges, and Policy Priorities for Agricultural Trade

Agricultural exports in Pakistan have witnessed notable growth in FY2023–24, with major crops expanding by 16.82%, cotton ginning rising by 47.23%, and fruits and vegetables registering growth between 5.77% and 8.40%, contributing a combined 13.9% to GDP (Pakistan Economic Survey, 2024). This expansion was led by key commodities such as rice, which alone accounted for $2.5 billion in export revenue, and textiles at $16.4 billion. However, this growth has been accompanied by a 15.8% increase in agricultural imports, particularly

agrochemicals, machinery, and fertilizers, indicating a persistent reliance on foreign inputs that narrows the net export margin (SBP, 2024).

Despite short-term gains, structural inefficiencies continue to undermine the long-term growth impact of agricultural exports. Research by Wahid et al. (2015) found a negative correlation between agricultural exports and GDP growth due to Pakistan's dependence on low-value raw commodities such as raw cotton. Similar findings in West Africa by Richardson et al. (2016) highlight that weak value chains often result in minimal economic spillovers. In contrast, evidence from China shows that digital agriculture can increase exports by 14% through better efficiency and traceability (Zhou et al., 2024). Yet, in Pakistan, only 12% of farmers use precision agriculture technologies (ITU, 2023), restricting export competitiveness and innovation.

Econometric analysis reveals that a 1% increase in agricultural exports boosts GDP by 0.26% in the short term, but over-reliance on unprocessed exports constrains sustainable growth. To address this, Pakistan must prioritize value addition, transitioning from raw cotton to finished textiles could generate an additional $5 billion annually. Digital transformation through agri-tech adoption and blockchain can modernize supply chains and enhance market access. Improving rural labor productivity by investing in education and reducing the rural-urban literacy gap (currently 54% vs. 72%) is equally essential. Trade policy reforms should also encourage high-value crops and rationalize minimum support prices to promote export diversification. A coordinated strategy focused on innovation, inclusion, and value chain development can unlock the full potential of agricultural exports as a driver of equitable and resilient economic growth.

Conclusion

Pakistan's agricultural exports, while significant in foreign exchange earnings and rural employment, have yet to translate into sustained, broad-based economic growth due to the country's entrenched dual economy structure. The traditional agricultural sector, marked by low productivity, limited value addition, and minimal technological integration, continues to lag behind the modern industrial sector, deepening rural-urban disparities. Though major crops and commodity exports such as rice and cotton show year-on-year growth, overreliance on unprocessed goods and global market volatility constrains their developmental impact.

The export-led growth paradox reveals that without structural transformation, through value chain enhancement, digital innovation, and human capital investment, agricultural exports alone cannot drive long-term progress. Moreover, the failure to integrate smallholders into global supply chains and the limited adoption of agri-tech continue to weaken Pakistan's competitiveness.

To resolve these challenges, trade policy must pivot toward fostering value-added exports, expanding digital and physical infrastructure, and prioritizing inclusive rural development. Reducing the productivity gap between sectors through targeted education, financial inclusion, and better market access is essential. A future-forward export strategy, aligned with inclusive growth and sustainability, can transform agriculture from a subsistence sector into a dynamic engine of national prosperity, ensuring that growth is not only export-driven but also equitable and resilient.

References: Economic Survey of Pakistan; FAO; Zhou, et al.; World Bank; Smith; Ricardo; Lewis; Wahid et al.; Richardson et al.; Zhou et al.; ITU

Please note that the views expressed in this article are of the author and do not necessarily reflect the views or policies of any organization.

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Modernization Opportunities in Türkiye's Agriculture

Türkiye's agriculture is at a crucial juncture with abundant resources but facing challenges like a declining farming population and fragmented supply chains. This situation opens the door for agricultural modernization to enhance national food systems.

Mithat Direk

7/11/2025

The decline in the agricultural population is often highlighted in public discourse, yet the topic is frequently misunderstood by those unfamiliar with the complexities of the sector. At its core, agricultural production is driven by four essential factors: natural resources, labor, capital, and entrepreneurship. Among these, natural factors such as climate, soil, and water availability are fixed and governed by geography. These cannot be altered, only managed wisely. However, the remaining factors including labor, capital, and entrepreneurial capacity are dynamic and can be shaped through technological innovation, education, investment, and policy reform.

Türkiye enjoys a rare agricultural advantage due to its unique geography and climate diversity. Few countries in the world can match Türkiye's ecological richness, where multiple climatic zones coexist. This enables a wide range of crops to flourish from cherries in the highlands of Konya to citrus fruits in the warm valleys of Antalya. A traveler in early summer might witness cherry orchards in full bloom fed by snowmelt in Central Anatolia, then find themselves skiing in the Bey Mountains and swimming in the Mediterranean all in one day. Such biodiversity makes Türkiye not only agriculturally productive but also strategically important in the global food landscape.

Despite this potential, the country struggles to convert its natural wealth into global market success. Although Türkiye ranks as the world's fourth-largest vegetable producer (FAO, 2022), its agricultural exports are not yet optimized to match its production capabilities. Weak logistics, fragmented supply chains, and inconsistent export policies have hindered the full commercialization and globalization of Turkish agriculture.

To reverse the declining interest in farming and boost the sector's appeal, Türkiye must modernize its agricultural infrastructure, incentivize youth participation, and implement robust export-oriented policies. Only then can it translate its natural bounty into sustained economic growth and global agricultural leadership.

Productivity Gains or Structural Warning?

The steady decline in Türkiye's agricultural population raises important questions about the future of farming. Once home to nearly 4 million farmers, Türkiye now has just 2.17 million registered farmers according to the Farmers' Registration System (ÇKS) as of 2023 (Ministry of Agriculture and Forestry, 2023). This means that only about 6% of the national workforce is now engaged in agriculture, a sharp decrease from previous decades. At first glance, such a drop may appear alarming, especially in a country with a rich agrarian tradition and favorable agroecological conditions.

However, this trend mirrors patterns in many developed economies, where agricultural employment has declined even as productivity has increased. In the United States, for example, less than 1% of the population is directly involved in agriculture, yet the country remains one of the world's top agricultural exporters (USDA, 2023). This evolution underscores a critical insight: agricultural success is no longer strictly tied to the number of people working the land but to how efficiently that land is managed.

In Türkiye, the decline in farming population may not be entirely negative if it coincides with technological progress, improved mechanization, and more efficient value chains. When fewer but better-equipped and better-trained farmers produce more with less, agriculture becomes both sustainable and economically viable. However, this transition must be managed carefully. Without investment in rural education, digital infrastructure, and agri-tech innovation, declining participation may lead to knowledge loss, aging rural communities, and widening rural-urban inequality.

Rather than viewing the shrinking agricultural workforce as a threat, Türkiye can transform it into a strength by fostering innovation, youth engagement, and policy reforms. If productivity continues to rise while sustainability is maintained, the country can secure its place as a global agricultural leader, even with fewer farmers.

Modernizing Agriculture and Managing Migration

As Türkiye's agricultural landscape evolves, mechanization and specialization are emerging as central pillars of its future. Although agriculture has traditionally relied heavily on manual labor, the advent of advanced technologies is steadily reducing this dependency. Innovations such as precision farming, sensor-based irrigation, drone surveillance, and AI-driven crop diagnostics are transforming farming into a more data-driven and capital-intensive enterprise. Türkiye now boasts over 1.2 million tractors (TÜİK, 2023), reflecting a significant increase in mechanization and signaling improved efficiency across rural areas.

This technological shift has also redefined gender roles in agriculture. Where physical strength once shaped labor division, machines now level the playing field. Women are increasingly visible in roles

once dominated by men e.g. driving tractors, managing greenhouses, and leading agribusinesses. Likewise, men are engaging in previously feminized agricultural tasks, such as nursery work and packaging. This transformation underscores the growing importance of skills and technical competence over traditional gender norms in the rural workforce.

Concurrently, Türkiye faces the challenge of managing rural-to-urban migration. As agriculture modernizes, some rural populations are displaced due to mechanization and shrinking job opportunities. Many migrants arrive in cities unprepared for the labor demands of urban economies. With an urban unemployment rate of 10.4% (TÜİK, 2024), this influx of unskilled labor contributes to rising joblessness and social integration issues.

To address these interconnected issues, Türkiye must adopt a dual-track strategy. First, investment in rural infrastructure, extension services, and agricultural education is vital to make rural life more sustainable and appealing. Second, structured vocational training programs for rural migrants can ease their integration into urban economies. By fostering smart rural development and managing migration proactively, Türkiye can ensure that modernization enhances both agricultural productivity and social stability.

Conclusion

Türkiye stands at a pivotal moment in its agricultural trajectory blessed with abundant natural resources and ecological diversity, yet challenged by a shrinking farming population, fragmented supply chains, and rural-to-urban migration pressures. The decline in agricultural employment, while often viewed with concern, also presents an opportunity to modernize the sector through mechanization, specialization, and increased productivity. Global examples demonstrate that a smaller, more skilled workforce, when supported by smart technologies and robust policies, can sustain and even enhance national food systems.

To unlock its full agricultural potential, Türkiye must shift focus from quantity to quality: investing in precision farming, strengthening rural infrastructure, and fostering entrepreneurship in agri-food value chains. At the same time, the migration of rural workers to urban centers must be managed strategically. Without appropriate support, this demographic shift could deepen urban unemployment and rural decline. Through targeted vocational training, inclusive rural development programs, and incentives for youth participation, Türkiye can retain talent in its villages while equipping migrants for urban integration.

If embraced as a moment for transformation, rather than decline, this demographic shift can catalyze a resilient, competitive, and globally engaged agricultural sector. With the right mix of innovation, policy reform, and social investment, Türkiye can turn today's agricultural challenges into tomorrow's leadership in global food security.

References: FAO; Ministry of Agriculture and Forestry; TÜİK; USDA

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POLICY BRIEFS
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Price Stability in Agriculture: Key to Rural Incomes

Discover how price stability in agriculture is essential for safeguarding rural incomes and promoting inclusive economic growth in Pakistan. Learn about the impact of fluctuating prices on farming livelihoods and rural resilience.

Khadija

7/3/2025

Agriculture plays a pivotal role in agro-based economies, particularly in Pakistan, where over 60% of the rural population relies directly or indirectly on farming for their livelihood. In such settings, price stability in agricultural markets is more than just an economic concern is a cornerstone of rural welfare, social stability, and national food security. When agricultural prices are stable, farmers enjoy predictable income streams that allow them to plan for future investments, manage consumption, and save during good seasons to weather poor ones.

Fluctuating prices, on the other hand, create significant uncertainty for small and marginal farmers. Sharp price drops during harvest periods, lack of storage facilities, and weak market linkages often result in distressed sales. According to Mellor (1969), agricultural prices have a stronger influence on rural income than on national income, highlighting the vulnerability of rural communities. Rural income, comprising both farm and non-farm sources, is highly sensitive to these price dynamics, especially when farming is the primary source of livelihood.

Price volatility also disrupts local economies, impacting input suppliers, wage laborers, and rural entrepreneur's dependent on agriculture. Stable prices, in contrast, promote diversification, encourage the adoption of technology, and enhance resilience to climate and market shocks (Yang et al., 2022). Effective price stabilization measures such as minimum support prices (MSPs), crop insurance, contract farming, and market information systems can buffer smallholders from market uncertainties.

In the context of Pakistan, policy interventions must aim to ensure fair, transparent, and consistent agricultural pricing mechanisms. Strengthening institutional support, investing in rural infrastructure, and expanding access to warehousing and credit can significantly enhance price stability and rural income security. By mitigating price volatility, Pakistan can empower its rural population and lay a stronger foundation for inclusive and sustainable economic growth.

Economic Theories on Price Stability

Economic theories provide valuable insight into the importance of price stability for sustainable development, particularly in agriculture-dependent economies. Keynesian economics emphasizes the critical relationship between price stability and overall economic activity. John Maynard Keynes argued that economic agents, especially producers, require a degree of profit certainty to sustain investment and production. When prices are unstable, producers face uncertainty, which often leads to reduced investment, falling output, rising unemployment, and, ultimately, broader economic stagnation (Keynes, 1936). In agriculture, where most rural populations depend on seasonal crops, this uncertainty can have far-reaching effects on livelihoods and food systems.

In agrarian economies like Pakistan, the impact of price volatility is often delayed but profound due to the inelastic nature of agricultural supply. Unlike industrial sectors, agriculture cannot rapidly adjust to changing market conditions because of biological growth cycles, weather dependency, and rigid input requirements. Farmers typically make production decisions based on price signals received months in advance. When actual prices fall short at harvest time, it not only erodes profitability but also discourages future investment in quality inputs, new technologies, and sustainable practices.

Additionally, price instability increases financial vulnerability for smallholders, many of whom already operate with minimal capital and high levels of debt. As prices drop, their capacity to repay loans or reinvest in their farms weakens, leading to a vicious cycle of poverty and underproduction. According to FAO (2023), unpredictable market prices are a major barrier to technology adoption, productivity enhancement, and risk management in developing countries. Therefore, from an economic theory

perspective, maintaining stable agricultural prices is essential not only to protect farm incomes but also to ensure broader economic resilience. A predictable pricing environment enables better planning, promotes rural entrepreneurship, and supports long-term development goals.

Price Volatility and Rural Livelihoods

Agricultural price volatility poses a persistent threat to rural livelihoods, particularly in low-income, agrarian economies like Pakistan. The root causes of such volatility are multifaceted. Natural shocks including droughts, floods, pest outbreaks, and plant diseases regularly disrupt crop cycles, leading to supply fluctuations. Additionally, agricultural commodities typically exhibit low demand and supply elasticities. As a result, even minor shifts in production or consumption necessitate significant price changes to re-balance the market (IMF, 2011; UNCTAD, 2011). Production lags, such as the time required to grow crops or rear livestock, create cyclical price patterns like the classic "hog cycle," where prices rise and fall in delayed succession. On the global stage, price fluctuations in export-oriented commodities such as cotton or rice also influence domestic markets, especially when international demand contracts or surges unexpectedly (World Bank, 2022).

Stable agricultural prices have proven to be instrumental for improving rural incomes. When farmers can predict future returns with confidence, they are more likely to invest in productivity-enhancing inputs such as certified seeds, fertilizers, irrigation technologies, and machinery. This fosters long-term planning, better resource allocation, and economic resilience. Conversely, unstable prices trap smallholders in subsistence cycles. Lacking financial safety nets, even a modest 10% drop in prices can severely erode their earnings, leading to reduced food consumption, school dropouts, or asset liquidation (IFPRI, 2023).

In Pakistan, the Minimum Support Price (MSP) policy was introduced to counteract wheat price volatility. However, findings from The Pakistan Development Review (2024) reveal mixed outcomes. Although MSP offered a price floor, farmgate prices still lagged retail prices by 6.2%–20.3%, due to inefficiencies like spoilage, transport costs, and trader commissions. Despite spending Rs. 130 billion on procurement, retail wheat prices rose to nearly twice the MSP, disproportionately benefiting intermediaries over producers. Moreover, simulations suggest that market liberalization allowing private-sector-led procurement could have reduced retail prices by 28%, illustrating the need for a more efficient, transparent pricing mechanism that truly benefits farmers rather than middlemen.

Structural Barriers to Effective Price Stabilization in Agriculture

Efforts to stabilize agricultural prices in developing economies like Pakistan face several systemic and operational challenges. The most prominent among these is the persistent imbalance between supply and demand, which is increasingly exacerbated by climate change. Unpredictable rainfall, prolonged droughts, and extreme weather events disrupt production cycles, reducing supply in some years while leading to glut conditions in others (Tong, 2012). Additionally, poor rural infrastructure such as inadequate storage, transportation, and market facilities compounds these issues. For example, Shahidur and Meron (2008) observed in Ethiopia that weak logistics caused local market surpluses to translate into lower prices rather than distribution to deficit areas.

Another critical obstacle is the limited adoption of risk management instruments. In many countries, including Pakistan, farmers rarely use crop insurance, forward contracts, or commodity futures markets due to lack of awareness, accessibility, or trust (Gouel, 2014). Consequently, they remain exposed to significant income risks, especially when prices drop unexpectedly.

Policy-induced distortions also hinder price stability. Excessive state interventions such as price setting, compulsory procurement, and export bans discourages private sector engagement. Demeke et al. (2012) argue that such policies often crowd out more efficient market-based mechanisms. Pakistan's Minimum Support Price (MSP) policy, for instance, has sometimes caused procurement delays and price mismatches that hurt both producers and consumers. Similar criticisms have been levied against India's MSP regime, which according to the Economic Survey of India (2023), has led to stockpiling, misallocation of resources, and market inefficiencies.

To overcome these challenges, several reforms are essential. Reducing government overreach in pricing decisions and creating a more enabling environment for private trade can improve efficiency. At the same time, robust regulatory

oversight is needed to ensure fair pricing and prevent monopolistic practices by traders and middlemen. Strengthening market infrastructure and promoting financial literacy among farmers can also enhance their capacity to manage risks and respond effectively to market signals.

Conclusion

Price stability in agriculture is vital for safeguarding rural incomes and ensuring inclusive economic growth in Pakistan. In a country where most rural households depend on farming for their livelihood, fluctuating prices disrupt not only income but also long-term investment and consumption patterns. As highlighted throughout this article, unpredictable prices discourage the adoption of modern farming techniques, trap smallholders in poverty cycles, and reduce rural resilience to both economic and climatic shocks.

While government interventions like the Minimum Support Price (MSP) policy have been introduced with the intent of supporting farmers, their design and implementation often fall short. The current system benefits intermediaries more than producers, resulting in market inefficiencies and continued vulnerability for small farmers. Furthermore, structural challenges such as poor infrastructure, limited risk management tools, and excessive government intervention undermine the very objectives of price stabilization.

To effectively address these issues, a multi-faceted policy approach is required. Market-driven pricing mechanisms, coupled with strong regulatory oversight, improved rural infrastructure, crop insurance, and farmer education, can build a more responsive and equitable agricultural pricing system. If implemented well, these measures will not only reduce volatility but also empower rural communities, boost productivity, and strengthen national food security, laying the foundation for a more inclusive and resilient agricultural economy in Pakistan.

References: Demeke, et al.; FAO; IMF; UNCTAD; *The Pakistan Development Review; World* Bank; Mellor; Yang et al.; Keynes; IFPRI; Tong; Shahidur and Meron; Gouel

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Water Crisis in Balochistan: Challenges in Quetta

Explore the complex water crisis in Balochistan, particularly in Quetta, which threatens agriculture, food security, and rural livelihoods. Learn about the unsustainable reliance on groundwater and the urgent need for water-saving technologies.

Tahira Sadaf & Muhammad Amjed Iqbal

7/7/2025

Balochistan, despite being Pakistan's largest province, suffers from acute water scarcity, receiving less than 200 mm of annual rainfall (PMD, 2023). Agriculture, which is the backbone of the province's rural economy, relies heavily (over 90%) on groundwater (PCRWR, 2023). In districts like Quetta, this reliance has led to alarming aquifer depletion, with groundwater levels declining at a rate of 2 to 5 meters annually. This poses a grave threat to both food security and rural livelihoods in the region.

Quetta's agricultural system, characterized by orchard farming (particularly apples, almonds, and grapes), and vegetable cultivation, has shown declining productivity due to inefficient water use. Traditional flood irrigation methods dominate, leading to substantial water loss through evaporation and runoff. The economic returns from high-water-consuming crops are increasingly unsustainable, especially in the face of declining yields and rising pumping costs.

Improving groundwater use efficiency requires a multifaceted strategy. The adoption of drip and sprinkler irrigation systems can reduce water use by up to 50% while enhancing yields. Crop diversification toward less water-intensive and high-value crops, such as saffron or olives, could also improve economic resilience. Additionally, community-based water governance, groundwater recharge initiatives, and farmer education on soil moisture monitoring are crucial for long-term sustainability.

Policy interventions must include targeted subsidies for water-efficient technologies, enforcement of groundwater extraction limits, and integration of climate-smart agriculture into provincial planning. Establishing groundwater monitoring units and incentivizing data sharing can further support informed decision-making. Ultimately, preserving groundwater in Quetta is not just a technical issue but a matter of ecological and economic survival. Sustainable water management in Balochistan will depend on aligning farmer practices, technological innovation, and regulatory frameworks to protect this vital but vanishing resource.

Balancing Profitability and Sustainability in Quetta's Agriculture

Balochistan's mounting water crisis is rooted in its overwhelming dependence on groundwater. With just 5% of the province's farmland connected to canal irrigation via the Indus Basin system (World Bank, 2023), most agriculture in Balochistan is sustained by groundwater extraction. In Quetta, government subsidies on electricity for tube wells have led to unchecked over-extraction. Alarmingly, over 30,000 illegal tube wells now operate in the Quetta Valley alone (Balochistan Agriculture Department, 2023). This overuse has led to a dramatic drop in the water table, from 50 meters in 2000 to over 150 meters by 2023 (IUCN, 2023), posing an existential threat to the province's agricultural base.

In Quetta's farmlands, the trade-off between profitability and water sustainability is stark. Wheat, though offering the highest water productivity at 1.19 kg/m³, yields low profitability with a benefit-cost ratio (BCR) of only 1.2. Maize provides better market returns despite lower water efficiency (0.75 kg/m³), while tomatoes show moderate water use (0.91 kg/m³) but are highly sensitive to market price fluctuations. Despite an average net income of Rs. 32,168 per month from farming, household expenses (Rs. 33,960/month) consistently exceed earnings. To bridge the gap, farmers rely heavily on supplementary income from livestock (35% of total income) and off-farm employment (25%), bringing average monthly household income to Rs. 76,000 (Survey Data, 2023).

Regression analysis from recent field data shows that productivity and profitability can improve significantly through targeted interventions. Farmers with formal education showed a 12% higher gross value of production (GVP). Use of quality seeds boosted yields by 18%, while mechanized practices improved farm efficiency by 9%. Conversely, rising irrigation costs reduced wheat GVP by 0.16% for every 1% increase in cost. Overuse of agrochemicals, particularly in tomato farming, was found to reduce GVP by 0.09%.

Policy Recommendations for Sustainable Water Use in Balochistan

Addressing Balochistan's escalating groundwater crisis demands an integrated policy approach focused on regulation, innovation, education, and diversification. Strengthening groundwater governance is foundational. The provincial government must enforce licensing of tube wells and implement meter-based pricing models, as successfully piloted in parts of Punjab. Such measures can discourage over-extraction and foster responsible usage. Additionally, investment in aquifer recharge initiatives such as the construction of check dams and the rehabilitation of traditional systems like the *karez* can help replenish groundwater resources while respecting indigenous water heritage.

Adopting water-efficient technologies is equally critical. With the current adoption of drip and sprinkler irrigation systems below 5% in Balochistan, targeted subsidies and awareness campaigns are necessary to scale up these practices. Expanding solar-powered irrigation can also reduce reliance on diesel pumps, lowering both costs and emissions. The Public Sector Development Program (PSDP, 2023) supports this transition and should be expanded across water-stressed districts.

Farmer education and input optimization are key levers for sustainable water use. Mobile-based advisory platforms can deliver real-time guidance on irrigation scheduling and crop selection. Parallel efforts to certify and distribute drought-resistant seed varieties will improve yields while reducing water demand.

Diversifying agricultural output and building climate resilience are long-term solutions. Transitioning from water-intensive cereal crops to high-value, drought-tolerant horticultures such as olives and almonds can generate more income per unit of water used. Moreover, fostering water-user cooperatives can promote community-based monitoring, equitable access, and shared infrastructure for efficient water distribution.

By combining regulatory reform, technology adoption, capacity building, and economic incentives, Balochistan can chart a path toward sustainable water use. These actions will not only safeguard the province's groundwater reserves but also enhance agricultural productivity and rural livelihoods in the face of climate stress.

Conclusion

The water crisis in Balochistan, particularly in Quetta, is a multifaceted challenge with far-reaching implications for food security, rural livelihoods, and ecological sustainability. With over 90% of agriculture in the province dependent on rapidly depleting groundwater, current trends are unsustainable. Traditional irrigation methods, excessive reliance on tube wells, and low adoption of water-saving technologies have accelerated aquifer depletion, while economic returns from farming often fail to meet household needs.

Yet, the path forward is clear. Through evidence-based interventions ranging from the adoption of drip irrigation and drought-resilient crops to community-based water governance and farmer training, significant improvements in productivity and water efficiency are possible. Policy measures that support groundwater regulation, provide targeted subsidies, and promote diversified, high-value agriculture must be implemented urgently.

Aligning technological innovation with farmer empowerment and environmental stewardship will be key. Sustainable groundwater management is not merely an agricultural issue but a development imperative. For Balochistan, securing the future of its rural economy depends on its ability to balance profitability with long-term ecological resilience.

References: IUCN; PCRWR; World Bank; Balochistan Agriculture Department; PSDP; PCRWR; PMD

Please note that the views expressed in this article are of the author and do not necessarily reflect the views or policies of any organization.

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CPEC 2.0: Pakistan's Path to Sustainable Development

As Pakistan embarks on CPEC 2.0, the need for aligning economic growth with environmental sustainability becomes crucial. This initiative offers a unique chance to integrate green principles into development, focusing on clean energy, electric vehicles, and waste management.

Muhammad Faisal Ali

7/14/2025

Pakistan’s population is growing rapidly, and to fulfill the population's needs, the country’s economy must grow at 8 percent annually consistently for 2 to 3 decades, whereas the current growth rate is hovering around 2.68 percent (Economic Survey of Pakistan, 2025). This can be realized only with several development initiatives in multiple areas. For this, Pakistan has recently taken some big initiatives, such as SIFC, Reform packages for different businesses, CPEC 2.0, and URAAN Pakistan.

It is well understood that higher growth or increased development always comes with added environmental deterioration in transitioning economies, specifically. Therefore, environmental deterioration is prospective as a result of all these development initiatives in Pakistan. Consequently country needs to prepare itself for a bigger fight for the provision of an improved environment to its citizens. Pakistan's poor standing in the global environmental indices makes this situation more critical. Pakistan currently ranks 179th out of 180 countries in the Environmental Performance Index (EPI, 2024). As Pakistan seeks to accelerate its development through CPEC 2.0, the environment should be the top priority in this development agenda, as incorporating environmental concerns into Pakistan's development plans is no longer optional but a necessity.

Energy projects, expansion of the industrial sector, and large-scale infrastructure under CPEC have great potential to drive economic growth. But, without a robust environmental framework, they could accelerate ecological degradation and climate vulnerabilities, consequently.

Pakistan can address its environmental challenges through investment in green infrastructure, introducing stricter regulations, promoting public awareness, etc. CPEC phase 2 presents a big opportunity to balance economic growth with environmental sustainability. This can be done by introducing and implementing stringent environmental standards in new infrastructure projects, leveraging green technologies, and nurturing resource conservation and clean energy, especially renewable energy. Embedding green strategies into project planning and execution not only supports environmental resilience in the long run but also boosts economic prosperity in the country.

Here, a few important environmental issues are summarized where collaboration and cooperation under CPEC 2.0 can make our environment better and livable.

Learning from China's Emissions Reduction Success

China has significantly reduced its emissions while upholding steady economic growth. Under CPEC 2.0, Firstly, Pakistan should learn from China how it balanced both of these aspects. Secondly, an engagement through policy dialogues and expert-level discussions with China to understand the policies, technologies, and strategies to decouple growth from emissions. This learning process will be invaluable as Pakistan's economy grows, leading to a potential rise in emissions unless preemptive measures are taken. This process is ongoing, but the implementation of this learning is more important within the country.

A few years back, we all knew that the big urban centers in China were under a severe smog crisis. And now many of Pakistan's big urban centers are ranked among the top 20 most polluted cities globally, with severe repercussions on the economy and health.

One of China's technologies is carbon capture towers, which offer both direct and indirect benefits in reducing air pollution. Pakistan should explore opportunities for collaboration with China to implement similar solutions. This could include technology transfer agreements, knowledge sharing, and joint ventures aimed at combating smog and improving air quality in Pakistan’s most polluted cities. Such initiatives will not only address the environmental crisis but also contribute to broader public health and economic stability. Moreover, Chinese industries operating in Pakistan need to adopt low-emission production technologies.

The Integration of EVs

Given the global environmental concerns, a shift to clean energy sources and electric vehicles is most obvious. China is playing an important role in the EV industry. Pakistan should explore and expand avenues for potential collaboration. The first step may be the import of EVs from China, but a long-term strategy could involve establishing an EV production industry in Pakistan. This would create jobs for local people, reduce production costs, and consequently emissions in the country. A group from China with a local partner has pledged $340 million in investment (Pakistan today, 2025). Although EV imports from China to Pakistan have begun. But, for a successful EV integration, a parallel need for charging infrastructure is of supreme importance.

This requires a detailed country-wide assessment to determine where charging infrastructure will be needed most, for example, highways, transit routes, and

urban centers. Establishing charging stations strategically will encourage EV adoption. While planning big infrastructure-related projects, establishing charging infrastructure should be given importance.

Pakistan often has an excess electricity supply during the winter months, which could be harnessed to support the EV charging infrastructure. A targeted plan to utilize this surplus power for EV charging stations would not only optimize energy use but also support the economic and environmental goals of reducing reliance on imported fossil fuels.

This multi-step approach, mapping the needs, exploring collaboration with China, building charging infrastructure, and utilizing excess electricity, will lay a solid foundation for a sustainable and scalable EV ecosystem in Pakistan.

Addressing Pakistan's Air Quality Monitoring Infrastructure

Pakistan faces a serious deficit in the infrastructure needed to effectively measure air pollution (PIDE, 2024). Reliable evidence is crucial for efficient and effective planning, making it essential to rapidly install additional air quality monitoring systems. These systems will provide accurate data on pollution levels, allowing for better spatial planning and identification of congestion hotspots. In turn, this data will significantly improve transport and environmental planning. To accelerate the deployment of these systems, assistance from China could be sought. Chinese companies like Hanwei Electronics Group, Huawei Environmental Technologies, and Nova PM Sensors produce low-cost and high-quality sensors and equipment. Further leveraging Huawei's IoT and AI technologies for predictive air quality modeling and real-time air quality monitoring. China's expertise could assist Pakistan in establishing a comprehensive air quality monitoring network also enabling more precise and informed decision making.

Waste Management

Waste management is another big environmental concern in Pakistan, with almost 30 million tons of solid waste generated each year. Further, waste disposal practices are not adequate due to lower infrastructure, and almost 50 to 60 percent of waste is collected in urban areas (UNEP, 2020). Solid waste, even in big urban centers, is usually left uncollected, if collected, dumped in open spaces. This causes land and water pollution and a big health burden. This contributes to the spread of diseases, affects biodiversity, and worsens the overall quality of life for residents.

Pakistan should focus on recycling and circular economy initiatives. For plastic, electronics, and hazardous waste, collaboration with Chinese recycling companies will be a good way forward to set up material recovery facilities. As electronic waste is growing in Pakistan, the establishment of recycling plants related to e-waste is more important based on Chinese models.

Waste-to-energy projects can be instrumental in better waste management due to the bulk of potential. Under CPEC 2.0, Chinese expertise can be utilized to establish WTE plants in major cities to reduce landfill dependency. China's models related to biogas and composting can be implemented in Pakistan for the management of food and agricultural waste. China's methane capture technologies can also be adopted to reduce the GHG emissions from landfills. To monitor and regulate hazardous waste material from industries, China's industrial waste tracking system can be leveraged. Research collaborations with Chinese universities and institutions, especially in recycling innovation and waste treatment for sustainable waste management, is another big opportunity that must be considered under CPEC 2.0

Advance Water Management and Recycling

Despite being a water-stressed country, and most likely a water-scarce country by 2040 (WRI, 2024), Pakistan's approach to water management is highly unsustainable. Water management in the country can be characterized by inefficiency and over-extraction, largely due to the absence of economic water pricing. Water is almost treated as a free commodity, leading to excessive and wasteful consumption in various sectors, especially in agriculture, where water-intensive crops are cultivated with little regard for efficient use. With Pakistan facing increasing water scarcity due to climate change, population growth, and inefficient irrigation systems, the current trajectory is unsustainable and calls for urgent reforms. Pakistan also faces urban flooding, water scarcity, and poor drainage, especially in cities like Karachi, Lahore, and Rawalpindi. China's experience in water recycling and conservation, such as its "Sponge Cities" initiative, could provide a roadmap for Pakistan to address its water scarcity challenges. Sponge city idea can help in reducing urban flooding by implementing rain gardens, wetlands, and permeable pavements in flood-prone areas, harvesting and reusing rainwater, increasing green spaces, and eco-friendly infrastructure. This can help in building climate-resilient cities and better management of water resources.

Conclusion

As Pakistan advances into the next phase of development under CPEC 2.0, aligning economic ambitions with environmental sustainability is no longer optional, it is imperative. The country stands at a critical juncture where unchecked industrialization and infrastructure expansion could intensify existing ecological and climate vulnerabilities. However, CPEC 2.0 also presents a rare opportunity to embed green principles at the heart of Pakistan's development strategy. By learning from China's successful emissions-reduction models and embracing technology transfer in key sectors such as clean energy, electric vehicles, air quality monitoring, and waste-to-energy solutions, Pakistan can pivot toward a low-carbon, resilient growth trajectory.

Strategic investments in green infrastructure, EV charging networks,

sustainable water management, and circular economy models will not only mitigate environmental degradation but also unlock long-term socio-economic gains. Enhancing air quality monitoring, adopting carbon capture and methane reduction technologies, and modernizing waste and water systems can foster healthier cities, protect biodiversity, and promote climate resilience.

Ultimately, the success of "Greening CPEC 2.0" hinges on visionary policymaking, effective implementation, and strong bilateral collaboration. By placing environmental stewardship at the core of its development agenda, Pakistan can chart a future that is economically vibrant, ecologically sound, and socially equitable, benefiting both current and future generations.

References: Economic Survey of Pakistan; EPI; Pakistan today; PIDE; UNEP; WRI

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Understanding Türkiye's Potato Market Volatility

Explore the structural challenges and policy inertia affecting Türkiye's potato market. Learn how climate shocks and weak support impact farmers, despite strong yield efficiency and export potential.

Mithat Direk

7/18/2025

Türkiye’s potato farmers often operate in an environment marked by persistent price volatility, unpredictable sales patterns, and erratic market fluctuations. These challenges have become more pronounced in recent years, as agricultural markets become increasingly sensitive to both local and global disruptions. However, while market fluctuations are frequently discussed, the structural issues driving these patterns such as inadequate production planning, policy inconsistencies, weak climate adaptation strategies, and unstable trade dynamics have received far less attention from policymakers and stakeholders (TÜİK, 2024).

The case of potato farming illustrates how short-term decision-making can exacerbate long-term instability. Farmers typically base their planting decisions on the previous season’s prices, which can result in overproduction during one cycle and shortages in the next. This cyclical imbalance is a classic manifestation of the Cobweb Theory in Agricultural Economics, which explains how rational but backward-looking behavior leads to persistent supply-demand mismatches and price oscillations (Tarım Ekonomisi Dergisi, 2023).

Moreover, Türkiye’s potato sector suffers from limited access to timely market intelligence and coordinated supply chain management. Farmers often lack reliable forecasts or institutional support to guide crop selection and market entry. Compounding the issue, government procurement policies are often reactive rather than strategic, and trade policies related to potato imports and exports lack long-term coherence.

Climate change has added another layer of uncertainty, altered rainfall patterns and increased the risk of pest outbreaks, which disproportionately affect perishable crops like potatoes. Yet, climate-smart technologies and adaptive extension services remain underutilized in many farming regions.

To achieve stability in potato markets, Türkiye needs a more integrated approach one that combines forward-looking production planning, strategic policy design, transparent market information systems, and climate-resilient farming support. Without addressing these core challenges, Turkish potato farmers will continue to operate in a cycle of uncertainty and economic vulnerability.

Structural Challenges in Türkiye’s Potato Market

The potato market in Türkiye is shaped by a complex interplay of production inefficiencies, climate vulnerabilities, and technological dependencies that contribute to persistent instability and underperformance. One of the most pressing issues is the recurring supply-demand mismatch. Farmers, reacting to prior-year prices, often overproduce in certain years, which leads to market saturation and plummeting prices. Conversely, cautious planting after low-price seasons can result in shortages and sharp price hikes. The lack of developed industrial processing capacity such as for frozen fries or potato chips—further limits the sector’s ability to absorb excess produce and stabilize prices (TZOB, 2023; Türkiye Tarım Kredi Kooperatifleri, 2024).

Climate and disease-related challenges also weigh heavily on productivity. Increasingly erratic weather patterns, including droughts and untimely rains, affect both planting and harvesting seasons. Additionally, outbreaks of pests and diseases, such as late blight, have led to inconsistent yields across regions. While global potato yields have generally improved, Türkiye’s average yield dropped from 38.1 tons per hectare in 2020 to 37.3 tons per hectare in 2023, signaling lagging adaptation to evolving agronomic practices (Tarım ve Orman Bakanlığı, 2024; FAO, 2024).

The country’s heavy reliance on imported seed is another bottleneck. With approximately 90% of certified seed potatoes sourced from abroad, production costs remain high and vulnerable to currency fluctuations and trade disruptions (Tohumcular Birliği, 2023). Moreover, the limited cultivation of industrial and specialty varieties, such as pink or fingerling potatoes, prevents diversification into higher-value markets (TÜBİTAK, 2024). These structural constraints demand coordinated reforms to unlock Türkiye’s full potential in potato agriculture.

Türkiye’s Position in the Global Potato Market

Türkiye occupies a unique and evolving place in the global potato market. With an average annual production of 5.3 million tons between 2021 and 2023, Türkiye ranks 15th globally in terms of total output. Interestingly, it stands 23rd in terms of cultivation area, with just over 150,000 hectares under potato cultivation highlighting its relatively efficient land use compared to global averages. Türkiye's average yield of 37.3 tons per hectare is significantly higher than the global average of 22 tons/ha and is only surpassed by top performers like the Netherlands, which achieves 50.2 tons/ha (FAO, 2024; Eurostat, 2023). This production efficiency reflects both

favorable agro-ecological conditions and improving farming practices. Additionally, a notable 11.7% rise in production during this period suggests growing industrial and domestic demand (TÜİK, 2024; Türkiye Gıda Derneği, 2024).

Trade data further underscores Türkiye's emerging potential. From 2021 to 2023, annual potato export values averaged around $45 million, with key markets including Iraq, Russia, Libya, the UAE, and the EU. In recent years, Türkiye has also expanded its presence in value-added segments. Exports of processed potato products, such as frozen fries and chips, grew by 18% in 2023 alone, reflecting a shift toward industrial diversification (İstanbul İhracatçılar Birliği, 2024). However, despite being largely self-sufficient in table potato production, Türkiye remains dependent on imported certified seed potatoes, an area of strategic vulnerability.

Globally, the EU remains the dominant exporter, with the Netherlands, France, and Germany controlling 60% of international potato trade (FAO, 2024). For Türkiye to strengthen its global competitiveness, targeted investment in seed production, processing capacity, and international marketing will be crucial.

Strategic Pathways for Stabilizing Türkiye's Potato Market

Ensuring long-term stability in Türkiye's potato sector requires a multifaceted approach that addresses both structural weaknesses and emerging opportunities. One key strategy is industrial expansion, particularly in processing facilities for chips and frozen potatoes. Investments in this area not only create value-added products but also absorb surplus harvests, stabilizing prices. For example, PepsiCo's recent investments in Türkiye significantly boosted processed potato exports by 22% in 2023, demonstrating the benefits of vertical integration (Yatırım Dergisi, 2023; Türkiye Kalkınma Bankası, 2024).

Seed sovereignty is another vital area. Currently, Türkiye relies heavily on imported certified seed potatoes, which increases production costs and external vulnerabilities. Enhancing domestic research and development, especially through institutions like TÜBİTAK's Marmara Research Center, can accelerate the breeding of disease-resistant and climate-resilient varieties suited to local conditions.

On the policy front, mechanisms like price stabilization funds, successfully implemented under India's Potato Mission, can mitigate extreme price fluctuations and provide income security to farmers. Additionally, zoning reforms that legally prioritize potato cultivation in high-potential regions would support sustainable production planning (Tarım Reformu Kanun Teklifi, 2024).

Lastly, embracing smart farming technologies offers considerable potential. Precision irrigation systems could reduce water use by up to 30%, a critical advantage in the face of increasing climate variability (DSI, 2024). Pilots using IoT-based yield monitoring in key potato-producing provinces like Konya and Niğde have already shown 15% productivity gains (TARBİL, 2023). By integrating technological innovation with institutional reform, Türkiye can build a more resilient, efficient, and competitive potato market.

Conclusion

The volatility of Türkiye's potato market stems not from random market behavior but from deep-rooted structural challenges and policy inertia. Farmers remain caught in a cycle of reactionary planting, price crashes, and unpredictable returns, all amplified by climate shocks and weak institutional support. While Türkiye has demonstrated strong yield efficiency and increasing export potential, especially in processed potato products, it continues to rely heavily on imported seeds and lacks coordinated industrial infrastructure.

Addressing these gaps requires a forward-looking strategy that integrates climate-resilient production planning, localized seed development, and smart farming technologies. Policy reforms such as zoning regulations and price stabilization mechanisms can provide a safety net for farmers and improve market predictability. Moreover, investments in value-added processing can help absorb production surpluses and boost global competitiveness.

Türkiye stands at a pivotal moment in transforming its potato sector from a volatile subsistence market to a resilient, innovation-driven industry. Without immediate and coordinated action, however, the cycle of instability will persist, undermining the livelihoods of thousands of farmers and weakening the food system's sustainability. By embracing systemic reforms and strategic investments, Türkiye can unlock its full potential and secure long-term market stability in one of its most essential crops.

References: FAO; TÜİK; Tarım ve Orman Bakanlığı; TÜBİTAK; Tarım Ekonomisi Dergisi; TZOB; Türkiye Tarım Kredi Kooperatifleri; Tohumcular Birliği; Eurostat; Türkiye Gıda Derneği; İstanbul İhracatçılar Birliği; Yatırım Dergisi; Türkiye Kalkınma Bankası; Tarım Reformu Kanun Teklifi; TARBİL

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Pakistan's Rural Youth Unemployment Crisis

Pakistan's rural youth unemployment crisis necessitates urgent, multi-faceted solutions. With 64% of the population under 30 and joblessness rates nearly double in rural areas, addressing systemic barriers may help reduce rural youth unemployment.

Aftab Karim Mengal

7/21/2025

Pakistan is facing an urgent youth unemployment crisis, with rural youth bearing the brunt of the struggle. As the country's youth bulge continues to grow, with 64% of the population under the age of 30 (Economic Survey of Pakistan, 2023), the lack of job opportunities has evolved into a multi-dimensional challenge that threatens economic growth, social stability, and long-term development. While unemployment is a national concern, its impact is disproportionately felt in rural areas, where young people face significantly more obstacles to employment than their urban counterparts. Even when rural youth attain comparable levels of education, they are less likely to find stable, formal jobs due to a combination of geographic isolation, weaker infrastructure, limited vocational training opportunities, and fewer networks for employment referrals.

Recent evidence from the Pakistan Labour Force Survey (2022–23) and the Household Integrated Economic Survey (HIES 2023) reinforces these concerns. Youth unemployment in rural areas stands at 18.1%, nearly twice the urban rate of 9.8%. Alarmingly, even university-educated rural youth experience an unemployment rate of 14.5%, compared to 7.2% among their urban peers. This data underscores the limits of education alone in solving the employment gap and suggests the need for more comprehensive, place-based strategies. Digital exclusion is another critical barrier: only 28% of rural households have internet access (PTA, 2023), cutting off rural youth from the digital economy, remote work, and online skill-building opportunities. These stark disparities point to deeply rooted structural issues that require multi-sectoral policy interventions. Closing the urban-rural employment gap will depend on targeted investments in digital infrastructure, rural enterprise development, vocational training tailored to local economies, and inclusive labor market reforms. Without urgent action, Pakistan risks alienating a vast and vital segment of its population, its rural youth who hold the key to a more resilient and inclusive future.

Why Rural Youth Struggle to Enter the Workforce in Pakistan

Despite progress in education and infrastructure, rural youth in Pakistan continue to face a multitude of barriers that prevent them from meaningfully participating in the job market. One major hurdle is the mismatch between education and employment outcomes. While higher education may improve job prospects in theory, many rural students graduate without access to career counseling or industry-aligned curricula. Schools rarely provide job guidance, and outdated syllabi do not equip students with market-relevant skills. Compounding this is the lack of professional networks; unlike their urban counterparts, rural youth often rely on informal contacts, which limits access to non-agricultural and formal employment.

The scarcity of vocational training further compounds the problem. Only 12% of rural youth have access to formal skill-building programs, in stark contrast to 34% in urban centers (ILO, 2023). Vocational institutes are concentrated in urban areas, leaving rural communities underserved and unprepared for modern, skill-intensive jobs.

For rural women, the barriers are even more severe. Cultural norms, safety concerns, and a lack of supportive infrastructure such as safe transport and childcare mean female labor force participation remains shockingly low at just 18%, compared to 32% in urban areas (LFS, 2023).

Meanwhile, the growing digital divide is reinforcing economic exclusion. More than 70% of rural youth lack digital literacy, cutting them off from e-learning platforms, remote work, and gig economy opportunities (GSMA, 2023). Without internet access and digital skills, they are increasingly locked out of the modern job market. Addressing these intersecting challenges is essential to unleashing the full potential of Pakistan's rural youth.

What the Data Tells Us About Rural Youth Unemployment

The most recent statistical analysis of youth unemployment in Pakistan provides powerful, data-driven insights into the structural challenges rural youth face. A logistic regression analysis using 2023 data from the Pakistan Bureau of Statistics (PBS) reveals that rural youth are 65% more likely to be unemployed than their urban peers, even when they hold similar educational qualifications. While education helps, each additional year of schooling reduces unemployment odds by 11%, location bias continues to disadvantage rural graduates who lack access to job markets, professional networks, and career infrastructure.

The data further shows that vocational training significantly improves employment prospects, reducing the risk of unemployment by 40%. However, rural youth remain underrepresented in such programs due to accessibility and affordability challenges. Gender disparities are also stark: young rural

women are 50% more likely to be unemployed than rural men, pointing to entrenched cultural, infrastructural, and policy-related barriers that restrict their economic participation.

These insights call for urgent and targeted policy responses. Expanding vocational and technical training into rural areas is critical. Mobile training units and industry partnerships can ensure that programs are relevant and accessible. Bridging the digital divide by subsidizing internet access and promoting digital literacy can empower rural youth to access remote work and online learning opportunities.

To promote female workforce participation, flexible work arrangements, safe transportation, and childcare services must be integrated into rural employment strategies. Additionally, creating local career hubs and linking them with employers will enhance job matchmaking. Supporting youth-led agribusinesses with microloans and incubators can also drive rural entrepreneurship.

The message is clear: without bold policy interventions rooted in data and equity, Pakistan risks squandering the potential of its largest demographic. It's time to transform statistics into strategies for inclusive rural prosperity.

Conclusion

Pakistan's rural youth unemployment crisis demands urgent, multi-faceted solutions. With 64% of the population under 30 and rural joblessness nearly double urban rates (18.1% vs. 9.8%), systemic barriers such as limited vocational training, digital exclusion, and gender disparities are stifling economic potential. Education alone cannot bridge this gap; rural graduates still face 14.5% unemployment due to weak job networks and skill mismatches.

The data is clear: vocational training reduces unemployment by 40%, yet only 12% of rural youth access such programs. Meanwhile, the digital divide locks out 70% of rural youth from online opportunities, and cultural constraints suppress female workforce participation to just 18%. To unlock rural potential, Pakistan must: Expand vocational training through mobile skill centers and industry partnerships; bridge the digital gap with affordable internet and digital literacy programs; Empower rural women via safe transport, childcare, and remote work options; and strengthen local job ecosystems with career hubs and youth entrepreneurship support.

Without decisive action, Pakistan risks wasting a generation's potential. By investing in rural youth today, the country can transform them into tomorrow's innovators, entrepreneurs, and drivers of inclusive growth.

References: Pakistan Bureau of Statistics; World Bank; ILO; PTA; UNDP; Economic Survey of Pakistan; Labour Force Survey; HIES; LFS; GSMA

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Private Sector Investment in Agriculture Opportunities

Explore the dual nature of private sector investment in agriculture for developing economies like Pakistan. Discover how it can modernize farming, enhance incomes, and improve market linkages while addressing challenges such as marginalization of smallholders and food sovereignty.

Afeera Kashif

7/30/2025

Agriculture remains a cornerstone of economic stability in developing nations, contributing 23% to Pakistan's GDP and employing 37.4% of the labor force (World Bank, 2023). Historically characterized by smallholder-driven production and reliance on government subsidies, the sector is undergoing a significant transformation. A surge in private sector investment, spurred by population growth, shifting dietary preferences, agri-tech innovation, and the urgent need for climate adaptation, is reshaping agricultural value chains across the Global South.

In 2022 alone, global agri-food investments totaled $51.5 billion, with private equity and venture capital accounting for a growing share (AgFunder, 2023). These investments are increasingly directed toward precision agriculture, digital farming platforms, climate-resilient seed technologies, and post-harvest infrastructure. For Pakistan, where agricultural productivity remains below potential and post-harvest losses exceed 30% in some crops, such capital injection could catalyze modernization and unlock new markets.

However, the influx of private capital is not without concerns. Evidence from regions such as Sub-Saharan Africa and Southeast Asia highlights risks including land grabs, water overuse, biodiversity loss, and the marginalization of smallholders in favor of large-scale agribusinesses. Corporate monopolization of seeds, inputs, and data platforms could further entrench inequalities and reduce farmers' autonomy. These challenges underscore the need for robust regulatory frameworks and inclusive investment models.

This article examines both the opportunities and risks of private sector participation in agriculture, drawing on emerging data and relevant case studies. It argues for a balanced approach that aligns private investment with public policy goals, particularly food security, environmental sustainability, and equitable rural development. Policy recommendations include blended finance models, public-private partnerships (PPPs), farmer cooperatives, and enforceable environmental and social safeguards. Ultimately, the goal is to leverage private capital not just for profit, but to build a resilient, inclusive, and sustainable agricultural future for Pakistan and other developing economies.

Unlocking Agricultural Growth: The Promise of Private Sector Investment

Private sector investment in agriculture is emerging as a powerful catalyst for growth and modernization in developing countries. One of the key benefits is capital inflow into critical infrastructure such as irrigation systems, storage facilities, and transport logistics, areas often underfunded by public budgets. In India, private-led cold chain development has cut post-harvest losses in perishables by 30% (FAO, 2022), while in Kenya, warehouse investments backed by the private sector boosted smallholder market access by 40% (IFC, 2023). Beyond infrastructure, technology transfer has been transformative. Agri-tech innovations like drones, remote sensors, and Internet-of-Things (IoT) devices have increased crop yields by 15–25% globally (McKinsey, 2023). Mobile-based platforms such as Esoko in Ghana offer real-time weather, pricing, and extension advice, which raised farmer incomes by 20% (GSMA, 2022).

Private investment also enhances value chain efficiency and market connectivity. Contract farming arrangements, such as Nestlé's dairy partnerships in Pakistan, offer farmers reliable buyers and fair pricing, while ensuring supply chain consistency for corporations (ILO, 2023). In addition, agro-processing zones and rural agribusiness parks have proven effective in creating rural employment. Bangladesh and Vietnam's private-sector-driven agri-parks have generated over 500,000 jobs, supporting inclusive economic development (World Economic Forum, 2023).

Crucially, sustainability is increasingly a priority. With climate change threatening agricultural resilience, the private sector has stepped up, channeling $14.6 billion globally into regenerative and climate-smart farming practices in 2023 alone (Climate Bonds Initiative, 2024). These include investments in soil health, carbon farming, drought-tolerant crops, and low-emission technologies. By aligning profitability with sustainability, private capital can support long-term environmental goals.

Taking together, these trends demonstrate the transformative potential of private investment in agriculture. If guided by inclusive policies, it can help modernize farming, enhance rural livelihoods, and build climate-resilient food systems.

Balancing Profit and Equity: The Risks of Private Sector Investment in Agriculture

While private sector investment offers numerous benefits for agriculture, it also introduces significant risks that can

undermine equity, sustainability, and food sovereignty if not carefully managed. One of the most pressing concerns is land grabbing and community displacement. Since 2000, over 50 million hectares of farmland in Africa have been acquired by foreign investors, often displacing indigenous communities without fair compensation (Land Matrix, 2023). In Pakistan's Punjab region, large-scale corporate sugarcane plantations have ignited disputes over water rights, leaving local farmers marginalized (HRW, 2022).

Smallholder farmers, who form the backbone of rural economies, are frequently excluded from modern supply chains. In India, 80% of small farmers remain outside high-value markets due to scale and quality demands (Oxfam, 2023), while in Latin America, exploitative contracts have trapped farmers in cycles of debt (World Bank, 2023). Environmental degradation is another serious risk, with palm oil expansion in Indonesia causing the deforestation of 3 million hectares (WWF, 2023), and unsustainable fertilizer use degrading 27% of Pakistan's cotton-growing lands (PCRWR, 2023).

Moreover, investor short-termism and market volatility can destabilize rural livelihoods. In East Africa, corporate withdrawal during droughts left farmers without buyers or market access (UNDP, 2023). The consolidation of agricultural inputs, such as seeds, further compromises food sovereignty, four corporations currently control 60% of the global seed market, curbing farmer choice and genetic diversity (ETC Group, 2023).

To mitigate these risks, robust policy frameworks and governance mechanisms are vital. Pakistan's new Land Reform Act (2024) aims to restrict exploitative leasing practices, while ESG compliance standards for agri-investors, such as those adopted by the EU, promote ethical investment. Inclusive public-private partnerships, cooperative business models, digital credit systems, and blockchain-based accountability tools are key to ensuring that private sector engagement contributes to sustainable and equitable agricultural transformation.

Conclusion

Private sector investment in agriculture presents both a powerful opportunity and a complex challenge for developing economies like Pakistan. On one hand, it offers critical capital, technological innovation, and improved market linkages that can modernize agriculture, reduce post-harvest losses, and enhance farmer incomes. Investments in infrastructure, digital agriculture, and climate-smart solutions demonstrate how private capital can drive growth while addressing environmental and productivity concerns. On the other hand, without proper safeguards, such investments risk marginalizing smallholders, displacing communities, and undermining food sovereignty.

Evidence of land grabbing, environmental degradation, and market exclusion underscores the need for deliberate and inclusive governance. To ensure that private investment contributes to long-term development rather than short-term profit, Pakistan must strengthen regulatory frameworks, enforce ESG compliance, and promote inclusive business models. Public-private partnerships, digital empowerment, and farmer cooperatives can serve as key vehicles for equitable growth.

With strategic oversight, the private sector can complement public efforts, helping to build a resilient, inclusive, and climate-adaptive agricultural economy. The challenge ahead is not whether to invite private capital into agriculture, but how to channel it responsibly for the benefit of farmers, ecosystems, and national food security. A balanced, policy-driven approach will be essential to transform this opportunity into lasting progress.

References: AgFunder; FAO; IFC; Land Matrix; World Bank; McKinsey; GSMA; ILO; World Economic Forum; Climate Bonds Initiative; Land Matrix; HRW; Oxfam; PCRWR; WWF; ETC Group; UNDP

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Turkey's Food Resilience Post Russia Ukraine War

The Russia Ukraine war highlighted vulnerabilities in global food systems, especially for countries like Türkiye. Discover how Türkiye's adaptive strategies, including boosting domestic production and diversifying imports, are strengthening food sovereignty amidst market volatility.

Mithat Direk

8/1/2025

Thomas Robert Malthus, the 18th-century English economist, famously posited that unchecked population growth would surpass food production, triggering famine and societal collapse. While his dire predictions were tempered by technological advances and global trade, modern crises are reviving his thesis in new contexts. The Russia-Ukraine war has exposed vulnerabilities in global food systems, especially for import-dependent nations. Türkiye, despite being among the world's top ten agricultural producers, has faced unique challenges and opportunities in navigating this turbulent landscape.

As of 2024, Türkiye remains highly reliant on imports for key staples such as wheat and sunflower oil, with Russia and Ukraine supplying over 70% of its wheat imports and nearly 80% of sunflower oil (FAO, 2023). The war severely disrupted these supply lines, triggering short-term price hikes and public anxiety. However, Türkiye's response highlights the importance of proactive policy and strategic diversification. The government expanded procurement from alternative markets like Kazakhstan and Romania, while accelerating domestic production incentives under its "Agricultural Mobilization Plan."

In parallel, Türkiye has invested heavily in grain storage infrastructure, smart irrigation systems, and farmer subsidies to reduce dependency on volatile import markets. Urban agriculture initiatives in Istanbul and İzmir, along with renewed focus on agroecology, signal a shift toward long-term food sovereignty. Moreover, Türkiye leveraged regional diplomacy to secure food corridors through the Black Sea, mitigating the worst effects of the crisis.

Thus, while the geopolitical crisis echoed Malthusian concerns, Türkiye's adaptive strategies demonstrate that resilience is not solely about abundance, but about flexibility, innovation, and policy foresight. Rather than validate Malthus, the current moment reaffirms that food security in the 21st century depends on both local capability and global agility.

Türkiye's Agricultural Adjustments After the Russia-Ukraine Conflict

The Russia-Ukraine war disrupted global agricultural trade flows, particularly in oilseeds and grains, triggering serious repercussions for import-reliant countries like Türkiye. However, the post-conflict period has also revealed Türkiye's capacity to respond strategically to ensure food system resilience and economic stability.

One of the earliest impacts was felt in the oilseed sector, especially sunflower oil, where Russia and Ukraine previously accounted for nearly 80% of global exports (USDA, 2022). In 2021, Türkiye sourced over 60% of its sunflower oil imports from these countries (TÜİK, 2022). The war led to immediate price hikes and bottlenecks. However, Türkiye managed to soften the blow through existing domestic production of oilseeds like olives and soybeans. According to FAO (2023), Türkiye's vegetable oil sufficiency ratio averaged 108% from 2020 to 2023, supported by increased olive oil production. The implementation of the "National Oilseed Strategy" in 2022 further incentivized local oilseed cultivation, leading to a 22% reduction in sunflower oil imports by 2023 (TÜİK, 2024).

Grain, particularly wheat, presented a more challenging scenario. Despite being among the world's top wheat producers, Türkiye is also its largest wheat importer, historically depending on Russia and Ukraine for 70% of imports (ITC, 2022). In 2023, domestic wheat production reached 20 million tons, while consumption exceeded 25 million tons (TMO, 2024). Consequently, grain self-sufficiency fell to 92%, down from 96.5% in 2019 (TÜİK, 2024). To address this vulnerability, Türkiye took strategic steps to diversify import sources, bringing in supplies from Kazakhstan and Brazil, and launched expansive irrigation and yield-enhancement projects under the 2023 "Agricultural Mobilization Program." These adaptive shifts underscore Türkiye's growing emphasis on food sovereignty, strategic resilience, and sustainable agricultural development in a volatile global landscape.

Beyond Malthus: Türkiye's Food Security in the Age of Global Interdependence

While Thomas Malthus's 18th-century warnings about population growth outpacing food supply continue to influence discourse, modern data paints a different picture. Today, global agricultural output is more than sufficient to feed the world's population; the FAO estimates that global food production can nourish over 10 billion people, far more than the current 8 billion (FAO, 2023). For Türkiye, the issue is not absolute food scarcity but rather vulnerabilities tied to geopolitical, structural, and market-related factors.

Türkiye's food security challenges during and after the Russia-Ukraine war highlight the pitfalls of global dependency. Disruptions to the Black Sea grain corridor, compounded by

speculative trading in commodity markets, drove food inflation to a staggering 65% in 2023 (TCMB, 2024). Additionally, domestic inefficiencies such as poor storage infrastructure and post-harvest handling losses, estimated at 15% of total agricultural output (TÜİK, 2023), exacerbated consumer price volatility and supply constraints.

Addressing these challenges requires a strategic pivot. First, Türkiye must accelerate domestic grain production by investing in high-yield, climate-resilient wheat varieties and expanding the use of precision agriculture technologies to boost productivity and efficiency. Second, the Turkish Grain Board (TMO) should enhance national food reserves, targeting a buffer stock that covers at least six months of national consumption to cushion future supply shocks. Third, Türkiye should deepen its collaboration within the Organization of the Black Sea Economic Cooperation (BSEC), fostering regional trade stability and coordinated food security strategies.

In essence, Türkiye's food security does not require a retreat into isolation but rather smarter integration, one that builds internal capacity while leveraging regional and global partnerships. This approach not only rebuts Malthusian anxieties but also charts a path for sustainable and resilient food systems in an interconnected world.

Conclusion

The Russia–Ukraine war served as a stark reminder of the fragility of global food systems and the risks inherent in commodity dependency, particularly for countries like Türkiye. While initial disruptions in sunflower oil and wheat imports triggered inflation and market volatility, Türkiye's adaptive response demonstrated the power of policy foresight and agricultural resilience. Through domestic production incentives, diversification of import sources, investment in irrigation infrastructure, and regional trade diplomacy, Türkiye has taken concrete steps to mitigate external shocks and strengthen its food sovereignty.

Crucially, the crisis did not confirm Malthusian fears of absolute scarcity but highlighted structural inefficiencies, speculative pricing, and logistical disruptions as the real threats to food security. Türkiye's case illustrates that national food resilience hinges not only on production volumes but also on infrastructure, governance, and global cooperation. With continued investment in precision farming, post-harvest systems, and strategic reserves, Türkiye can transform its agricultural vulnerabilities into long-term strengths.

Rather than retreating from global markets, Türkiye's path forward lies in building smarter, more diversified interdependencies while bolstering local capacities. In doing so, it can serve as a model for other import-reliant nations navigating a complex, interconnected, and increasingly uncertain agricultural future.

References: FAO; TÜİK; USDA; TCMB; TMO; TCMB

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Nature-Based Solutions for Climate Resilience in Pakistan

Explore how nature-based solutions (NBS) empower Pakistan's rural communities by enhancing climate resilience and promoting ecological sustainability. Discover effective strategies like agroforestry, restoration, traditional water conservation systems, etc.

Naeem Ali Bhatti

7/2/2025

As climate change intensifies, rural communities in Pakistan particularly in vulnerable districts like Naushahro Feroze, Sindh are increasingly exposed to environmental stressors such as rising temperatures, erratic rainfall patterns, water scarcity, soil degradation, and biodiversity loss (World Bank, 2023). These climate-induced pressures pose a serious threat to agrarian livelihoods, which remain the backbone of rural economies and support over 65% of the local population (UNDP, 2023). Traditional farming systems, already constrained by limited infrastructure and financial resources, are now facing unprecedented climate variability that undermines food security and economic well-being.

In this context, nature-based solutions (NbS) present a transformative approach to building resilience. These solutions involve the sustainable management and restoration of natural ecosystems to address socio-environmental challenges, including climate adaptation, disaster risk reduction, and sustainable agriculture. Importantly, NbS are rooted in local context and knowledge systems, making them inherently inclusive and community driven.

For example, agroforestry, integrating trees with crops and livestock, can help sequester carbon, regulate water cycles, and provide diversified income streams. Similarly, restoring mangroves and wetlands in flood-prone regions can reduce disaster risks while supporting fisheries and livestock. Rainwater harvesting and regenerative farming techniques also help improve water retention and soil health, increasing productivity under changing climate conditions.

Engaging communities especially women and youth in designing and implementing NbS is essential for success. By combining indigenous knowledge with modern environmental science, rural populations can take ownership of their adaptation strategies, enhancing both ecological integrity and social equity.

Scaling up NbS in Pakistan will require policy support, financial incentives, and capacity building at the local level. Donor agencies, government departments, and civil society must collaborate to mainstream NbS into national climate resilience planning. Done right, nature-based solutions can secure sustainable rural livelihoods while restoring Pakistan’s ecological balance.

Harnessing Nature-Based Solutions for Sustainable Rural Development

Nature-Based Solutions (NbS) are increasingly recognized as effective, low-cost tools for tackling environmental, economic, and social challenges. According to the International Union for Conservation of Nature (IUCN, 2023), NbS are “actions to protect, sustainably manage, and restore natural or modified ecosystems to address societal challenges while benefiting biodiversity and human well-being.” In the context of Pakistan’s rural landscape, NbS are especially critical due to the intertwined challenges of climate vulnerability, biodiversity loss, and agricultural degradation.

Key NbS strategies gaining traction in Pakistan include agroforestry, wetland restoration, sustainable grazing, and community-managed forests. Agroforestry, integrating trees with crops, enhances soil fertility, improves microclimates, and provides farmers with additional sources of income such as fruits, timber, or fodder. Wetland restoration helps mitigate floods and recharges groundwater aquifers, which are critical for both agriculture and household use. Sustainable grazing in arid zones helps reverse desertification trends, while community-managed forests strengthen local ownership and restore biodiversity.

Rural communities are central to the success of these solutions. Despite their ecological significance, these areas remain underfunded and overlooked in national policy frameworks (FAO, 2023). For instance, in Sindh, agriculture accounts for 23% of provincial GDP (PBS, 2023), yet traditional practices continue to deplete resources. By contrast, NbS approaches offer tangible benefits: regenerative farming methods have increased yields by up to 30% in pilot sites (WWF, 2023), while climate-smart irrigation techniques like drip systems have reduced water use by 40–60% (ICIMOD, 2022).

Moreover, NbS unlock new economic opportunities. From eco-tourism and organic farming to carbon credit markets, rural households can diversify income while conserving their natural capital. Equally important is the preservation of indigenous biodiversity, including native crops that are more resilient to local climatic conditions. With inclusive implementation, NbS can drive environmental recovery, economic growth, and community resilience across Pakistan’s rural heartlands.

Indigenous Wisdom and Local Success

Indigenous knowledge forms the cornerstone of effective Nature-Based Solutions (NbS) in Pakistan. For generations, rural communities have practiced sustainable land and water management techniques that closely

mirror modern NbS frameworks. These time-tested methods are not only culturally relevant but also environmentally sound and economically viable.

For instance, the ancient *Karez* system in Balochistan, a network of underground tunnels that transports water from aquifers, has sustained arid agriculture for centuries. Similarly, traditional practices like crop rotation and intercropping help maintain soil fertility and manage pests without synthetic inputs. Seed banking, a widespread practice among rural women, ensures the preservation of hardy, drought-resistant crop varieties vital in the face of climate change. A 2023 study conducted in Naushahro Feroze (Sindh Agriculture University) revealed that farmers employing indigenous water conservation techniques were 50% less vulnerable to droughts compared to others using conventional irrigation.

Several successful NbS projects across Pakistan exemplify how indigenous practices and local ownership yield tangible results. In the Thar Desert, communities revived *beris* (traditional wells) and constructed small-scale rainwater harvesting ponds, improving water access by 60% across 15 villages (UNDP, 2022). In Gilgit-Baltistan, reforestation initiatives using native juniper and willow species have curbed erosion by 25% and enhanced local biodiversity (IUCN, 2023). In southern Punjab, smallholder farmers shifting to agroecology through composting and crop diversification have reported income gains of 20–35% (FAO, 2023), alongside healthier soils and reduced chemical use.

These examples demonstrate that NbS, when rooted in indigenous knowledge and local leadership, are more likely to succeed and scale. Recognizing and formalizing these community-led efforts in national policy can bridge the gap between tradition and innovation. By supporting rural wisdom with technical guidance and institutional support, Pakistan can build a resilient agricultural future anchored in its cultural and ecological heritage.

Policy Recommendations for Scaling Nature-Based Solutions in Pakistan

Nature-Based Solutions (NbS) offer a transformative path for climate adaptation, biodiversity restoration, and rural resilience. To realize their full potential across Pakistan, policymakers must pursue a multi-tiered strategy that includes fiscal incentives, capacity building, institutional integration, and localized implementation.

First, incentivizing regenerative agriculture is essential. The government should expand subsidies for organic fertilizers, composting practices, and drought-resistant seed varieties that improve soil health and reduce dependency on chemical inputs. Additionally, a national carbon credit framework could reward smallholder farmers for adopting climate-positive practices such as agroforestry, cover cropping, and reduced tillage. These incentives would not only drive sustainable land use but also open new income streams for rural communities.

Second, strengthening local capacity is vital for embedding NbS into everyday agricultural practices. Establishing farmer field schools focused on NbS such as water harvesting, intercropping, and soil restoration can facilitate knowledge transfer. Equally important is empowering women in conservation, especially through initiatives like kitchen gardening, medicinal plant cultivation, and traditional seed preservation, which enhance food security and biodiversity at the household level.

Third, Pakistan must invest in ecosystem restoration. The successful mangrove replanting in coastal Sindh, which currently sequesters 142,000 tons of CO_2 annually (WWF, 2023), should be expanded. Similarly, reviving Indus River floodplains can act as a natural buffer against floods, while replenishing groundwater and supporting fisheries.

Finally, integrating NbS into national and provincial climate frameworks will provide policy coherence and funding pathways. Pakistan's updated Nationally Determined Contributions (NDCs) should explicitly prioritize NbS as key climate adaptation strategies. The formation of provincial NbS task forces will ensure that these strategies are context-specific, inclusive, and responsive to local ecological conditions.

Conclusion

Nature-Based Solutions (NbS) present a critical pathway for building climate resilience, ecological sustainability, and inclusive economic growth in Pakistan's rural communities. As demonstrated through successful local case studies and rooted indigenous practices, NbS offer practical, low-cost strategies to address complex challenges such as drought, land degradation, and biodiversity loss. Whether through agroforestry, wetland restoration, or traditional water conservation systems, these approaches harness the power of ecosystems while empowering rural populations especially women and youth as stewards of change.

What makes NbS especially powerful is their adaptability and scalability. From Sindh's water-scarce villages to Gilgit-Baltistan's erosion-prone mountains, communities are already proving that NbS can deliver tangible results when grounded in local knowledge and supported by targeted policy and financing. With appropriate incentives, capacity building, and institutional support, these efforts can be amplified nationwide.

To truly transform Pakistan's climate adaptation and rural development agenda, NbS must be formally embedded into national and provincial planning processes. Prioritizing ecosystem restoration, enhancing community-led conservation, and investing in NbS-related education and training will help unlock Pakistan's vast natural and human capital. In doing so, the country can move beyond reactive strategies and embrace a sustainable, nature-positive development model that benefits both people and planet for generations to come.

References: FAO; ICIMOD; IUCN; Pakistan Bureau of Statistics; UNDP;World Bank; WWF; Sindh Agriculture University

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Empowering Rural Youth with Climate-Smart Agriculture

Discover how climate-smart agriculture (CSA) empowers rural youth in Sindh, addressing climate challenges and unemployment. Learn about sustainable practices like drip irrigation and agroforestry that enhance productivity and ensure food security.

Qadir Bux Aghani

7/7/2025

Sindh, Pakistan's second-largest agricultural province, contributes 23% of the nation's total crop output (Pakistan Economic Survey 2023–24). Yet, it faces a mounting dual crisis: climate-induced stress and rising rural youth unemployment. Over the past decade, erratic weather patterns, rising temperatures, shifting monsoons, and increasing soil salinity, have caused a 15% decline in agricultural productivity (World Bank, 2023). These environmental shocks not only threaten food security but also undermine the livelihoods of millions dependent on agriculture.

Parallel to these challenges, youth in rural Sindh face significant economic exclusion. Over 35% of individuals aged 15–24 is either unemployed or underemployed, many lacking accesses to vocational training, land, or credit (ILO, 2024). The resulting frustration has triggered increased rural-to-urban migration, further depopulating villages and straining urban infrastructure. However, this trend also presents an opportunity: rural youth, if equipped with the right skills and tools, can become the driving force behind a climate-resilient agricultural transformation.

Climate-smart agriculture (CSA) offers a viable solution. CSA practices including drip irrigation, heat-tolerant seed varieties, agroforestry, and digital farm monitoring enhance productivity while conserving natural resources. Training rural youth in CSA methods can bridge the skills gap, foster entrepreneurship, and promote sustainable farming models adapted to Sindh's changing climate. Community-led agri-hubs, mobile-based extension services, and school-to-farm vocational programs can be instrumental in this transformation.

By investing in youth-focused CSA initiatives, policymakers and development partners can simultaneously address ecological vulnerability and economic marginalization. Such efforts would not only mitigate the impacts of climate change on agriculture but also create dignified livelihoods for the next generation of farmers. Empowering youth in Sindh with climate-smart tools and knowledge is not merely an adaptation strategy, it is an investment in the province's long-term agricultural resilience and rural prosperity.

The Urgency of Climate-Smart Agriculture in Sindh

As climate change accelerates, the urgency for widespread adoption of climate-smart agriculture (CSA) in Sindh becomes more pressing. CSA refers to an integrated approach that sustainably increases agricultural productivity, strengthens resilience to climate impacts, and reduces greenhouse gas emissions (FAO, 2023). In Sindh, where over 70% of agricultural practices still depend on flood irrigation, the region faces acute vulnerabilities due to water scarcity, erratic rainfall, and escalating soil degradation. These factors collectively threaten food security and undermine the livelihoods of millions of smallholder farmers.

The potential of CSA to reverse this trend is significant. Technologies such as drip and sprinkler irrigation drastically reduce water consumption compared to traditional methods, helping conserve a resource that is becoming increasingly scarce. The introduction of drought-tolerant and salt-resistant seed varieties tailored for Sindh's agro-climatic conditions can stabilize crop yields amid rising temperatures and declining soil health. Likewise, agroforestry, integrating trees into farming systems, not only improves soil fertility and microclimates but also provides additional income through fruits, fodder, and timber.

Evidence from pilot programs in Tharparkar and Sanghar districts shows that sustainable land management and crop diversification can reduce vulnerability to climate shocks while improving household income and food availability (UNDP, 2023). Precision agriculture, powered by satellite imaging and mobile-based advisory services, further supports informed decision-making and efficient input use, making farming more profitable and environmentally sustainable.

However, for CSA to scale effectively in Sindh, enabling policy frameworks, financial incentives, and widespread capacity building are essential. Engaging rural youth in CSA practices offers dual benefits, reviving a sector in decline while tackling rural unemployment. Ultimately, climate-smart agriculture is not just a technical solution; it is a lifeline for transforming Sindh's agriculture into a resilient, inclusive, and future-ready system.

Youth as Catalysts for Agricultural Transformation

Pakistan's rural youth, 60% of whom are under 30 (Pakistan Bureau of Statistics, 2023), represent a powerful but underutilized demographic in agriculture. Despite being increasingly tech-savvy and entrepreneurial, they face systemic barriers that discourage long-term engagement with farming. Only 5% of young farmers own land, limiting their ability to invest in or benefit from agricultural innovation. Access to affordable credit remains minimal, while most vocational training programs fail to include modules on climate-smart agriculture (CSA). Furthermore, farming

continues to be perceived as a low-income, high-risk occupation, driving rural youth toward urban migration and informal employment.

However, regional examples demonstrate that when empowered with the right tools and knowledge, rural youth can revitalize agriculture. India's National Skill Development Corporation (NSDC) found that youth trained in digital agriculture and agribusiness are 40% more likely to pursue farming careers (World Bank, 2024). Likewise, Nepal's Rural Skills Development Project led to a 25% increase in youth-led agri-enterprises (ADB, 2023), underscoring the impact of targeted interventions.

To harness this potential in Sindh, critical skills must be imparted. Digital agriculture tools such as PakAgriMarket and Farmdar can help youth access weather forecasts, input prices, and precision farming techniques in real time. Agribusiness and entrepreneurship training, particularly in value-added areas like organic processing and cooperative dairy farming, offer alternative income streams. Climate-smart technologies such as laser land leveling, solar-powered irrigation, and biofertilizers can reduce production costs and environmental harm. Equally important are leadership and communication skills that enable young people to lead community adoption of CSA through peer education and social media.

Despite progress by initiatives like the Youth Engagement in Agriculture Program (YEAP) and the Sindh Agriculture Growth Project (SAGP), gaps remain. Only 12% of rural vocational institutes currently offer CSA-related courses (PSDF, 2023). To close this gap, CSA should be integrated into school curricula and supported through public-private training hubs in underserved districts like Mirpurkhas and Larkana. Microloans and business incubators should be scaled to support youth-led agri-startups, and digital infrastructure must be expanded to ensure access to e-learning and farm advisory services. With targeted investment, rural youth can lead the transformation of Sindh's agriculture into a climate-resilient, innovation-driven sector.

Conclusion

Empowering rural youth through climate-smart agriculture (CSA) is not only an urgent response to Sindh's mounting climate and employment crisis is a strategic investment in the province's future. As agricultural productivity declines under pressure from erratic weather patterns, and youth unemployment continues to rise, CSA presents a clear pathway for sustainable development. With practices like drip irrigation, agroforestry, and digital advisory tools, CSA enhances productivity while conserving scarce resources, ensuring long-term food and income security.

Pakistan's young, rural population offers a tremendous opportunity to drive this transformation. However, realizing their potential requires systemic changes, land access, credit availability, and curriculum reform must align with evolving climate realities. Vocational programs must incorporate CSA training, while digital infrastructure should be expanded to enable precision farming. Public-private partnerships, targeted subsidies, and entrepreneurship incubators can further support youth-led agri-innovation.

When empowered with knowledge, tools, and supportive policies, rural youth can become leaders of a resilient agricultural movement. Their engagement will not only mitigate the risks posed by climate change but will also revitalize Sindh's rural economy. By prioritizing youth-centered CSA interventions today, Pakistan can build a more equitable, sustainable, and climate-resilient agricultural sector for tomorrow. The future of Sindh's food systems depends on investing in its youth, today's problem solvers and tomorrow's stewards.

References: ADB; FAO; ILO; Pakistan Economic Survey; World Bank; UNDP; Pakistan Bureau of Statistics

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Challenges to Global Food Security and Solutions

Explore the immense challenges to global food security driven by climate change, rising populations, and pest resistance. Learn how agricultural entomology plays a vital role in developing sustainable and resilient food systems.

Muhammad Hamid Bashir & Huzaifa Jamil

7/8/2025

As global populations soar and the effects of climate change become ever more unpredictable, the urgency of ensuring food security has reached unprecedented levels. The complex relationship between humans, agriculture, and the diverse insect species that interact with our crops plays a pivotal role in this global challenge. Agricultural entomology the study of insects and their interactions within agricultural systems is an indispensable field of science. It seeks to mitigate the harmful effects of pests while maximizing the contributions of beneficial insects to enhance agricultural productivity.

However, traditional pest management strategies are being increasingly undermined by a growing issue: the rise of insecticide resistance. A combination of climate change and the overuse of chemical pesticides has intensified pest resistance, threatening to destabilize food security systems worldwide. To address this, entomologists are needed more than ever to develop sustainable, evidence-based solutions. This article explores the mechanisms behind pest resistance, examines Integrated Pest Management (IPM) strategies, and highlights how the latest entomological advances are essential for protecting crops and securing food supplies for the future.

Understanding Insecticide Resistance

For decades, chemical insecticides have served as the primary line of defense against agricultural pests. While effective in the short term, this reliance has set the stage for an evolutionary arms race. Insecticide resistance occurs when pests evolve the ability to survive the toxic effects of chemicals that were once effective, undermining pest control strategies.

The genetic adaptations that drive this resistance are varied and highly effective. Insects may develop mutations that alter the target sites of insecticides in their nervous systems, or they may produce enzymes capable of neutralizing the chemicals. Some pests even exhibit behavioral changes, avoiding treated areas or selecting alternate feeding sites to minimize exposure. These mechanisms, present in a wide array of pests, create an ongoing challenge to the effectiveness of chemical treatments.

The consequences of insecticide resistance are dire. As pests evolve resistance, farmers must use higher doses of pesticides or turn to more toxic, environmentally harmful alternatives. This increases costs and contributes to environmental degradation, harming beneficial organisms such as pollinators, natural pest enemies, and soil health-promoting insects. The fruit fly *Bactrocera zonata*, for example, has developed resistance to widely used insecticides, and wheat aphids are responsible for crop losses ranging from 20% to 80%. This escalating resistance highlights the urgent need for a new approach to pest management.

Integrated Pest Management (IPM): A Holistic, Sustainable Solution

To address the shortcomings of conventional pesticide-dependent practices, Integrated Pest Management (IPM) has become a foundational strategy in sustainable agriculture. IPM is a science-based, environmentally conscious approach that manages pest populations at levels that do not cause economic harm, rather than aiming for total eradication. It combines proactive and reactive strategies rooted in ecological principles and tailored to specific crops and pest dynamics.

Effective IPM relies on several interlinked components. Prevention and suppression are prioritized to deter infestations before they begin. Continuous pest monitoring enables timely assessment of population trends and crop damage. Decision-making is guided by economic thresholds, ensuring interventions are only applied when necessary. When control is required, non-chemical methods are preferred, and pesticide use is highly selective applied only when alternatives fail and in a way that minimizes harm and delays the development of resistance. Anti-resistance practices, such as pesticide rotation, further help reduce resistance buildup, while regular evaluation allows for adaptation and improvement of control strategies.

IPM employs a variety of techniques to maintain ecological balance. Cultural methods like crop rotation, intercropping, and trap cropping reduce pest attraction. Biological control utilizes natural predators and parasites; in Pakistan, Trichogramma wasps are used against sugarcane borers, and Beauveria bassiana fungi are applied to control whiteflies and aphids. Mechanical tools like pheromone traps and insect screens provide physical barriers and have proven effective against bollworms and fruit flies. Additionally, advanced methods such as the Sterile Insect Technique (SIT), which involves releasing sterilized males to prevent pest reproduction, offer

promising results in specific pest management scenarios.

Despite its success, IPM adoption remains limited in countries like Pakistan due to labor demands and sensitivity to climatic variations. However, programs like the National IPM Program have shown impressive outcomes, including pesticide reductions of up to 87% and yield increases between 10% and 25%, underscoring IPM's value in building resilient and productive farming systems.

Entomology's Broader Role in Sustainable Food Systems

Agricultural entomology plays a vital role in advancing food security well beyond the realm of pest control. Entomologists contribute to essential ecological processes that underpin sustainable agricultural systems. One of the most critical of these services is pollination. Insects such as bees, butterflies, and moths are responsible for pollinating nearly 75% of global food crops. Protecting these pollinators is a key focus of entomological research, which includes developing strategies to enhance habitat diversity and minimize pesticide exposure during flowering periods.

Insects also contribute significantly to soil health. Species like beetles, ants, and earthworms break down organic matter, aerate the soil, and improve its structure, all of which are essential for nutrient cycling and sustainable crop production. These natural processes reduce the need for synthetic soil amendments and support resilient farming systems.

Entomology is also at the forefront of innovative solutions to reduce food waste. The use of insects such as black soldier fly larvae to convert organic waste into high-quality animal feed and organic fertilizer exemplifies how insect-based technologies are enabling circular agricultural practices. This not only reduces waste but also provides sustainable alternatives for animal nutrition and soil management.

Moreover, agricultural entomology supports economic development. Integrated Pest Management (IPM) strategies reduce farmers' dependence on expensive chemical inputs, lowering production costs. At the same time, the emerging field of insect farming is creating new rural livelihood opportunities while contributing to food and feed security. From pollination and soil fertility to waste recycling and economic empowerment, the contributions of agricultural entomology are integral to building more secure, sustainable, and efficient food systems.

The Future of Crop Protection

As agricultural technology advances, the future of pest management is moving toward more precise, efficient, and environmentally responsible solutions. Genetically modified (GM) crops, such as Bt cotton, have already transformed pest control by reducing reliance on chemical pesticides and increasing crop yields. In regions like Pakistan, insect-resistant maize varieties are being developed to address local pest pressures. However, while GM crops offer clear benefits, their deployment requires thorough ecological risk assessments to ensure long-term sustainability and minimize unintended consequences.

Emerging tools in precision agriculture are further revolutionizing pest management. Innovations like drones, remote sensing, and AI-driven monitoring systems allow for real-time pest detection and targeted interventions. These technologies improve the timing and accuracy of pest control measures, reduce the need for blanket pesticide applications, and help lower the overall environmental impact of farming operations.

Beyond existing tools, cutting-edge research is unlocking entirely new methods for pest suppression. Techniques such as RNA interference (RNAi) and CRISPR-based gene editing are being explored for their potential to disrupt pest development and reproduction at the molecular level. In parallel, strategies like mating disruption using synthetic pheromones, microbial biopesticides tailored to specific pests, and nano-formulations for more efficient pesticide delivery offer promising alternatives to conventional chemicals. Collectively, these innovations represent the next frontier in sustainable pest management.

Conclusion

The challenges to global food security are immense, driven by the combined pressures of climate change, rising populations, and pest resistance. Agricultural entomology is not just a specialized science but a cornerstone in the quest for sustainable and resilient food systems.

By advancing our understanding of insect biology and ecology, entomologists provide the knowledge needed to implement effective pest control strategies. IPM offers a balanced, sustainable approach to managing pest populations, while emerging technologies, including GM crops and precision agriculture, hold the potential to further enhance crop protection.

As the world confronts the dual challenges of feeding a growing population while protecting the environment, entomology will be critical in ensuring that food systems are both resilient and sustainable. By fostering collaboration among researchers, farmers, and policymakers, and embracing integrated pest management and innovative technologies, we can secure a future where food systems are capable of feeding generations to come.

Please note that the views expressed in this article are of the author and do not necessarily reflect the views or policies of any organization.

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Solar Tube Wells: A Smart Shift for Punjab's Rice

Explore the urgent economic and environmental benefits of transitioning to solar tube wells in Punjab's rice sector. Discover how solar irrigation reduces costs, boosts farmer income by 149%, and promotes sustainability, ensuring food and energy security for the future.

Rahman Illahi & Asghar Ali

7/15/2025

Punjab, often referred to as the agricultural backbone of Pakistan, plays a pivotal role in the nation's food production system. As the leading contributor to rice cultivation, the province accounts for approximately 75% of the country's total rice output, significantly bolstering national food security and agricultural exports (Pakistan Bureau of Statistics, 2023). Rice, Pakistan's second-largest crop after wheat, contributes around 0.6% to the national GDP and generates more than $2.5 billion annually through exports, making it a crucial driver of rural employment and foreign exchange earnings (Ministry of Commerce, 2023).

However, Punjab's rice production faces growing challenges rooted in its dependency on diesel-powered tube wells for irrigation. These systems are not only financially burdensome due to rising global fuel prices, which have surged by 35% since 2021 (IMF, 2023) but also environmentally damaging, contributing to greenhouse gas emissions and local air pollution. Additionally, maintenance and operational inefficiencies of diesel tube wells often increase production costs and lower profit margins for smallholder farmers, threatening their long-term sustainability.

Given Pakistan's high solar irradiance levels, estimated at up to 5.3 kWh/m²/day, among the highest globally (World Bank, 2023), solar-powered tube wells offer a highly feasible and environmentally sustainable alternative. The transition to photovoltaic (PV) irrigation systems could significantly reduce farmers' input costs, enhance energy independence, and lower the carbon footprint of rice cultivation. Despite the clear benefits, the widespread adoption of solar tube wells remains constrained by upfront capital costs, limited financing options, and a general lack of awareness among farmers regarding long-term economic advantages.

Considering increasing climate variability, fuel cost volatility, and the urgent need to decarbonize agriculture, scaling up solar irrigation in Punjab is no longer a matter of innovation, it is a necessity. Facilitating this transition will be critical for sustaining rural livelihoods and achieving long-term food and energy security in Pakistan.

Economic Viability of Solar Versus Diesel Tube Wells in Punjab's Rice Sector

Field-level data from 120 rice farmers across Punjab highlights a compelling economic case for transitioning from diesel-powered to solar-powered tube wells. The financial metrics indicate that solar irrigation systems offer substantial cost savings and improved profitability compared to their diesel counterparts.

Farmers using diesel-powered tube wells incur an average production cost of PKR 165,022 per acre, with irrigation alone accounting for over PKR 40,000, nearly 25% of total costs. These high operational expenses significantly reduce profitability, yielding an average net income of just PKR 27,209 per acre. The benefit-cost ratio (BCR) for diesel irrigation stands at a modest 1.16, suggesting limited economic efficiency despite an average yield of approximately 39.75 maunds per acre.

In contrast, farmers utilizing solar-powered tube wells report a much lower production cost of PKR 122,913 per acre, about 26% less than those using diesel. This cost reduction translates into a significantly higher net income of PKR 67,635 per acre, marking a 149% increase in profitability. The BCR for solar systems rises to 1.55, indicating a stronger return on investment and improved financial sustainability. Moreover, the typical payback period for solar systems ranges from 3 to 5 years, depending on system size, available government subsidies, and usage patterns.

These findings clearly establish that solar irrigation is not only environmentally beneficial but also economically advantageous. However, the primary barrier to adoption remains the steep initial investment required for installation, with system costs ranging between PKR 800,000 and PKR 1,200,000 (Pakistan Solar Association, 2023). For many smallholder farmers, this upfront expenditure is unaffordable without access to financing or subsidies. Addressing this financial constraint is essential for scaling up solar irrigation and unlocking its full potential for sustainable and profitable agriculture in Punjab.

Determinants of Solar Tube Well Adoption Among Rice Farmers in Punjab

Adoption of solar tube wells in Punjab's rice-growing regions is shaped by a complex interplay of socioeconomic, informational, and institutional factors. A multivariate analysis reveals that farmers' education and awareness levels are among the most significant predictors. Those with formal education beyond secondary level are 2.3 times more likely to adopt solar technology, owing to their greater access to information, risk assessment skills, and openness to innovation (IFPRI, 2022).

Peer influence and digital exposure also play a growing role. Social media platforms such as WhatsApp and

YouTube are increasingly used to share success stories and tutorials, boosting adoption likelihood by up to 40% (LUMS AgriTech Report, 2023). These platforms reduce informational asymmetries and build trust through community testimonials.

Interestingly, the analysis identifies a "farm size paradox." Large-scale landowners (20+ acres) are often less inclined to transition to solar despite their financial capacity. Their reluctance stems from existing investments in efficient diesel infrastructure and the perceived long payback period of solar systems. In contrast, small and medium-scale farmers show greater interest but face financial constraints.

Indeed, lack of access to affordable financing remains a major bottleneck. Only 12% of surveyed farmers reported receiving solar-specific loans, and current subsidies cover merely 20–30% of the installation cost (State Bank of Pakistan, 2023). In addition, concerns over theft, technical malfunctions, and operational reliability during cloudy monsoon months create perceived risks that further deter adoption. Notably, minor technical issues like dust accumulation were not considered major obstacles.

To expand solar irrigation uptake, policies must address both economic and behavioral barriers. Increasing subsidies, offering low-interest green loans, and deploying demonstration farms can boost farmer confidence. Private sector involvement through leasing models and improved after-sales support, combined with regulatory oversight under Punjab's Groundwater Act 2024, can further facilitate equitable and sustainable adoption.

Conclusion

The economic and environmental case for transitioning to solar-powered tube wells in Punjab's rice sector is both urgent and compelling. With diesel-based irrigation driving up production costs and contributing to environmental degradation, solar technology presents a viable, cost-effective alternative. Empirical evidence from rice farmers across Punjab demonstrates that solar irrigation significantly reduces per-acre production costs and increases net income by 149%, while offering a higher benefit-cost ratio than diesel systems. These advantages, coupled with Pakistan's abundant solar potential, position solar tube wells as a strategic tool for enhancing agricultural resilience, lowering emissions, and achieving long-term food and energy security.

However, widespread adoption remains constrained by critical barriers, including high upfront costs, limited financing, and informational gaps. Social and behavioral factors, such as education levels and peer influence via digital platforms, also shape adoption trends. The reluctance of large landowners, along with perceived risks and inadequate subsidies, further complicates the transition.

To unlock the full potential of solar irrigation, a multifaceted policy approach is essential—one that includes enhanced subsidies, accessible green financing, public-private partnerships, and targeted farmer outreach. Without such interventions, Punjab's progress toward sustainable rice farming will remain limited. Facilitating solar adoption is not just a technological upgrade; it is a socio-economic imperative for rural prosperity and climate resilience.

References: Pakistan Bureau of Statistics; Ministry of Commerce; World Bank; IMF; IFPRI; State Bank of Pakistan; Pakistan Solar Association; LUMS AgriTech Report

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Transforming Pakistan's Dairy Sector for Growth

Explore the potential of Pakistan's dairy sector as a leader in milk production. Discover the challenges it faces, including low productivity and climate vulnerabilities, and learn how cooperative models are empowering smallholder farmers and transforming rural incomes.

Saba Adil

7/17/2025

Milk production is a vital component of global agriculture, supporting the livelihoods, nutrition, and food security of over 750 million people (FAO, 2023). Over the past few decades, global milk output has grown substantially from 522 million tonnes in 1987 to 918 million tonnes in 2023. This increase reflects not only rising demand but also improved production and market systems. Cow milk dominates global production, accounting for 82%, followed by buffalo milk at 14%. Goats contribute about 2%, while sheep and camels together provide the remaining 1% (IFCN, 2024).

South Asia, despite having relatively lower milk yields per animal, plays a pivotal role in global dairy supply, contributing approximately 25% of the world's milk. This regional strength stems from its vast population of dairy animals, supported by a deeply embedded culture of smallholder farming. The region is home to 21% of the global dairy animal population, comprising an estimated 745 million cattle, buffaloes, sheep, goats, and camels (FAO, 2023). India, Pakistan, and Bangladesh are major contributors, relying heavily on buffaloes and indigenous cow breeds adapted to local climates and fodder resources.

While productivity challenges persist due to constraints in feed, genetics, and veterinary services, the region has shown resilience through traditional knowledge, cooperative structures, and a growing interest in dairy innovation. The integration of small-scale farmers into dairy value chains has empowered rural communities, particularly women, by generating income and improving household nutrition. To further boost productivity and sustainability, South Asia must now focus on genetic improvements, climate-resilient dairy practices, and market access. As global demand for milk and dairy products continues to rise, South Asia's role will be increasingly significant in shaping the future of the dairy economy.

Pakistan's Dairy Sector: Growth, Challenges, and Regional Dynamics

Pakistan's dairy industry is a cornerstone of its agricultural economy, with livestock contributing 60.8% to the agricultural GDP and 11.5% to the overall national GDP (Economic Survey of Pakistan, 2024). It serves as a primary source of income for over 8 million rural households, highlighting its importance in rural livelihoods and food security (Pakistan Bureau of Statistics, 2023). Pakistan is currently the fourth-largest milk producer globally, with an annual output of 65.3 million tonnes (USDA, 2024), marking a remarkable growth from just 6.6 million tonnes in the 1960s.

Over the decades, milk production has steadily increased, driven by population growth, rising demand, and expanding livestock numbers. However, a gradual shift in milk composition is noticeable. In 1985-86, buffaloes accounted for 67% of total milk production, which declined to 58% by 2024, while the share of cow milk increased from 31% to 38%. This transition reflects changing preferences and evolving farm practices. Despite this growth, 97% of milk in Pakistan is still sold raw, leading to significant post-harvest losses of 15–20% due to poor handling and inadequate cold chains (LUMS, 2023).

Provincially, Punjab dominates the sector, housing 64% of the buffalo population and producing 31.5 million litres of milk annually. Sindh follows with high per capita consumption (250 kg/year), while Khyber Pakhtunkhwa and Balochistan contribute smaller shares but remain vital in local economies (Pakistan Dairy Development Company, 2024). Yet, productivity remains a critical issue average daily milk yields are only 10 liters for buffaloes and 14 liters for cows, significantly lower than the 50–60 liters seen in European and North American herds (ICAR, 2023). Addressing this yield gap through genetic improvements, better feeding practices, and modern dairy infrastructure is essential for sustaining growth and ensuring food security.

Dairy Cooperatives and the Path to Inclusive Growth in Rural Pakistan

Dairy cooperatives are transforming Pakistan's rural economy by enhancing farmer incomes, empowering women, and improving milk quality. One of the most promising examples comes from Vehari district, where Plan International Pakistan, in partnership with the Punjab Cooperatives Department, has launched targeted initiatives to modernize the dairy value chain.

The Milk Value Chain Project (MVCP), implemented across 100 villages, provided modern equipment, artificial insemination (AI) training, and veterinary services. A strong emphasis was placed on women's empowerment, with over 400 women trained in livestock management (Plan International, 2024). Alongside this, the formation of Cooperative Milk Societies helped eliminate exploitative middlemen, leading to a 30% increase in farmers' profits (Punjab Cooperatives Report, 2024). According to the Impact Assessment Report (2023), women saw a 76% rise in income, while men reported a 91% increase demonstrating

the cooperative model's broad socioeconomic impact.

The project's success is further reflected in its tangible outcomes: 33 women-led dairy enterprises were established, milk bacterial counts dropped by 40%, and over 1,200 jobs were created, including roles for drivers, milk collectors, and sales personnel.

However, challenges persist. Low productivity remains a critical issue, with the National Dairy Council (2024) advocating the promotion of high-yield breeds like Holstein and Sahiwal and expanding AI programs. Only 3% of milk is processed into UHT milk, cheese, or powder highlighting the need for investment in processing infrastructure and tax incentives (Finance Bill, 2024). Additionally, heat stress due to climate change is reducing milk yields by up to 15%, necessitating drought-resistant fodder initiatives (University of Agriculture Faisalabad, 2023).

Looking ahead, Punjab's 2025 expansion plan aims to replicate the Vehari model in 10 new districts and introduce digital milk collection systems, reducing spoilage and ensuring traceability (UNDP, 2024). These steps signal a promising future for inclusive, climate-resilient dairy development in Pakistan.

Conclusion

Pakistan's dairy sector stands at a crucial juncture rich in potential yet challenged by low productivity, poor processing infrastructure, and climate vulnerabilities. As the fourth-largest milk producer globally, the country's livestock sector contributes significantly to rural incomes, national GDP, and food security. The integration of smallholder farmers into cooperative models, as demonstrated by Plan International's success in Vehari, has shown transformative effects: improving milk quality, raising household incomes, and empowering women through enterprise development.

However, systemic issues such as high post-harvest losses, limited milk processing, and underdeveloped cold chains hinder progress. Future efforts must prioritize genetic improvements, climate-resilient fodder systems, and market-oriented infrastructure. The replication of successful cooperative models and investment in digital systems offer pathways to inclusive growth. If supported by the right policies and investments, Pakistan's dairy industry can become a model for sustainable, equitable, and climate-adaptive agricultural development in South Asia.

References: FAO; Economic Survey of Pakistan; Punjab Cooperatives Department; Plan International Pakistan; IFCN; USDA; LUMS; Pakistan Dairy Development Company; ICAR; National Dairy Council; University of Agriculture Faisalabad; UNDP

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Future of Global Food Production with Advanced Tech

Discover how advanced technologies like precision farming, AI, and biotechnology are transforming global food production. Learn how these innovations address climate change and resource scarcity while supporting smallholder farmers and enhancing agricultural efficiency.

Khadija Almas

7/24/2025

Food production is the backbone of civilization, central to economic growth, human health, and social development. Over the centuries, agriculture has transitioned from traditional subsistence methods to complex, mechanized systems capable of feeding billions. However, the current era presents an unprecedented convergence of challenges. Global population growth, expected to reach 9.7 billion by 2050, coupled with climate change, water scarcity, soil degradation, and biodiversity loss, is placing immense pressure on already strained food systems (UN DESA, 2024). These challenges demand innovative solutions that can sustainably increase food output while minimizing environmental harm.

Technology is now at the forefront of revolutionizing how food is produced, distributed, and consumed. Precision agriculture, powered by artificial intelligence (AI), drones, and satellite imagery, is enabling farmers to monitor crops in real time, apply inputs like water and fertilizer more accurately, and reduce waste. Gene-editing technologies such as CRISPR are enhancing crop resilience, nutritional value, and yields by allowing targeted genetic improvements without traditional genetic modification. Meanwhile, vertical farming is redefining urban agriculture, using controlled environments to grow food year-round with significantly less land and water. Blockchain technology is also being integrated into supply chains to ensure traceability, transparency, and food safety from production to retail. These innovations not only improve efficiency and reduce costs but also contribute to more equitable and sustainable food systems by enabling smallholders to access information, markets, and finance.

As we navigate the future of global food security, investing in agricultural technology and scaling these solutions, especially in developing countries, is vital. Bridging the digital divide and ensuring inclusive access to technological advancements will be key to transforming food production for a resilient, nutritious, and sustainable future.

Driving the Future of Sustainable Food Production

Agriculture today is more than food cultivation, it is a linchpin for global economic security, environmental sustainability, and public health. Even though over 80% of the world's food is produced by smallholder farmers, hunger still affects 828 million people globally (FAO, 2023). Compounding this crisis, agriculture is responsible for nearly 24% of global greenhouse gas emissions (IPCC, 2023), making it both a victim and driver of climate change. With the world population projected to hit 9.7 billion by 2050, food production must increase by 70%and this must be achieved without expanding farmland (World Bank, 2024). Traditional agriculture alone cannot shoulder this burden. The answer lies in scaling up technology-driven solutions that enhance productivity while preserving resources.

Precision agriculture is revolutionizing farming through data analytics. GPS-guided machinery, AI algorithms, and soil sensors allow farmers to monitor and respond to crop needs with surgical precision. John Deere’s autonomous tractors, for instance, increase planting efficiency by 20%, while drones and variable rate technologies reduce input waste by up to 40%. Robotics and drones are also solving labor shortages, automated harvesters and pesticide-spraying drones are accelerating fieldwork and minimizing chemical use.

The Internet of Things (IoT) is making smart farming a reality. Netafim’s irrigation systems, for example, cut water use by half while increasing yields. AI-equipped greenhouses adjust light, humidity, and nutrients automatically, enabling urban vertical farms like Bowery Farming to produce 30 times more food per acre. Meanwhile, apps like Plantix use computer vision to diagnose plant diseases in real time, supporting millions of smallholders with critical crop insights.

Biotechnology is transforming crop resilience. CRISPR gene editing is delivering climate-smart crops such as

drought-tolerant wheat, while Golden Rice 2.0 combats vitamin A deficiency in millions of children. Vertical and hydroponic farms are also taking root in cities, Singapore's Sky Greens grows a ton of vegetables daily using 95% less water, addressing both urban food demand and climate goals.

Unlocking the Promise of Agri-Tech: Benefits, Barriers, and the Road Ahead

The adoption of agricultural technologies is reshaping the future of farming, offering a pathway toward higher productivity, environmental sustainability, and food system resilience. Precision agriculture powered by AI is enabling farmers to double yields by making real-time, data-driven decisions on planting, irrigation, and pest control (FAO, 2024). Smart irrigation systems are conserving water on a massive scale, saving over 250 trillion liters annually by optimizing when and where water is needed (WWF, 2023). Genetically modified drought-resistant crops are already proving their worth in vulnerable regions, potentially saving up to $30 billion annually in lost crops due to extreme weather events (World Bank, 2024). Meanwhile, blockchain technology is streamlining food logistics, reducing supply chain losses by up to 20%, thus curbing food waste and ensuring greater transparency and traceability (WEF, 2023).

Despite these remarkable benefits, several challenges remain. High upfront costs often prevent smallholder farmers from accessing advanced tools, but government subsidies, cooperative leasing models, and shared machinery can mitigate these barriers. The digital divide also persists in rural areas, yet ongoing 5G expansion and the rise of low-cost IoT devices offer scalable connectivity solutions (ITU, 2024). Concerns around data privacy and GMO skepticism require targeted solutions: blockchain can secure farm data, while public education and clear labeling standards can build consumer trust in biotechnology.

Looking ahead to 2025–2030, the agri-tech landscape promises revolutionary advances. AI-driven autonomous farms, like Iron Ox's robotic greenhouses, are expected to redefine commercial agriculture with fully automated planting and harvesting. Lab-grown meat is projected to become 30% cheaper than traditional beef by 2030, offering ethical and environmental benefits (GFI, 2024). Even space farming is transitioning from science fiction to reality, NASA's Veggie system has successfully grown lettuce aboard the International Space Station, opening new frontiers for food production.

Conclusion

The future of global food production hinges on the successful integration of advanced technologies to meet the dual challenge of feeding a growing population while preserving the planet's finite resources. As climate change, resource scarcity, and demographic shifts place unprecedented strain on agriculture, precision farming, AI, robotics, IoT, and biotechnology are emerging as transformative solutions. These innovations not only enhance yields, conserve water, and reduce chemical use but also offer tailored tools to improve the resilience and efficiency of smallholder farmers, the backbone of global food supply. The adoption of CRISPR, vertical farming, and blockchain technologies reflects a paradigm shift toward smarter, climate-adaptive, and equitable food systems.

However, the road to agri-tech transformation is not without obstacles. Bridging the digital divide, reducing the cost barriers for smallholders, and addressing public concerns around GMOs and data privacy require inclusive, well-coordinated policy frameworks. Government incentives, global partnerships, and private sector innovations must work in concert to ensure access, equity, and sustainability.

With bold investments and inclusive strategies, agri-tech can deliver a future where food security, environmental stewardship, and economic prosperity go hand in hand. Harnessing these tools with urgency and foresight is essential, not just for meeting the food demands of 2050, but for building a food system that is resilient, just, and sustainable for generations to come.

References: FAO; IPCC; McKinsey; World Bank; WEF; UN DESA; WWF; ITU

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Türkiye: A Leader in Cherry Production

Türkiye is at a crucial juncture in its cherry production journey, boasting unmatched genetic diversity and favorable conditions. However, to maintain its status as a global leader, it must address persistent structural challenges.

Mithat Direk

7/25/2025

Fruit cultivation plays a vital role in Türkiye's agricultural economy, supporting livelihoods, enhancing export revenues, and contributing to sustainable rural development. Among various fruits, cherries hold a distinctive place due to Türkiye's rich genetic diversity, favorable agro-climatic conditions, and strong position in global markets. Türkiye is not only one of the world's top cherry producers but also a major exporter, with fresh cherries reaching markets across Europe, the Middle East, and Asia. The country's unique microclimates, ranging from coastal to highland areas, enable the production of cherries with excellent taste, firmness, and shelf life, meeting international quality standards.

Despite its strengths, cherry farming in Türkiye faces several persistent and emerging challenges. Climate variability including late spring frosts, hailstorms, and heatwaves threatens crop yields and quality. Market volatility, influenced by global demand fluctuations and logistical disruptions, adds uncertainty for growers and exporters. Additionally, structural weaknesses in post-harvest infrastructure, such as inadequate cold storage and packaging facilities, limit the industry's competitiveness and reduce export potential.

This report analyzes global cherry market trends, Türkiye's production and trade performance, and sector-specific challenges and opportunities. Global demand for cherries is growing, driven by consumer preference for healthy, high-value fruits. Türkiye has an opportunity to expand its market share by investing in modern production practices, cold chain logistics, and branding. Emphasis on quality certification, integrated pest management, and climate-resilient farming can further enhance competitiveness. As we look toward 2024 and beyond, strengthening farmer cooperatives, upgrading export standards, and improving digital traceability systems will be crucial for sustaining growth in the cherry value chain. With strategic planning and targeted investments, Türkiye can reinforce its leadership in the global cherry market and deliver lasting economic benefits to rural communities.

Global Cherry Market Trends and Türkiye's Position in 2024

The global cherry market continues to expand in both volume and value, fueled by rising demand for fresh, high-quality fruit in developed and emerging economies. In 2024, global cherry production is estimated at approximately 2.8 million tons annually (USDA, 2024), with Türkiye maintaining its position as the world's top producer, contributing nearly 25% of total output, around 700,000 tons. Other major producers include Chile (20%), the United States (15%), and China (12%), reflecting the geographical diversity of cherry cultivation across temperate zones.

On the trade front, Chile leads the world in cherry exports, generating $2.1 billion in revenue in 2023. The United States follows with $1.3 billion, while Türkiye ranks third with $320 million in cherry exports, a decline from $450 million in 2022, largely due to adverse weather conditions, including spring frosts (TUIK, 2024). Chile's dominance in the export market stems from several strategic advantages: its counter-season production cycle allows it to supply Northern Hemisphere markets during winter months, when local cherry supplies are unavailable. Additionally, Chile has invested heavily in cold chain infrastructure, efficient logistics, and targeted marketing campaigns that emphasize the premium quality of "Chilean Cherries."

As international markets become increasingly competitive, branding, post-harvest handling, and compliance with sanitary and phytosanitary standards are becoming key differentiators. While Türkiye has a natural edge in terms of production capacity and taste profile, it lags behind in export value due to limitations in cold storage facilities, inconsistent quality control, and weaker global branding efforts. To remain competitive and boost export earnings, Türkiye must improve its value chain particularly in packaging, cold logistics, and market positioning. The growing appetite for cherries in Asia and the Middle East also offers Türkiye an opportunity to diversify export destinations beyond traditional European markets.

Türkiye's Cherry Sector

Türkiye's cherry sector holds a distinctive place in global horticulture, rooted in its rich genetic diversity and favorable climatic conditions. Anatolia, the historical origin of sweet cherries (*Prunus avium*), hosts more than 200 native varieties, offering Türkiye's growers a unique competitive advantage. Notably, premium cultivars such as 0900 Ziraat, Napoleon, and Stark Gold are renowned for their taste, firmness, and suitability for export markets. The country's extended harvest window, from May to August, further enhances its competitiveness, enabling steady supply over four months when supported by cold storage infrastructure. Türkiye's proximity to major European markets like Germany, Russia, and the

Netherlands, which together absorb over 75% of cherry exports, underscores its logistical advantage in ensuring fruit freshness.

Despite these strengths, the sector faces several critical challenges. Climate variability, particularly spring frosts, has severely impacted production in recent years, Izmir and Manisa saw up to 90% export losses in 2023. Ongoing research at Atatürk University into frost-resistant cherry varieties using CRISPR technology signals a path forward. However, 25–30% post-harvest losses due to inadequate cold storage remain a persistent issue. To address this, the Ministry of Agriculture has initiated subsidies for pack house infrastructure.

Structural fragmentation of farms, where 85% of orchards are under five hectares, limits mechanization and economies of scale. Cooperative models, such as the Aegean Fruit Union, offer promising solutions for collective marketing and resource sharing. Meanwhile, Türkiye faces intense competition in premium export markets from Chile and the USA. Branding initiatives like " Türkiye's Cherry" could improve recognition, akin to the global success of "Chilean Cherry."

Opportunities are emerging in processed cherry products, dried, frozen, or juiced, valued at $5 billion globally. Türkiye's firms are ramping up investments in this space. Similarly, demand for organic cherries is rising, particularly in Europe, where Türkiye exported $50 million worth in 2023. Technology adoption, including AI-based yield forecasting and drone-assisted pest control, is gaining momentum, promising to increase efficiency and sustainability.

Policy Recommendations for Strengthening Türkiye's Cherry Sector

To enhance Türkiye's competitiveness in the global cherry market and support rural livelihoods, a set of targeted policy interventions is essential. One of the most pressing challenges is frost damage, which has severely disrupted production in key regions like Izmir and Manisa. The government should expand subsidies for agricultural insurance specifically tailored for cherry growers, enabling better risk management. Additionally, investment in early warning systems, based on AI and satellite weather tracking, can help farmers take preventive action before frost events occur.

Post-harvest losses, currently estimated at 25–30%, are largely due to inadequate cold chain infrastructure. To address this, the Ministry of Agriculture should initiate a national cold storage expansion strategy, aiming to increase storage capacity by at least 50% by 2026. Public-private partnerships could help accelerate this infrastructure development, especially in high-yield provinces.

Low productivity on small-scale farms is another constraint. Since over 85% of cherry orchards are under five hectares, facilitating cooperative formation through grants and offering mechanization loans for shared equipment can boost efficiency, reduce labor dependency, and raise incomes. Special credit lines through agricultural banks could support these efforts.

Finally, Türkiye must strengthen its international presence by launching a unified export branding initiative "Türkiye's Cherry" modeled after successful campaigns like "Chilean Cherry." This should involve trade expos, digital marketing, and geographic indication (GI) labeling to distinguish Türkiye's cherries in premium markets such as China, Germany, and the Gulf region. Together, these recommendations offer a roadmap for resilience, sustainability, and growth in Türkiye's cherry sector.

Conclusion

Türkiye stands at a pivotal moment in its journey as a global cherry leader. With unmatched genetic diversity, favorable agro-climatic conditions, and a strong production base, the country has all the ingredients to remain a top-tier player in the expanding global cherry market. However, realizing this potential requires overcoming persistent structural challenges. Climate shocks, post-harvest losses, and farm fragmentation continue to threaten productivity and export competitiveness. Meanwhile, the rise of Chile and the U.S. as dominant exporters underscores the urgency for Türkiye to modernize its cherry value chain.

Strategic investments in cold chain infrastructure, climate-resilient farming practices, and digital traceability are essential to minimizing losses and maintaining high-quality standards. Strengthening farmer cooperatives and providing mechanization loans can empower smallholders, enhancing yields and market access. Equally important is the development of a robust export branding strategy such as "Türkiye's Cherry" to distinguish Türkiye's produce in premium international markets.

Looking ahead, emerging opportunities in value-added processing, organic cultivation, and agri-tech adoption offer promising avenues for sectoral growth. If these pathways are supported through coherent policy action and stakeholder collaboration, Türkiye's cherry sector can thrive, delivering sustained economic gains, improved rural livelihoods, and a stronger global identity for Türkiye's horticulture.

References: TUIK; USDA; TOBB; Ministry of Agriculture; USDA; Atatürk University

Please note that the views expressed in this article are of the author and do not necessarily reflect the views or policies of any organization.

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Evolution of Pakistan's Potato Sector

Discover how the Potato Growers Co-operative Society (PGCS) in Okara has transformed Pakistan's potato sector through cooperative-led agricultural development. Explore the achievements in yield, acreage expansion, and export capacity, alongside the challenges of climate change and seed shortages.

Habiba Amjad

7/29/2025

Agriculture remains the cornerstone of Pakistan's economy, contributing 22.7% to the national GDP and providing employment to 37.4% of the labor force, as reported in the Economic Survey of Pakistan 2023–24. Among the country's major crops, potatoes hold increasing importance, not only as a food staple but also as a driver of rural livelihoods and export revenues. Globally, potatoes are the third most consumed food crop after wheat and rice, with production exceeding 400 million metric tons (FAO, 2023).

Pakistan has positioned itself among the world's top ten potato-producing nations, harvesting 5.2 million metric tons in 2023, an impressive 13% increase from 2020 (Pakistan Bureau of Statistics, 2024). Despite this growth, yields still fall short of international benchmarks, averaging around 20 MT per hectare. In contrast, countries like the Netherlands and India report yields of 45 MT/ha and 25 MT/ha, respectively (World Bank, 2023). Bridging this yield gap is critical to enhancing food security and increasing farm incomes. The Potato Growers Co-operative Society (PGCS) based in Okara, Punjab, plays a pivotal role in advancing productivity by supporting farmer training, facilitating access to high-quality seed, and promoting export-ready practices.

Potatoes contribute approximately 8% to Pakistan's horticultural GDP (PHDEC, 2023), and their export potential continues to rise. In 2023 alone, Pakistan exported 180,000 MT of potatoes to regional and international markets including Afghanistan, the UAE, and Malaysia (Trade Development Authority, 2024). On the nutritional front, potatoes provide around 10% of the daily caloric intake for rural low-income populations, making them a vital component of food security (IFPRI, 2023). With continued investment in infrastructure, extension services, and export diversification, Pakistan's potato sector is well-positioned to contribute significantly to inclusive agricultural growth and nutrition.

Empowering Potato Farmers: The Evolution and Impact of PGCS Okara

The Potato Growers Co-operative Society (PGCS), Okara, was founded in 1979 in response to the fragmented nature of potato farming, the scarcity of high-quality seed varieties, and weak market access that plagued farmers in the Punjab region. Since its inception, PGCS has grown into a transformative force in Pakistan's potato sector, driven by a vision to modernize farming practices and enhance the livelihoods of smallholder farmers. Under the dynamic leadership of Mian Muhammad Siddique (President) and Ch. Muhammad Maqsood Ahmad Jatt (Vice President & Chairman, Potato Research Board Punjab), PGCS has made remarkable progress over the decades.

Between 1990 and 2024, the area under potato cultivation in Okara expanded from 28,000 acres to 150,000 acres, making it one of the largest potato-producing districts in the country. Average yields more than doubled during this period, rising from 150 maunds per acre (approximately 6 MT/ha) to 300 maunds per acre (12 MT/ha), thanks to improved agronomic practices and widespread farmer training. Over 10,000 farmers have benefited from PGCS-led training in modern techniques such as drip irrigation and integrated pest management (IPM).

PGCS has also been at the forefront of seed innovation, introducing three high-yield, disease-resistant potato varieties in collaboration with Punjab Agricultural University. These innovations have played a critical role in increasing national potato exports by 35% since 2020 (PHDEC, 2024). Internationally, PGCS has cultivated over 15 strategic partnerships, including with Dutch agri-tech firms to pilot aeroponic seed production systems and with the World Potato Congress, where it led Pakistan's 2023 delegation and attracted $5 million in investment commitments.

PGCS's advocacy efforts have significantly shaped policy as well. It successfully lobbied for tax exemptions on potato cold storage equipment and played a central role in establishing Punjab's first Potato Research Institute in 2022. With this trajectory, PGCS continues to set a benchmark in cooperative-led agricultural development.

Overcoming Challenges and Building a Resilient Future for Pakistan's Potato Sector

As PGCS Okara advances Pakistan's potato industry, it faces a host of structural and environmental challenges. Chief among these is climate change, which has led to increased smog and fog in Punjab, causing a 20% yield decline in 2023. In response, PGCS is actively promoting the adoption of early-maturing and climate-resilient potato varieties that can be harvested before extreme weather events peak. Similarly, seed scarcity remains a persistent bottleneck, Pakistan needs over 400,000 metric tons of quality potato seeds annually, yet local production is below 15,000 MT (PARC, 2023). Only 2% of

seed in circulation is certified. To address this, PGCS is setting up tissue culture labs, offering seed subsidies to farmers, and piloting community-based seed multiplication systems. Additionally, it has advocated for the removal of import duties on certified seed varieties to bridge immediate shortfalls.

Post-harvest losses also undermine sectoral growth, with an estimated 30% of potatoes harvested spoiled annually due to inadequate storage. PGCS is facilitating the expansion of cold storage networks through government-backed subsidies and has initiated blockchain traceability pilot programs to monitor and optimize the supply chain. On the export front, phytosanitary issues have caused shipment rejections in key markets. To remedy this, PGCS is offering targeted training to farmers and exporters on meeting international phytosanitary standards and certification processes.

Looking ahead to 2030, PGCS has charted a strategic roadmap aimed at achieving long-term sustainability and value chain integration. The Society plans to establish five aeroponic seed farms to enhance domestic seed sovereignty and reduce import dependence. To boost rural income and reduce post-harvest waste, PGCS is also seeking $20 million in investment to develop value-added processing facilities for chips, starch, and frozen products. A digital transition is underway, with the planned launch of the PGCS Farmer App to provide real-time weather forecasts, market trends, and agronomic advice. Additionally, PGCS is collaborating with the International Potato Center (CIP) in Peru to introduce drought-tolerant potato varieties like Tacna, supporting climate resilience across Pakistan's potato belt.

Conclusion

The evolution of Pakistan's potato sector, driven largely by the efforts of the Potato Growers Co-operative Society (PGCS) Okara, highlights the transformative power of cooperative-led agricultural development. From expanding cultivated acreage and doubling yields to introducing seed innovations and building export capacity, PGCS has played a central role in positioning Pakistan among the world's top potato producers. Yet, significant challenges remain. Climate change, seed shortages, and post-harvest losses continue to constrain productivity and competitiveness.

Through proactive measures such as tissue culture labs, cold chain expansion, and farmer training on phytosanitary standards, PGCS is addressing these gaps with a forward-looking strategy. Its roadmap to 2030, including seed sovereignty, digital agriculture, and value-added processing, signals a bold vision for a more resilient, efficient, and inclusive potato value chain. As global demand for food rises, Pakistan's potato sector stands poised to deliver not only economic growth but also enhanced food and nutritional security.

Continued investment, policy support, and innovation will be critical in realizing this potential. PGCS offers a replicable model for other crop sectors in Pakistan and beyond, demonstrating how organized farmer communities, when empowered with knowledge, technology, and market access, can reshape the future of agriculture.

References: FAO; Pakistan Economic Survey; World Bank; PARC; Pakistan Bureau of Statistics; PHDEC; Trade Development Authority; IFPRI

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Transforming Pakistan's Agriculture with Organic Farming

Explore how organic farming can revolutionize Pakistan's agricultural sector by promoting sustainable agriculture, economic diversification, and rural upliftment. Learn about the benefits of exporting high-value organic commodities and enhancing farm profitability through eco-friendly practices.

Rawaha Fatima

7/30/2025

Organic farming, centered on natural soil fertility, crop rotation, composting, and biological pest control, has gained global momentum as a sustainable alternative to chemical-intensive agriculture. Valued at $188 billion globally and projected to grow at a 14% compound annual growth rate (CAGR) through 2030 (FiBL, 2024), organic agriculture promises both environmental restoration and market-driven economic returns. In Pakistan, however, organic farming remains marginal. With conventional farming reliant on 4.2 million tons of synthetic fertilizers annually (PBS, 2023), the sector is entrenched in practices that compromise soil health, biodiversity, and long-term productivity.

Despite this, the potential for organic farming in Pakistan is considerable. The country's diverse agro-climatic zones, rich biodiversity, and abundance of smallholder farmers offer an ideal foundation. Studies show that organic produce can fetch 20–40% higher prices in export and niche domestic markets. Moreover, lower input costs, combined with long-term improvements in soil quality and water retention, make organic farming economically viable when coupled with the right training and market linkages.

Yet, growth is hampered by significant barriers. These include the high cost of organic certification (often beyond the reach of smallholders), lack of dedicated government subsidies, weak extension services, and fragmented supply chains. Farmers also face difficulties in accessing premium markets and often lack knowledge of organic standards.

To unlock this potential, Pakistan must invest in policy reforms and public-private partnerships. These include subsidized certification programs, farmer training in organic practices, research on local bio-inputs, and support for organic cooperatives. Linking organic producers to domestic supermarkets and international buyers through digital platforms can boost trust and traceability. If backed by strategic planning, organic farming could enhance food safety, improve rural livelihoods, and position Pakistan as a serious player in the growing global organic market.

Unlocking Economic and Ecological Value: The Case for Organic Farming in Pakistan

Organic farming offers a compelling economic opportunity for Pakistan's agricultural sector. One of the key advantages lies in premium market pricing. Globally, organic produce commands 20–50% higher prices than conventionally grown crops (FAO, 2023). Pakistan has already begun to benefit from this trend, organic cotton exports reached $12 million in 2023, and prospects are bright for expanding exports of basmati rice, mangoes, and spices to high-value European Union markets, where organic imports surged to €53 billion in 2023 (Eurostat, 2024). This presents a significant window for diversifying and upgrading Pakistan's agri-export portfolio.

Beyond pricing, organic farming also delivers cost-efficiency over time. Conventional wheat cultivation in Pakistan allocates 35–40% of its expenditure to synthetic fertilizers and pesticides (PARC, 2023). Organic systems, by contrast, rely on low-cost inputs like compost, green manure, and crop rotation. After an initial transition phase of two to three years, input costs can fall by 25% or more, improving farm profitability (IFAD, 2023).

The government and civil society are beginning to support this shift. The Pakistan Organic Farming Association (POFA) now trains over 5,000 farmers annually, while Punjab's "Green Tractor Scheme" includes subsidies for bio-fertilizers and organic seed, targeting smallholders with limited capital (Agriculture Dept., 2024). These initiatives help offset initial conversion costs and build farmer confidence.

Environmental and health dividends further strengthen the economic case. Organic methods reduce agrochemical runoff, which currently costs Pakistan $1.2 billion per year in water pollution and ecosystem damage (WWF, 2023). Health-wise, reduced pesticide exposure is critical, as 250,000 Pakistani farmers suffer from related illnesses annually (WHO, 2023).

Overcoming Barriers to Organic Farming Expansion in Pakistan

Despite its potential, the organic farming sector in Pakistan faces several structural and operational challenges that hinder widespread adoption. One of the most significant hurdles is the high cost of certification. With certification expenses ranging between $1,500 and $3,000 per farm, smallholders, who dominate Pakistan's agricultural landscape, find it financially unfeasible to transition to certified organic production (POFA, 2024). This is compounded by the limited availability of certifying agencies; as of 2023, only 12 accredited certifiers operate nationwide (PSQCA, 2023), creating bottlenecks and slowing formal organic sector development.

Farmer awareness is another major issue. According to a 2023 PARC survey, 72% of Pakistani farmers are unaware of organic farming techniques or their

potential economic benefits. This knowledge gap restricts adoption and limits farmer confidence in alternative pest and nutrient management methods. Even among those adopting organic practices, weak market linkages hamper profitability. Currently, only three dedicated organic markets, located in Islamabad, Lahore, and Karachi, exist, leaving much of the country underserved. Furthermore, the absence of a cohesive national organic brand makes Pakistani exports less competitive on global shelves (Trade Development Authority, 2024).

Technical challenges also persist. Organic cotton producers, for example, have reported 30–40% yield losses due to pest attacks, largely due to limited access to bio-pesticides and resistant seed varieties (Sindh Agriculture University, 2023).

To address these challenges, Pakistan must implement a multi-pronged strategy. Policy interventions should include subsidized certification, mirroring India's approach where 50% of the cost is covered for small farms. A National Organic Policy is currently under drafting by the Ministry of Food Security (2024), which should prioritize training, market development, and export facilitation. Expanding digital platforms like Bazaar and Tajir to include organic listings and establishing regional export hubs in Sialkot and Multan can improve market connectivity. Research institutions like PARC are also developing organic pest-resistant seeds, set for rollout in 2025, alongside mobile training initiatives to boost farmer capacity.

Conclusion

Organic farming presents a transformative opportunity for Pakistan's agricultural sector, offering a pathway to sustainable production, economic diversification, and rural upliftment. With growing global demand and premium pricing for organic produce, the country stands to benefit from exporting high-value commodities such as cotton, rice, mangoes, and spices. Beyond export earnings, organic practices can enhance farm profitability through reduced input costs and long-term improvements in soil and water health.

Government and civil society initiatives, such as POFA's training programs and Punjab's bio-input subsidies, have laid a modest foundation for growth. However, systemic barriers remain, including high certification costs, limited farmer awareness, and weak market access. Addressing these requires comprehensive policy support, targeted subsidies, and stronger linkages between producers, consumers, and markets.

Public-private partnerships, digital platforms, and research investments in organic pest-resistant seeds can catalyze scale and inclusivity. If implemented strategically, organic farming can become a cornerstone of Pakistan's climate-smart, economically viable agricultural future, benefiting farmers, consumers, and the environment alike.

References: FiBL; PBS; Eurostat; PARC; IFAD; Agriculture Dept.; WWF; WHO; PSQCA; POFA; Trade Development Authority; Sindh Agriculture University; Ministry of Food Security

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Breadfruit Cultivation: A Sustainable Solution for Pakistan

Explore the transformative potential of breadfruit cultivation in Pakistan's agricultural sector. With its adaptability to climate change, high nutritional value, and environmental benefits, breadfruit is an ideal candidate

Azizullah Noondani

7/31/2025

Breadfruit (*Artocarpus altilis*) is a highly nutritious, underutilized tropical crop traditionally cultivated in Pacific Island nations and parts of Southeast Asia, where it has been a staple food for centuries (Ragone, 2011). Despite its proven value, breadfruit remains largely unfamiliar in Pakistan's agricultural and dietary landscape. However, with the escalating impacts of climate change, such as prolonged droughts, rising temperatures, and deteriorating soil fertility, breadfruit presents a timely opportunity for agricultural diversification and climate adaptation. Its remarkable tolerance to heat, low water requirements, and ability to thrive in marginal soils position as a resilient alternative to more resource-intensive crops.

Scientific interest in breadfruit has grown in recent years, particularly due to its designation as a "climate-smart crop" (Jones et al., 2022). Nutritionally, breadfruit is rich in complex carbohydrates, dietary fiber, potassium, and essential micronutrients. It is naturally gluten-free, low in fat, and versatile in culinary applications, ranging from boiling and roasting to milling into flour, which can be used in baking and infant food formulations (Liu et al., 2020). Furthermore, breadfruit trees begin bearing fruit within three to five years of planting and remain productive for decades, offering long-term food and income security. Environmentally, the crop contributes to soil health and carbon sequestration due to its extensive root system, making it compatible with agroforestry and sustainable land-use models (Zerega et al., 2015).

Preliminary field trials and climatic suitability assessments indicate that breadfruit could be introduced successfully in southern and coastal regions of Pakistan, including Sindh and Balochistan, where heat tolerance and water efficiency are vital. Integrating breadfruit into national agricultural development plans could not only support climate resilience and food security but also open new avenues for rural entrepreneurship and export diversification. As climate pressures mount, breadfruit deserves serious consideration as a future-ready crop for Pakistan.

Mapping Breadfruit's Agro-Climatic Viability in Pakistan through Climate Modeling

To assess the potential of introducing breadfruit in Pakistan, researchers applied Species Distribution Modeling (SDM), a tool used to predict suitable habitats based on key environmental parameters (Elith et al., 2011). Utilizing the MaxEnt algorithm, scientists incorporated 19 bioclimatic variables—such as mean annual temperature and rainfall—sourced from the WorldClim database. These were paired with future climate projections from CMIP6 under two Shared Socioeconomic Pathways (SSPs): SSP1-2.6 (moderate emissions) and SSP5-8.5 (high emissions), projecting scenarios for 2050 and 2070 (Fick & Hijmans, 2017). The method has proven reliable in prior assessments across Southeast Asia and Central America, demonstrating its value for guiding breadfruit expansion (Winters et al., 2023).

Application of this model to Pakistan identified coastal districts in Sindh, such as Thatta and Badin, as the most climatically suitable zones under current conditions. Additional areas, including Hyderabad and the southern Punjab districts of Multan and Bahawalpur, were also identified as viable cultivation sites. Breadfruit's ideal climatic range is 21–32°C with annual rainfall between 1500–3000 mm (Ragone, 2018), making these regions strong candidates. Under the SSP1-2.6 scenario, climate suitability may expand northward by 2050, encompassing parts of central Punjab and Khyber Pakhtunkhwa (KPK). However, the extreme heat scenario (SSP5-8.5) indicates potential yield declines in interior Sindh by 2070, necessitating adaptive strategies such as the use of shade nets and water-efficient drip irrigation (Elevitch et al., 2022).

Soil suitability is another critical factor. Breadfruit thrives in slightly acidic to neutral pH soils (6.1–7.4) that are well-drained and rich in organic matter. Importantly, its moderate salinity tolerance is advantageous in Pakistan, where over 4.5 million hectares suffer from soil salinity (PCRWR, 2023). Cultivation trials in India and Sri Lanka show that practices such as mulching, raised beds, and organic inputs can successfully mitigate salinity-related stress (Mootoo et al., 2021). Agroforestry integration further boosts resilience, offering a promising strategy for sustainable breadfruit cultivation in Pakistan.

From Research to Reality: Unlocking Breadfruit's Potential in Pakistan

To realize the benefits of breadfruit cultivation in Pakistan, a structured and phased implementation strategy is essential. The first step involves launching pilot trials in climatically suitable regions such as Thatta, Badin, Hyderabad, and Multan. These trials should closely monitor plant survival rates, yield performance, pest resistance, and farmer response. Initial findings can guide broader adaptation strategies and cultivar selection based on local conditions. Concurrently, establishing

regional nurseries is crucial to ensure a steady supply of healthy saplings, particularly given breadfruit's long growth cycle and vegetative propagation methods.

Farmer training will be central to successful adoption. Extension programs should focus on best practices in breadfruit cultivation, including intercropping methods, mulching techniques, irrigation scheduling, and organic soil enrichment. Post-harvest education, drying, storage, and processing can help farmers unlock added value through diversified product lines such as breadfruit flour, chips, or snacks. Simultaneously, efforts to develop domestic and export markets for breadfruit products will create the economic incentives needed to drive farmer adoption and investment.

Policy integration will also be vital. Breadfruit must be recognized as part of Pakistan's national climate-resilient crop portfolio, with access to government subsidies, research funding, and inclusion in agricultural extension services. Incentivizing agroforestry programs that incorporate breadfruit could further align national food and climate objectives.

Pakistan's agricultural sector is facing escalating stress from climate change, with staple crops like wheat and rice becoming increasingly vulnerable to heatwaves and water scarcity (World Bank, 2023). Breadfruit offers a rare opportunity: a nutritious, drought-resilient, and environmentally beneficial crop that supports both food security and ecosystem regeneration. While challenges remain, such as farmer unfamiliarity and climatic extremes, the path forward is clear. With timely investment and coordinated policy support, breadfruit can transition from experimental research to a viable pillar of Pakistan's climate-smart agriculture.

Conclusion

Breadfruit presents a transformative opportunity for Pakistan's agricultural sector amid the growing threats of climate change. Its exceptional adaptability to heat, drought, and saline soils make it uniquely suited for regions facing environmental degradation and water scarcity. Scientific modeling confirms that several districts in Sindh and southern Punjab are climatically suitable for breadfruit cultivation under current and future scenarios. Moreover, its high nutritional value, long productive lifespan, and environmental benefits, such as carbon sequestration and soil health improvement, make it an ideal candidate for sustainable farming systems.

The successful integration of breadfruit into Pakistan's agro-economy will require a phased approach encompassing pilot trials, farmer training, nursery development, and post-harvest innovation. Government support, in the form of policy inclusion, subsidies, and market development, will be essential to adoption. Beyond its agronomic promise, breadfruit offers a pathway to diversify food systems, strengthen rural incomes, and build climate resilience. With strategic investment and cross-sectoral collaboration, breadfruit can move from a novel idea to a national asset, contributing meaningfully to Pakistan's goals for food security, economic growth, and environmental sustainability. In a time of unprecedented climate uncertainty, breadfruit is more than a crop, it is a future-ready solution waiting to be realized.

References: Elevitch, et al.; Fick & Hijmans; Jones, et al.; PCRWR; Ragone; Jones, et al; Liu, et al.; Zerega, et al.; Elith et al.; Winters, et al.; Mootoo, et al.

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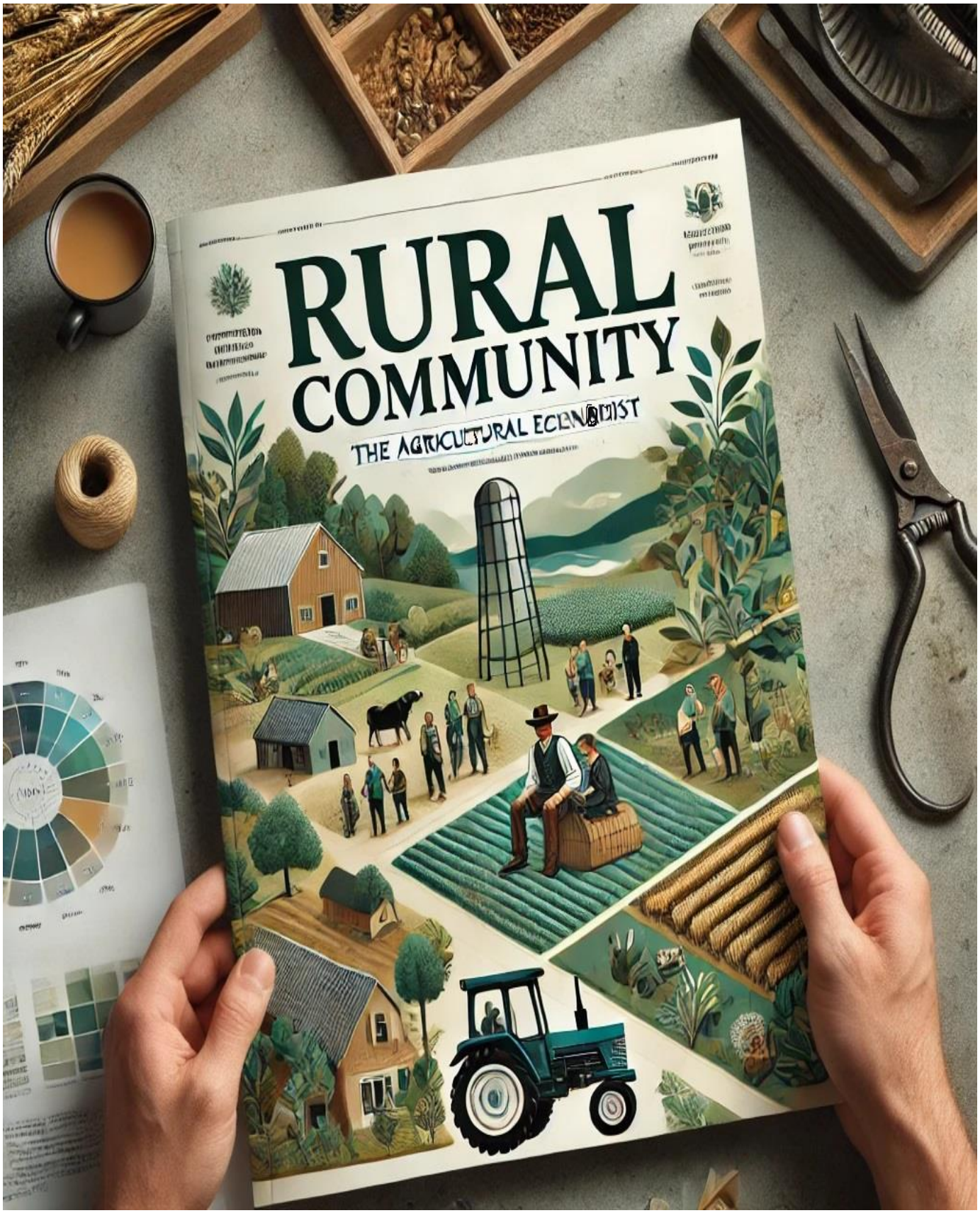
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Revitalizing Rural Employment in Pakistan

Tackling rural employment challenges in Pakistan demands a transformative approach. By shifting from fragmented efforts to integrated and inclusive development, the country can modernize agriculture sector.

Aqsa Ilyas

7/1/2025

Pakistan's rural regions are home to nearly 63% of the national population (Pakistan Bureau of Statistics, 2023), yet they continue to grapple with widespread underemployment, informal labor, and low economic mobility. Agriculture remains the primary source of livelihood, employing 37.4% of the labor force (Labor Force Survey 2022–23). However, the sector's potential is undercut by outdated farming methods, small landholdings, poor market access, and increasing vulnerability to climate change. Productivity remains low, incomes are stagnant, and youth disengagement from agriculture is growing. These factors collectively drive rural-to-urban migration, with nearly 40% of urban population growth stemming from rural migration (World Bank, 2024), exacerbating pressure on urban infrastructure and services.

Addressing this multifaceted challenge requires a comprehensive and inclusive rural employment strategy. First, modernizing agriculture through mechanization, climate-smart techniques, and digital innovation can significantly enhance productivity and attract youth back to farming. Second, investment in rural infrastructure such as roads, storage, internet connectivity, and energy access will unlock new economic opportunities and reduce transaction costs.

Third, promoting rural entrepreneurship and small enterprises, especially in agri-processing, eco-tourism, and renewable energy, can diversify income sources beyond farming. Access to microfinance, mentorship, and rural business incubation centers can help turn ideas into viable ventures. Fourth, strengthening vocational training aligned with market demand is critical. Programs should focus on building skills in areas like farm technology, construction, logistics, and ICT.

Additionally, empowering women and youth through inclusive policies and representation in rural governance structures is essential to equitable economic development. By linking local development with national priorities, Pakistan can transform its rural economy into a vibrant engine of inclusive growth, social stability, and environmental sustainability. The path forward lies in coordinated efforts between government, private sector, and communities to ensure that rural employment becomes an opportunity rather than a constraint.

Revitalizing Rural Employment through Strategic Interventions

To tackle Pakistan's growing rural employment challenges, a multi-dimensional strategy is essential. Agriculture, the backbone of the rural economy, contributes 22.7% to the national GDP (Economic Survey of Pakistan 2023–24), but remains plagued by low productivity and inefficient practices. Transitioning to modern agricultural techniques such as precision farming, high-efficiency irrigation systems, and the adoption of climate-resilient seed varieties can boost yields while conserving resources. Initiatives like the Prime Minister's Agriculture Transformation Plan (2023) are a step forward, but more inclusive access to solar-powered tubewells, improved seeds, and farmer advisory services is critical, especially for smallholders.

Infrastructure development is another key lever for rural employment growth. Many rural areas lack basic facilities such as paved roads, stable electricity, and reliable internet. Only 30% of rural regions currently have dependable digital connectivity (PTA, 2024), limiting the growth of e-commerce, telemedicine, and agri-tech services. Although CPEC-related investments have enhanced road infrastructure in selected districts, a broader focus on cold storage, value-chain integration, and agro-processing hubs is needed to reduce post-harvest losses and add value to raw produce.

Promoting rural entrepreneurship is vital for diversifying income sources beyond agriculture. While microfinance institutions like the Kashf Foundation and NRSP have collectively disbursed over PKR 50 billion in loans (State Bank of Pakistan, 2024), rural startups still struggle with market linkages and scalability. Business incubators and livelihood promotion programs such as those under the Punjab Jobs and Livelihoods Program are promising models. Meanwhile, initiatives like BISP Nashonuma can enhance women's participation in the rural economy through enterprise development.

Lastly, building a skilled workforce is fundamental. Currently, only 15% of rural youth receive formal vocational training (TEVTA, 2024). Expanding the outreach of institutions like NAVTTC, introducing apprenticeship models, and integrating digital and soft skills into curricula will prepare rural youth for modern job markets. By aligning public, private, and community efforts, Pakistan can build a resilient and inclusive rural employment ecosystem.

Navigating Challenges and Securing the Future of Rural Employment

Despite the promising nature of rural employment strategies in Pakistan, several structural and systemic challenges continue to undermine their effectiveness. Financial barriers remain

a significant concern. Smallholder farmers, who form most of the agricultural workforce, often lack the capital required to invest in modern tools, machinery, or high-efficiency seeds. This financial disparity risks widening the rural wealth gap, as only better-resourced farmers can benefit from government subsidies or technological interventions.

Infrastructure development, while improving under initiatives like CPEC, faces bureaucratic hurdles and inconsistent funding, leading to delays in project completion. Rural roads, irrigation systems, and power supply remain unreliable in many districts, limiting the reach of agricultural inputs and access to markets. Similarly, rural entrepreneurs frequently grapple with fragmented supply chains, inadequate storage, and limited transport options, which hinder scalability and profitability.

A major barrier to scheme effectiveness is low awareness. According to the Pakistan Social and Living Standards Measurement Survey (2023), literacy rates in rural areas lag significantly behind urban counterparts, contributing to low uptake of government programs. Many residents remain uninformed about available loans, vocational training, or health coverage schemes, further marginalizing them from economic growth opportunities.

To overcome these hurdles, Pakistan must adopt forward-looking and inclusive policies. Expanding Public-Private Partnerships (PPPs) can bring innovation and investment to agri-tech, food processing, and rural manufacturing sectors. Strengthening local governance will enhance transparency, accountability, and delivery of rural development programs. Investing in renewable energy, particularly solar and wind, can not only reduce energy poverty but also create green jobs and foster energy independence in rural areas.

Further, digital financial inclusion through mobile banking and fintech platforms can revolutionize access to savings, credit, and insurance for unbanked populations. Lastly, prioritizing climate-resilient farming techniques will help mitigate the risks of extreme weather, ensuring continuity of livelihoods and long-term agricultural sustainability. Together, these reforms can unlock the full potential of rural Pakistan, making employment growth inclusive, sustainable, and future-ready.

Conclusion

Tackling rural employment challenges in Pakistan requires a paradigm shift from fragmented interventions to integrated, inclusive development. While agriculture remains a critical pillar of the rural economy, relying solely on it is no longer sufficient to sustain livelihoods or curb rural-to-urban migration. By modernizing farming practices, upgrading infrastructure, investing in rural entrepreneurship, and expanding skill-building initiatives, Pakistan can unlock a wave of rural revitalization.

However, translating these strategies into tangible outcomes demands overcoming persistent challenges. Financial inclusion for smallholders, improved awareness of public schemes, and equitable access to technology and credit are critical. Bridging the rural-urban divide in education, health, and connectivity must be prioritized to foster upward mobility.

The way forward lies in fostering collaboration among government bodies, private sector actors, civil society, and local communities. Public-Private Partnerships, renewable energy initiatives, and digital platforms can create sustainable, green jobs and spur innovation. Furthermore, climate-resilient practices and disaster preparedness must be embedded within rural development planning.

Empowering rural youth and women, integrating local governance, and aligning development goals with national strategies will ensure that rural employment becomes a driver, not a drag, on inclusive growth. With vision, investment, and commitment, Pakistan can transform its rural landscape into a thriving hub of opportunity and resilience.

References: Pakistan Bureau of Statistics; World Bank; Ministry of National Food Security; State Bank of Pakistan; UNDP; Labor Force Survey; Economic Survey of Pakistan; TEVTA; PSLM

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Empowering Women for Rural Economic Growth

Explore how gender equality and women empowerment drive rural economic growth in Pakistan. Educating and empowering women leads to thriving communities, increased productivity, and sustainable growth. Discover the transformative impact of bridging the gender gap.

Tayyaba Alam

7/9/2025

Gender equality is a fundamental human right and a critical driver of inclusive economic development. It ensures that women, men, boys, and girls, regardless of class, caste, or ethnicity, participate equally in decision-making, access resources fairly, and exercise control over their personal and economic choices. In the context of rural Pakistan, where women make up nearly 49% of the population (Pakistan Bureau of Statistics, 2023), gender equality is essential not only for human dignity but also for sustained national progress.

However, women's economic potential remains vastly underutilized due to persistent structural barriers. These include limited access to quality education and healthcare, lack of land ownership rights, restricted mobility, unpaid care responsibilities, and deep-rooted patriarchal norms that discourage their participation in the formal workforce. Economic growth, which refers to the sustained increase in inflation-adjusted output over time, is closely linked to gender equality, as empowered women contribute to higher household incomes, improved child nutrition, and community resilience.

Globally, the UN's Sustainable Development Goal (SDG) 5 underscores gender equality as a cross-cutting priority, and the World Bank's 2023 *Women, Business and the Law* report shows that over 2.4 billion women are still denied equal legal and economic opportunities. In Pakistan, female labor force participation remains alarmingly low at just 22% (World Bank, 2023), with rural women even more disadvantaged due to cultural constraints and inadequate policy support. Unlocking the economic potential of rural women through access to credit, vocational training, digital inclusion, and legal empowerment can have transformative effects on both individual households and broader economic indicators. When women are enabled to engage in agriculture, entrepreneurship, and local governance, productivity rises, poverty declines, and communities become more resilient. Bridging the gender gap is not only a moral obligation, but also an economic imperative for Pakistan's sustainable future.

Catalysts for Inclusive Economic Growth

Women in rural Pakistan are the unsung backbone of the economy, particularly in agriculture, which employs over 42.3% of the national workforce (Pakistan Economic Survey 2022–23). They are deeply involved in every stage of the agricultural value chain, from sowing and harvesting crops to managing livestock and processing food, yet their contributions remain largely invisible in formal statistics due to a lack of recognition and compensation. Despite producing up to 60–80% of food in developing countries, rural women in Pakistan own less than 5% of agricultural land, highlighting the persistent gender disparity in resource control (FAO, 2022).

Beyond agriculture, many rural women sustain households through micro-enterprises such as embroidery, dairy production, and traditional crafts. These activities, while economically significant, are often constrained by structural barriers like low financial literacy, social mobility restrictions, and limited access to markets and capital. Only 7% of Pakistani women hold formal bank accounts, severely limiting their ability to scale businesses or invest in productivity-enhancing tools (State Bank of Pakistan, 2023).

However, success stories offer hope. Programs like the Benazir Income Support Program (BISP) have demonstrated that direct financial support can enhance household resilience and women's autonomy. Similarly, the Punjab Economic Opportunities Program (PEOP) has trained over 100,000 rural women in vocational and technical skills, increasing their employability and income prospects. The Lady Health Worker (LHW) Program is another powerful example, enabling women to gain healthcare training and employment while uplifting community well-being.

These initiatives prove that with targeted interventions, rural women can become agents of economic transformation. Unlocking their full potential requires policy measures focused on land rights, access to finance, market integration, and skill development. Empowering rural women is not just a matter of equity, it is a strategic imperative for Pakistan's inclusive and sustainable economic future.

Harnessing the Economic Power of Gender Equality in Rural Pakistan

Promoting gender equality in rural Pakistan is not only a matter of social justice, it is also a smart economic strategy. Numerous studies underscore the vast economic potential that lies in empowering rural women, particularly in agriculture and microenterprise. When women have equal access to land, inputs, and training, agricultural productivity can increase dramatically. The Food and Agriculture Organization (FAO, 2023) estimates that closing the gender gap in agriculture could raise

crop yields by 20% to 30%, directly contributing to improved food security and national economic growth.

Furthermore, rural women are more likely than men to reinvest their earnings into household welfare, including health, education, and nutrition. According to the World Bank (2023), women typically reinvest up to 90% of their income back into their families. Programs such as the Benazir Income Support Program (BISP) illustrate this multiplier effect: by providing targeted cash transfers to women, BISP has helped lift over 8 million households out of poverty, improving resilience and financial stability in some of the most vulnerable communities. Beyond economic gains, empowered women often become champions of innovation and sustainability. Studies show that women are more likely to adopt climate-resilient farming practices, such as using drought-resistant seed varieties and organic fertilizers, key strategies for mitigating climate change impacts. Additionally, gender equality yields powerful intergenerational benefits.

Educated and economically active women are more likely to raise healthier children, reduce infant mortality, and support higher school enrollment and retention rates, especially for girls. These social outcomes further feed into the cycle of development and poverty reduction. By investing in women through inclusive policies, capacity building, and equitable access to resources, Pakistan can unlock immense economic potential. Gender equality is not just a goal, it is a driver of sustainable, inclusive growth for the nation.

Overcoming Barriers to Gender Equality in Rural Pakistan

Despite playing a central role in Pakistan's rural economy, women continue to face entrenched barriers that limit their potential and reinforce cycles of poverty. One of the most significant challenges is limited access to education. Only 46% of rural girls are enrolled in secondary school (UNESCO, 2023), with cultural norms often prioritizing boys' education. As a result, early marriages and school dropout rates remain high among girls, curtailing their opportunities for economic participation. Without education, rural women are less likely to access formal employment or entrepreneurial training.

Another major barrier is the lack of landownership and financial autonomy. Women own less than 4% of agricultural land in Pakistan (Pakistan Bureau of Statistics, 2023), and discriminatory inheritance practices often prevent them from acquiring property. Moreover, banking systems are not always inclusive, women are less likely to meet collateral requirements or access loans, restricting their ability to invest in agriculture or businesses.

Cultural and social constraints further hinder women's mobility and agency. Norms such as purdah limit their participation in public life and the workforce, while domestic responsibilities consume up to 5–6 hours a day, reducing time for income-generating activities. Poor rural infrastructure exacerbates these challenges. With only 36% of rural women having access to maternal healthcare (WHO, 2023) and inadequate transportation and water services, their burden of unpaid labor remains high.

Addressing these barriers requires integrated policy action. Expanding girls' education through rural schools with female teachers and scholarships can create pathways to empowerment. Enforcing women's land rights, promoting financial inclusion through microfinance and digital banking, and investing in healthcare, transportation, and clean energy infrastructure are essential. Supporting women-led cooperatives and vocational training will further amplify rural women's contributions, unlocking the transformative power of gender equality in Pakistan's development.

Conclusion

Gender equality is not only a matter of justice and human rights, but also a transformative force for rural economic development in Pakistan. The evidence is overwhelming: when rural women are educated, economically empowered, and granted equitable access to land, finance, and decision-making, entire communities thrive. Their contributions to agriculture, household welfare, climate adaptation, and entrepreneurship are substantial yet often invisible. Bridging the gender gap can dramatically raise productivity, reduce poverty, and foster inclusive, sustainable growth.

Yet persistent barriers such as limited education, landlessness, financial exclusion, and restrictive social norms continue to suppress women's potential. These challenges are not insurmountable. Targeted interventions like vocational training, digital financial inclusion, girls' education, and support for women-led enterprises have already shown success. Initiatives such as BISP and PEOP prove that empowering women is not just good policy, it is sound economics.

Pakistan stands at a critical crossroads. With nearly half its population made up of women, especially in rural areas, the nation cannot afford to leave this demographic behind. Gender equality must move from rhetoric to action, embedded in every policy related to agriculture, finance, education, and infrastructure. Only then can Pakistan unlock the full potential of its rural economy and ensure a resilient, equitable future for all.

References: Pakistan Bureau of Statistics; World Bank; FAO; State Bank of Pakistan; UNESCO; BISP

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Empowering Women in Agricultural Governance

Empowering women in agricultural governance is crucial for Pakistan's rural development and food security. Their inclusion boosts productivity, economic growth, and community resilience. Discover how women's participation enhances farm management and local economies.

Qadir Bux Aghani

7/14/2025

Women form the backbone of Pakistan's agriculture, performing vital roles in food cultivation, livestock care, and post-harvest handling. In rural areas, they make up 73% of the agricultural workforce (Pakistan Bureau of Statistics, 2023), yet their contributions often go unrecognized in formal agricultural structures. Despite their indispensable labor, women own less than 5% of agricultural land (World Bank, 2023), and their voices are rarely heard in decision-making platforms at household, community, or policy levels.

This disconnect between contribution and representation undermines the potential of Pakistan's agriculture to become more inclusive, resilient, and productive. Structural barriers such as patriarchal norms, discriminatory inheritance laws, and gender-insensitive policies prevent women from accessing land titles, credit, extension services, and formal training opportunities. As a result, women are underrepresented in farmer organizations, only 12% hold membership, and have negligible input in policymaking forums that shape agricultural agendas (IFAD, 2022).

Empowering women in agricultural governance is not only an issue of gender justice but also an economic necessity. Studies by the FAO (2023) confirm that closing the gender gap in agricultural access and decision-making can increase productivity by up to 30%. It also leads to improved household nutrition, better child education outcomes, and more resilient farming communities.

To move from passive participation to active influence, Pakistan must institute legal reforms to guarantee women's land rights, ensure gender quotas in farmer organizations and agricultural boards, and tailor extension programs to meet women's needs. Moreover, incorporating women's voices in climate adaptation, seed selection, and irrigation planning will enhance sustainability and local ownership.

Recognizing women as full agricultural stakeholders, farmers, leaders, and innovators, will unlock untapped potential and pave the way for a more equitable and food-secure Pakistan. True agricultural development is impossible without gender-inclusive governance.

The Power of Women's Inclusion in Agricultural Decision-Making

Integrating women into agricultural decision-making is not just a question of gender equity, it's a proven driver of productivity, sustainability, and food security. When women actively participate in decisions regarding crop selection, resource use, and farm management, outcomes consistently improve across social and economic indicators. According to the 2023 UN Women report, households where women influence farming choices see up to 23% higher crop yields. This is largely attributed to more diversified planting strategies and a stronger emphasis on food crops over cash crops, improving household nutrition. Women also tend to adopt sustainable agricultural practices at higher rates, such as crop rotation, composting, and water conservation, which significantly bolster climate resilience.

The relationship between women's economic empowerment and decision-making power is further underscored by research from Ali & Khan (2022), which shows that female-led farms in Punjab experienced 30% greater profitability when women had access to training, resources, and market networks.

Successful case studies further reinforce this trend. In Khyber Pakhtunkhwa, the inclusion of women in Water User Associations resulted in a 20% increase in water use efficiency, benefiting both productivity and equity (World Bank, 2023). In Punjab, IFAD-supported women-led cooperatives boosted collective bargaining power, raising incomes by 40% through improved access to inputs and markets. Beyond Pakistan, Bangladesh offers a regional model of success, where gender-responsive climate adaptation initiatives improved food security by 35% in rural communities (UN Women, 2023).

These examples demonstrate that women's participation in agricultural governance leads to tangible, measurable benefits. Their inclusion not only enhances productivity and income but also promotes ecological sustainability and social cohesion. For Pakistan to build a more resilient, inclusive agricultural system, integrating women into every stage of decision-making must become a central policy priority.

Barriers to Inclusion and Policy Imperatives for Gender-Responsive Agriculture

Despite their critical role in agriculture, rural women in Pakistan continue to face deep-rooted structural barriers that limit their participation in decision-making and access to resources. One of the most significant obstacles is land ownership disparity only 3% of rural women hold land titles (State Bank of Pakistan, 2023). This restricts their eligibility for government subsidies, agricultural loans, and input schemes, reinforcing economic dependency and exclusion from formal agricultural governance structures.

Extension services also remain largely gender blind. With over 80% of agricultural advisors being male and fewer than 15% of programs tailored to women (FAO, 2023), rural women are systematically excluded from vital training and information channels. This gap widens due to low literacy rates among rural women, only 39% are literate (Pakistan Bureau of Statistics, 2023), and prevailing sociocultural norms that limit their mobility and discourage participation in farmer unions and cooperatives.

To bridge this gender gap, Pakistan must undertake comprehensive policy reforms. Land reforms should begin with amending inheritance laws to secure women's rights to land and introducing transparent, digital land registries. Instituting a 30% quota for women in farmer organizations, irrigation committees, and agricultural boards can ensure their voices are heard in governance forums. Gender-sensitive extension services must be expanded using mobile platforms like the Khushhali Maharat initiative, with the aim of reaching five million rural women by 2025.

Moreover, establishing women-led cooperatives funded by the government will provide access to microloans, quality seeds, and local markets empowering women economically and socially. Finally, all agricultural training for local officials should incorporate gender-responsive planning to ensure inclusivity in policy design and implementation.

Conclusion

Empowering women in agricultural governance is not only a matter of equity but a strategic necessity for Pakistan's rural development and food security. Despite constituting a significant portion of the agricultural workforce, women remain excluded from land ownership, financial services, training programs, and decision-making bodies. This exclusion hampers agricultural productivity, economic growth, and the resilience of rural communities. Evidence from Pakistan and across the region demonstrates that women's meaningful participation in farm management, climate adaptation, and cooperatives leads to higher yields, better nutrition, improved water use, and stronger local economies.

Closing the gender gap in agriculture could boost productivity by up to 30%, yet progress remains hindered by structural and cultural barriers. To move forward, Pakistan must urgently enact land reforms, implement gender quotas in farmer institutions, expand digital and gender-sensitive extension services, and invest in women-led cooperatives. Success depends on building inclusive agricultural policies that acknowledge and institutionalize women's roles not as auxiliary laborers but as farmers, decision-makers, and innovators.

By ensuring women have equal access to resources, representation, and leadership, Pakistan can unlock transformative potential within its agricultural sector. A gender-inclusive approach to agricultural governance is fundamental to building a more productive, climate-resilient, and socially just food system. The time to act is now.

References: FAO; IFAD; Pakistan Bureau of Statistics; UN Women; World Bank; Ali & Khan; State Bank of Pakistan

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Transforming Food Systems for Rural Well-Being

Transforming food systems is crucial for enhancing rural well-being and reducing poverty. With over 3.4 billion people in rural economies, it's vital to address nutritional insecurity and vulnerabilities to improve livelihoods.

Saba Javed

7/23/2025

The well-being of millions of people around the world hinges on the urgent need to transform food systems in ways that enhance food quality, nutritional outcomes, environmental sustainability, and climate resilience. This article explores three key aspects critical to understanding the intersection of vulnerability and rural poverty. First, persistent extreme poverty and hunger continue to entrench inequality and exacerbate vulnerabilities among rural populations.

Addressing this root cause is essential to breaking the cycle of deprivation. Second, rural development strategies often overlook the importance of on-farm and off-farm income diversification, which plays a crucial role in strengthening household resilience and providing financial stability in the face of shocks. Third, there is an insufficient understanding of rapid transformations in food markets, environmental conditions, and economic structure factors that profoundly shape rural livelihoods and food systems. Approximately 3.4 billion people globally still reside in rural areas and rely heavily on agriculture for their survival (UNDESA, 2021). These communities are not only more likely to be poor and food-insecure but also face higher exposure to climate variability and market instability. As global food systems evolve with increasing demand for high-value, diverse, and nutritious food, rural areas must adapt to new risks and opportunities. While these transitions can catalyze growth and development, they also pose significant challenges for marginalized groups.

To ensure no one is left behind, governments and policymakers must design inclusive, forward-looking strategies that promote rural economic development and social equity. This involves investing in infrastructure, education, and capacity building, while supporting sustainable agricultural practices and ensuring smallholder farmers are integrated into emerging food value chains. Ultimately, transforming food systems is not only a pathway to ending hunger and poverty, but also essential for building a more inclusive, healthy, and resilient future for all.

Rural Wellbeing and Food Systems

Livelihoods, nutrition, and vulnerability are three core pillars that determine the effectiveness and inclusiveness of food systems, particularly in rural settings. Livelihoods refer to the financial and productive resources people use to meet essential needs such as food, education, healthcare, and shelter (UNDP, 2010). Nutrition goes beyond food access and emphasizes inclusive food and nutritional security, ensuring that all individuals consume diets that are adequate, diverse, and health-promoting. Vulnerability, on the other hand, is the degree to which individuals and communities can maintain their well-being when confronted with external shocks such as climate change, natural resource degradation, market volatility, or political instability.

In recent years, growing attention has been paid to agriculture, food security, and nutrition under the framework of food systems. As global population and urbanization expand, so does the demand for food. However, this rising demand is not being met without consequences. Undernutrition, nutrient deficiencies, and overnutrition are becoming global health concerns. Additionally, food systems are major contributors to greenhouse gas emissions, exacerbating climate change and threatening future food production. This interplay signals that our current trajectory of food production is pressing the Earth's ecological boundaries and undermining sustainability goals.

Transformative food systems should prioritize rural well-being by enhancing income opportunities, boosting nutrition, and building resilience against shocks. Key drivers shaping food systems include population growth, urban expansion, environmental change, shifting diets, evolving technologies, market access, and policy frameworks. Within this dynamic context, four interrelated factors such as market revolution, diversified income sources, farm productivity, and broader livelihood options play a decisive role in shaping rural well-being. These can collectively lead to improved household income, better nutrition, and greater adaptive capacity. However, they also introduce new risks, such as disease outbreaks, price shocks, and environmental hazards, highlighting the need for integrated strategies that balance opportunity with resilience.

Rethinking Rural Livelihoods Beyond Farming

Rural livelihoods have traditionally been centered around farming, with agricultural income serving as the mainstay for most households. This focus shaped poverty alleviation and rural development programs, which emphasized boosting agricultural productivity, developing markets, and commercializing small-scale farms. The dominant narrative suggested that as economies develop, rural populations would gradually shift into better-paid jobs in manufacturing and services, reducing reliance on agriculture. This pattern has largely held true in high-income OECD countries, where farm employment has declined significantly.

However, this transition has not followed the same trajectory in many low- and

middle-income countries. Factors such as rapid population growth, limited employment alternatives in non-agricultural sectors, and the cultural and economic value of land ownership have led to persistently high levels of farm employment. Today, around 3.4 billion people still live in rural areas in these regions, and approximately 450 million of them are engaged in small-scale farming (UNDESA, 2019).

Rural household incomes in these contexts are highly diversified, drawing from remittances, microenterprises, petty trade, and social protection schemes (FAO, 2017). Empirical evidence from countries like India, Bangladesh, and Ethiopia shows that agriculture contributes about 40%, 33%, and 82% respectively to rural household income (Pingali et al., 2019; Ahmed et al., 2015; Bachewe et al., 2020).

This dualism, where small-scale agriculture coexists with diversified and non-farm income sources, demands a more nuanced understanding of rural development. It is essential to address the dual challenge of supporting small-scale farmers' food and nutritional security while enabling them to meet the growing food demand of rising populations. Many small-scale commercial farmers rely primarily on agriculture, while others, including urban-based salaried workers, maintain rural ties by investing back into farming.

Crafting inclusive food system strategies thus requires deeper insights into the diversity of rural households. Recognizing the varying degrees of farm commercialization and the role of non-farm income is critical to designing policies that truly uplift small-scale producers and promote resilient rural economies.

Understanding Evolving Trends in Rural Wellbeing

Today's rural wellbeing reflects a mix of progress and persistent challenges. On the one hand, decades of agricultural and rural development have lifted many communities out of poverty and hunger. Economic activity has expanded, rural-urban connections have strengthened, and infrastructure has improved across numerous villages and towns (UNDESA, 2021). Gender and ethnic disparities are gradually narrowing, contributing to more equitable development outcomes. However, despite this progress, large sections of rural populations—especially in sub-Saharan Africa and South Asia—remain trapped in both extreme and moderate poverty, often overlooked in broader assessments of rural wellbeing (Woodhill, 2022).

Globally, extreme poverty is defined as living below $1.90 per day, while moderate poverty is under $3.20 per day. Many rural families continue to fall below these thresholds, with limited access to education, healthcare, and adequate housing. The challenge is magnified by a rapidly growing rural youth population, for whom employment opportunities remain scarce. Efforts to reduce poverty must focus on creating sustainable livelihoods that support a dignified standard of living.

Rural communities also face a deepening nutritional crisis. While some suffer from hunger and undernutrition, others experience rising rates of obesity and diet-related diseases due to increased consumption of processed, nutrient-poor foods. This nutritional transition not only harms health but also reduces income-generating potential. Women's empowerment is crucial in reversing this trend and improving dietary outcomes in rural areas (IFPRI, 2020).

At the same time, rural areas are increasingly vulnerable to shocks such as climate change, political instability, and health crises. Events like the East African locust invasion and the COVID-19 pandemic have exposed weaknesses in food and economic systems. In the coming decades, extreme weather events, pest outbreaks, and natural disasters are expected to increase, threatening livelihoods and food security. Building resilient local food systems and addressing the root causes of hunger must be central to global rural development strategies.

Conclusion

Transforming food systems is central to achieving rural well-being and poverty reduction in a rapidly changing world. As over 3.4 billion people remain rooted in rural economies many of them reliant on small-scale farming addressing extreme poverty, nutritional insecurity, and vulnerability to shocks has become increasingly urgent. Traditional models that view agriculture as the sole engine of rural livelihoods are no longer sufficient. A more holistic understanding is needed, one that integrates farm and non-farm income, recognizes diverse household structures, and adapts to the complex realities of rural life.

Food systems must evolve to promote inclusivity, sustainability, and resilience. This means creating policies that go beyond productivity increases to focus on access to diverse and nutritious food, climate-resilient agricultural practices, and economic diversification that enable rural populations to withstand and recover from environmental and market disruptions. Empowering rural women, enhancing youth opportunities, and building robust infrastructure and social safety nets are equally critical.

In the face of environmental degradation, rising inequality, and shifting dietary trends, governments must craft forward-looking strategies that embed equity at their core. Only then can food systems become powerful drivers of social and economic transformation, uplifting rural communities and ensuring that no one is left behind in the pursuit of sustainable development.

References: UNDESA; UNDP; FAO; Pingali et., al 2019; Ahmed et al.; Bachewe et al; UN; IFPRI; Woodhill

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Empowering Smallholder Farmers for Sustainable Agriculture

Smallholder farmers play a crucial role in global food security and sustainability. Their traditional knowledge and community-focused practices help maintain ecological balance while providing nutritious food.

Neha Batool

7/28/2025

Smallholder farmers form the cornerstone of global food security, cultivating a significant share of the world's food on plots typically smaller than two hectares. The Food and Agriculture Organization (FAO) estimates that small-scale producers contribute up to 80% of the food consumed in regions such as Asia and sub-Saharan Africa (FAO, 2021). Relying heavily on family labor, indigenous knowledge, and low-input techniques, these farmers have sustained generations despite limited institutional support. However, they often remain overlooked in agricultural policies, financial systems, and innovation agendas, which tend to favor large-scale commercial agriculture.

Beyond their contribution to food supply, smallholders play a critical role in preserving agrobiodiversity, stewarding natural resources, and maintaining resilient rural landscapes. Their farming practices, typically organic, diverse, and low in chemical inputs, are often more environmentally sustainable than industrial methods. Moreover, small farms are vital engines of rural employment and empowerment, especially for women and youth who comprise most of the agricultural labor force in many developing countries (IFAD, 2023).

Supporting smallholder farmers is not only a matter of equity but also a strategic investment in the future of sustainable food systems. Improving access to credit, quality seeds, climate-resilient technologies, and training can dramatically enhance productivity and incomes. Strengthening local infrastructure, reducing post-harvest losses, and linking farmers to markets are equally essential to unlock their full potential. Equitable land rights, digital inclusion, and farmer cooperatives can further improve their resilience and bargaining power.

As climate change, global market volatility, and demographic shifts intensify, empowering smallholder farmers is central to ensuring a food-secure, inclusive, and sustainable world. Recognizing and investing in their potential must be a top priority for policymakers, donors, and development agencies committed to transforming food systems from the ground up.

The Vital Role of Small Farmers in Building Sustainable Food Systems

Small-scale farmers form the backbone of global food systems, producing a significant share of the world's food while employing environmentally sustainable practices rooted in traditional knowledge. Their role is especially critical in regions like Africa, Latin America, and South Asia, where they grow staple crops such as rice, maize, millet, and legumes that underpin local diets and food security (World Bank, 2022). By relying on short supply chains and local inputs, smallholders reduce the risks of global supply chain disruptions and play a vital role in preventing food shortages and hunger in vulnerable communities.

Beyond food production, small farmers stimulate rural economies by circulating income within communities. By hiring local labor, purchasing tools and inputs from nearby vendors, and selling directly through farmers' markets or community-supported agriculture schemes, they enhance food affordability and availability. This localized approach not only ensures fresher, more nutritious food for consumers but also strengthens the resilience of rural economies against market shocks.

Sustainability is at the heart of smallholder agriculture. Many practice sustainable farming by default, using crop rotation, composting, agroforestry, and mixed cropping systems. These low-input, high-diversity approaches improve soil health, conserve water, support biodiversity, and mitigate greenhouse gas emissions (Pretty et al., 2018). For instance, terraced farming in hilly regions prevents soil erosion, water harvesting in dry zones conserves limited resources, and polyculture systems help protect against total crop failure. Integrating crops with livestock further enhances farm sustainability by recycling nutrients naturally and reducing the need for synthetic inputs (Altieri & Nicholls, 2017).

However, smallholders face persistent challenges. Climate change has made weather patterns more unpredictable, increasing the frequency of droughts, floods, and pest outbreaks that threaten crop yields (IPCC, 2022). Access to reliable markets is limited by poor infrastructure, price fluctuations, and dependence on intermediaries who often offer below-market rates. Many smallholders also operate without secure land titles, making them vulnerable to displacement and discouraging long-term investments. Financial exclusion adds another barrier, without access to credit, insurance, or modern technologies, productivity gains remain out of reach.

To realize the full potential of small farmers, integrated support systems are needed. Expanding access to digital tools such as mobile apps for weather forecasting, crop management, and real-time market prices can empower farmers to make informed decisions. Community seed banks and climate-resilient crop varieties enhance adaptability to

environmental stress. Solar-powered irrigation and low-cost drip systems can reduce water use and improve yields. Secure land tenure policies, especially for women farmers, are vital for promoting sustainable investments and ensuring legal protection.

Moreover, improving market access through cooperatives, fair-trade certification, and digital platforms can enable smallholders to capture more value from their produce. These interventions, combined with capacity-building and inclusive policy frameworks, can transform small-scale farming into a pathway for economic growth, environmental sustainability, and social equity. Investing in smallholder farmers is not just a moral imperative, it is a strategic necessity for building resilient, just, and sustainable food systems in a rapidly changing world.

Conclusion

Smallholder farmers are indispensable to the resilience and sustainability of global food systems. Their unique blend of traditional knowledge, low-input practices, and community-centered approaches offers a powerful model for sustainable agriculture. By producing diverse, nutritious crops and maintaining localized food networks, they help ensure food security while preserving ecological balance. Yet, despite their immense contributions, smallholders continue to face systemic challenges, from climate volatility and land insecurity to limited access to credit, technology, and markets.

Empowering small farmers requires more than isolated interventions; it demands holistic, inclusive, and long-term strategies that address both structural and environmental barriers. This includes investing in infrastructure, expanding access to finance, supporting cooperatives, and promoting land rights, especially for women. Digital tools, climate-smart technologies, and fair-trade systems can further enhance their productivity, income stability, and resilience in the face of future shocks.

As the global community grapples with intersecting crises, climate change, rising inequality, and food insecurity, supporting smallholder farmers emerges as both a moral obligation and a strategic priority. By placing them at the center of agricultural policy, innovation, and investment, we can not only uplift rural communities but also build food systems that are equitable, regenerative, and capable of nourishing both people and planet for generations to come.

References: FAO; IFAD; World Bank; Altieri & Nicholls; IPCC; Oxfam; Pretty et al.

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Addressing Land Inequality for Rural Prosperity in Pakistan

Land inequality significantly hinders agricultural development and rural prosperity in Pakistan. Most farmers operate on less than five acres, facing challenges like limited irrigation and credit access resulting in low productivity and poverty.

Sarmad Veesar

8/1/2025

Income inequality continues to plague rural economies, particularly in developing regions where agriculture is the primary livelihood. In countries like Pakistan, India, and across Sub-Saharan Africa, deeply entrenched disparities in land ownership have led to skewed access to agricultural resources and opportunities. While large landowners often benefit from economies of scale, mechanization, and market linkages, smallholders, who constitute the majority, struggle with fragmented holdings, limited credit access, and inadequate extension services. Recent data reveal that in South Asia, the top 20% of landholders control over 70% of cultivable land (FAO, 2023), while in Sub-Saharan Africa, over 60% of farmers own less than one hectare, leading to significantly lower productivity per unit of land.

Moreover, small farm size correlates strongly with limited investment in productivity-enhancing technologies, further entrenching income disparities. In Pakistan, farms below two hectares earn 45% less per acre than large-scale farms due to lower input usage and poor market access (PARC, 2024). The resulting rural income inequality not only reduces aggregate agricultural output but also hampers national poverty reduction efforts.

To address these challenges, policies must focus on land reform, inclusive access to credit, and collective farming models that enable resource sharing among smallholders. Investments in rural infrastructure, market cooperatives, and digital extension platforms can also bridge productivity gaps. A more equitable land distribution system, paired with targeted support for small farms, can stimulate inclusive rural growth and reduce inter-farm income inequality. This paper delves into the empirical relationship between farm size and income distribution, offering policy recommendations aimed at restructuring rural economies for fairness, efficiency, and sustainability.

How Land Inequality Undermines Agricultural Productivity and Rural Prosperity

Land inequality remains one of the most entrenched structural barriers to agricultural productivity and poverty reduction in Pakistan. Despite agriculture employing over a third of the national workforce, the benefits of land ownership are highly skewed. According to the Pakistan Bureau of Statistics (2023), farms under 5 acres account for 65% of all landholdings but contribute just 30% of total agricultural output. In stark contrast, the top 2% of landowners control nearly half of all arable land, enabling them to dominate production and income flows.

This disparity is vividly reflected in productivity differentials. Large farms, defined as those exceeding 10 acres, average wheat yields of 3.5 tons per hectare, while small farms achieve only 2.1 tons. Cotton productivity follows a similar pattern, with large farms reaching 1,200 kg/ha versus just 700 kg/ha for smallholders (FAO, 2023). These gaps are not a reflection of smallholder inefficiency, but rather a symptom of systemic disadvantages. Access to reliable irrigation is limited to only 40% of small farms compared to 85% for larger ones (World Bank, 2023). Mechanization is similarly skewed, only 5% of small farmers own tractors, while 75% of large farms are mechanized (IFPRI, 2022). Access to certified seed and quality inputs is also disproportionately low among smallholders.

These structural constraints translate into stark income inequality. The average annual income for small farmers under 5 acres is just PKR 300,000, compared to PKR 1.5 million for farmers with more than 10 acres (World Bank, 2023). Small farmers are often forced into distress sales, offloading their produce immediately post-harvest at deflated prices, while large farmers store and sell at market peaks. With only 15% of smallholders connected to urban markets, they are often trapped in exploitative value chains and dependent on informal lenders charging exorbitant interest rates.

The broader implications are grim. Pakistan's land Gini coefficient of 0.68 places it among the most unequal globally. In highly unequal regions like southern Punjab and interior Sindh, rural poverty rates exceed 50%. Landless laborers earn 40% less than tenant farmers, perpetuating a cycle of deprivation. Addressing land inequality through redistributive reforms, inclusive credit systems, and infrastructure investment is essential to unlocking agricultural productivity and rural prosperity.

Global Lessons and Strategic Pathways for Reducing Rural Inequality

Several countries have demonstrated that bold policy reforms and targeted interventions can significantly reduce

rural inequality and enhance smallholder productivity. China's land reforms in the 1980s are a seminal example. The de-collectivization of agriculture and introduction of land leasing rights empowered small farmers and boosted rural incomes by 200% within a decade (FAO, 2022). India's PM-KISAN scheme, which provides direct cash transfers of ₹6,000 per year to smallholders, has led to a 12% increase in productivity and helped cushion input costs (NITI Aayog, 2023). In Vietnam, the rise of farmer cooperatives has transformed the post-harvest landscape. Through collective bargaining and shared logistics, these cooperatives have reduced post-harvest losses from 30% to just 10%, while enhancing farmer bargaining power in markets (World Bank, 2022).

Drawing from these success stories, Pakistan can adopt a comprehensive policy framework to address entrenched rural inequalities. Land reforms must be at the forefront, redistributing idle state-owned land to landless farmers and legally securing tenancy rights. Gender equity in land ownership should also be prioritized; currently, women own only 5% of farmland (PBS, 2023).

Financial inclusion is critical. Scaling up digital credit programs like the Kisan Card, which offers subsidized loans, and expanding mobile-based fertilizers and seed subsidies can ease smallholder liquidity constraints. Infrastructure investment is equally vital. Establishing rural cold storage networks and improving road connectivity will reduce Pakistan's post-harvest losses, currently at 35%, and enhance market access for remote farmers (FAO, 2023).

Climate-resilient agriculture must complement these efforts. Encouraging adoption of drought-resistant seeds and drip irrigation through subsidies and training will build long-term resilience. With adoption rates below 10% and 5%, respectively (IFPRI, 2023; World Bank, 2023), these technologies remain vastly underutilized. A holistic approach, combining land reform, finance, infrastructure, and innovation, is essential to reversing inequality and driving inclusive agricultural growth in Pakistan.

Conclusion

The evidence is clear: land inequality remains one of the most significant barriers to equitable agricultural development and rural prosperity in Pakistan. With most farmers operating on less than five acres, limited access to irrigation, mechanization, credit, and markets perpetuates a cycle of low productivity and poverty. As large landholders continue to capture the bulk of output and income, the rural economy becomes increasingly polarized, undermining national efforts to reduce poverty and improve food security.

However, global examples from China, India, and Vietnam show that meaningful reforms, ranging from land redistribution and cash support to cooperative models and market infrastructure, can uplift smallholder farmers and reduce rural disparities. For Pakistan, a multi-pronged strategy is essential. Land reforms must prioritize equity and tenure security, while digital credit systems and targeted subsidies can empower marginalized farmers. Infrastructure investments and expanded market access are equally critical to unlock productivity and value addition.

Ultimately, addressing rural income inequality is not just a matter of justice but of economic necessity. A more inclusive and productive agricultural sector will generate broader-based growth, support national food security, and enable millions of rural households to break free from poverty. The path to rural resilience lies in equity, innovation, and inclusive governance.

References: FAO; IFPRI; Pakistan Bureau of Statistics; State Bank of Pakistan; UNDP; World Bank; PARC; NITI Aayog

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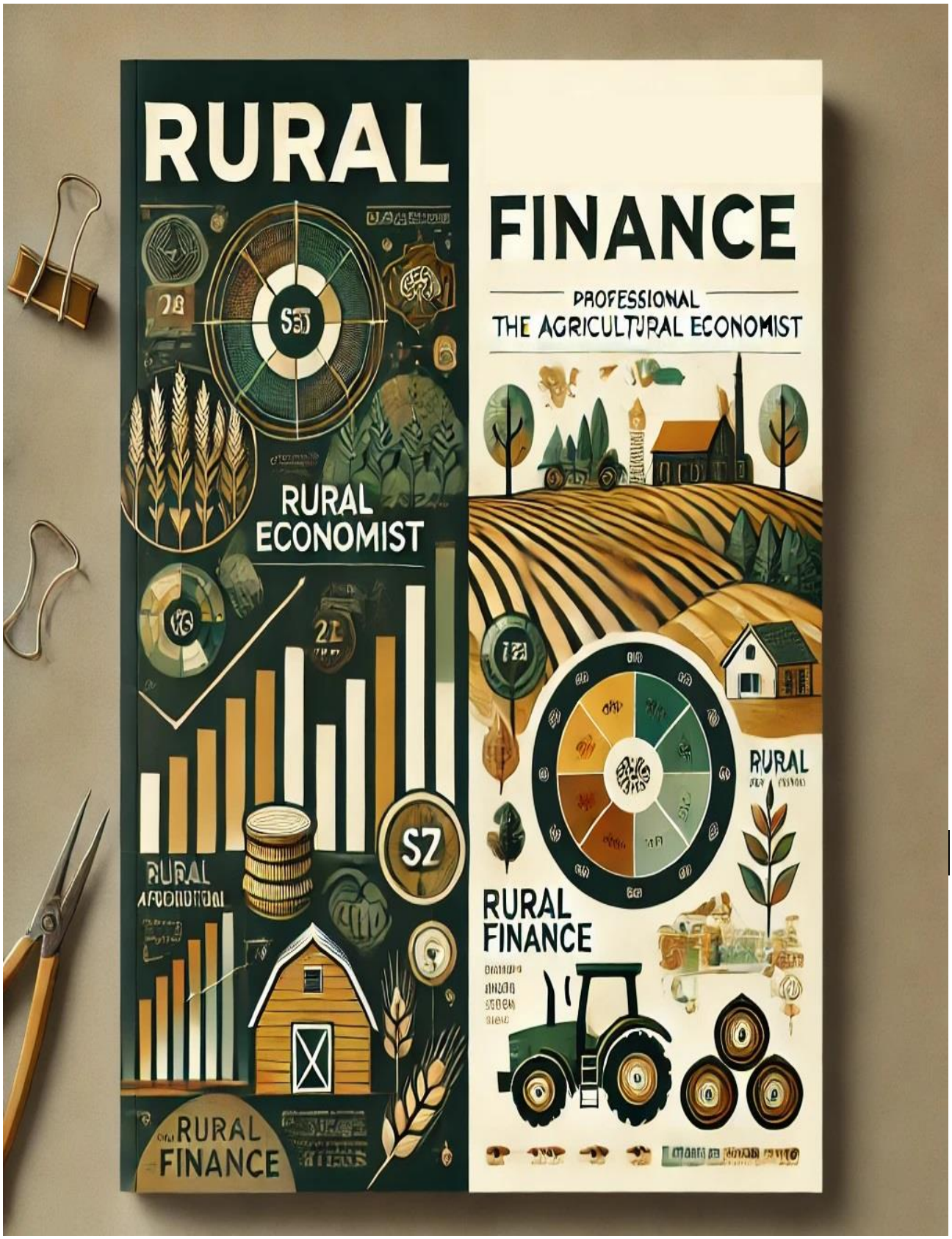

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Bridging the Gender Gap in Financial Literacy

Addressing the gender gap in financial and digital financial literacy is crucial for Punjab's economic growth. Despite increased female entrepreneurship, systemic barriers hinder women's access to finance and digital tools. Immediate action is needed to close this widening divide.

Tahira Sadaf, Asghar Ali, Nazia Tabasam, Ayesha Rouf & Komal Azhar

7/2/2025

The entrepreneurial landscape of Punjab is undergoing a positive transformation, marked by the increasing participation of women who are entering the business world with resilience, creativity, and ambition. From small-scale agri-enterprises to digital startups and service-based ventures, women are contributing significantly to the region's socio-economic fabric. However, while the momentum is encouraging, female entrepreneurs continue to face deeply rooted structural barriers that limit their potential and impact.

One of the most critical challenges is financial literacy. Many women lack basic knowledge of budgeting, saving, and managing credit, which restricts their ability to make informed business decisions. This is compounded by limited digital financial literacy (DFL), which hinders their use of online banking, mobile wallets, and e-commerce platforms tools that are becoming indispensable in today's economy. In a digital age, the inability to leverage technology for financial transactions and market outreach puts women-owned businesses at a competitive disadvantage.

Moreover, access to financial services remains unequal. Women often face difficulties in opening bank accounts, securing loans, or qualifying for government support due to lack of collateral, documentation, or awareness. Societal norms and mobility constraints further exacerbate these issues, particularly in rural areas. The digital gender divides where fewer women have access to smartphones and internet connectivity also restricts their engagement with digital markets and financial tools.

Addressing these challenges requires an integrated approach that combines targeted financial literacy programs, gender-responsive banking practices, and community-level digital skills training. Initiatives such as women-focused financial inclusion schemes, mobile-based learning platforms, and support from microfinance institutions can help bridge these gaps. Empowering women with the tools and knowledge to manage their finances and navigate the digital economy will not only uplift individual entrepreneurs but also contribute to broader goals of inclusive economic development and gender equity in Punjab.

Bridging the Gender Divide in Financial Literacy and Inclusion

The persistent gender gap in financial literacy continues to constrain the economic potential of women entrepreneurs in Punjab. A recent RASTA-PIDE funded survey involving 237 entrepreneurs across the province revealed stark disparities in both financial and digital financial literacy (DFL). While 86% of all respondents fell into the low-to-moderate financial literacy range, women fared significantly worse than their male counterparts. Male entrepreneurs scored an average of 54 out of 100, while female entrepreneurs averaged only 42 (PIDE, 2023), highlighting a critical barrier to effective financial decision-making among women.

The disparities were even more severe in digital financial literacy, an increasingly essential competency in today's tech-driven economy. Men scored an average of 67 out of 100, but women trailed far behind at 34. Alarmingly, not a single woman in the study fell within the "high DFL" bracket. This gap limits women's ability to use digital financial tools such as mobile banking, e-wallets, and online transactions, which are vital for accessing markets, managing business operations, and securing finance.

Importantly, the study also emphasized the transformative role of DFL in achieving financial inclusion. Logistic regression analysis showed that each one-point increase in a woman's DFL score raised the likelihood of financial inclusion by 12% (PIDE, 2023). Yet, despite this strong correlation, women in Punjab remain five times more likely than men to be financially excluded (State Bank of Pakistan, 2023). This exclusion not only affects individual women but also undermines broader economic development by sidelining a substantial segment of entrepreneurial talent.

The data underscores an urgent policy imperative: enhancing financial and digital financial literacy among women must become a cornerstone of financial inclusion strategies. Tailored training programs, women-centric fintech solutions, and community-based digital education campaigns can serve as powerful levers for change. Bridging this gender gap is not just a matter of equality, it is essential for building an inclusive and resilient economic future.

Unlocking Punjab's Economic Potential Through Gender-Inclusive Finance

Gender equality is not only a matter of social justice, it is a powerful driver of economic growth. In Punjab, closing the gender gap in financial literacy and inclusion could significantly enhance economic resilience by empowering women to participate more fully in entrepreneurial activities. According to

the World Bank (2023), increased female entrepreneurship correlates strongly with higher employment rates, increased investment, and innovation-led growth. Yet, the full economic potential of women entrepreneurs remains untapped due to structural and institutional barriers that must be urgently addressed.

At the heart of this exclusion are deep-rooted challenges: women's limited access to collateral due to property ownership disparities, discriminatory lending practices favoring men, cultural norms discouraging formal financial engagement, and an overreliance on informal borrowing. While well-intentioned microfinance programs exist, many fail to address foundational issues like digital illiteracy, lack of trust in financial systems, and gender-insensitive policies (UNDP, 2022).

To enable a transformative shift, Punjab must take a multi-pronged, evidence-based approach. Enhancing financial and digital financial literacy through practical, visual, and localized training can bridge essential knowledge gaps. Collaborating with fintech firms to co-design mobile apps and digital content tailored to women's needs is key.

Expanding access to digital financial services such as QR payments and mobile banking will democratize finance. Simplified, collateral-free loans with streamlined onboarding processes will enable women with limited documentation to participate. Equally important is gender-sensitizing the financial sector by training bankers and establishing women-only service desks or branches to build trust.

Educational institutions must embed financial literacy into school and vocational curricula, particularly targeting young women in rural areas. Finally, fostering peer mentorship through women-led business networks and community training hubs can build entrepreneurial confidence and knowledge-sharing ecosystems. Punjab stands at a pivotal juncture. With the right policy actions and public-private collaboration, gender-inclusive finance can be the catalyst for inclusive, sustainable economic growth across the province.

Conclusion

Bridging the gender gap in financial and digital financial literacy is both a moral imperative and a strategic opportunity for Punjab's economic future. Despite rising participation of women in entrepreneurial activities, systemic barriers continue to impede their full inclusion especially in access to finance, digital tools, and decision-making capacities. The data from the RASTA-PIDE study and national statistics point to a critical and widening divide that demands immediate, targeted intervention.

Empowering women with practical financial knowledge and digital competencies will not only enhance their individual business outcomes but also ripple outward to generate broader socio-economic gains. When women are financially literate and digitally included, they invest in their families, communities, and enterprises, driving sustainable development at every level.

To truly unlock this potential, Punjab must embrace a multi-pronged approach: integrating financial literacy into educational curricula, fostering gender-responsive fintech solutions, training financial service providers in inclusive practices, and supporting peer networks for women entrepreneurs. These actions, supported by strong public-private partnerships, can transform the economic landscape by enabling women to become equal participants in the province's growth story. The path forward is clear. By prioritizing gender-inclusive financial policies today, Punjab can secure a more equitable, innovative, and prosperous future for generations to come.

References: PIDE; State Bank of Pakistan; UNDP; World Bank

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Solutions for Rural Education & Healthcare through Waqf System

Discover how the waqf system can address Pakistan's rural education and healthcare crises. With millions of children out of school and inadequate health services, waqf offers a sustainable model rooted in Islamic principles to fund essential services independent of government budgets.

Maman Sarfraz

7/11/2025

Rural communities in Pakistan continue to face deep-rooted structural barriers to accessing quality education and healthcare. According to UNICEF (2023), an alarming 22.8 million children are currently out of school, with the majority residing in rural areas where infrastructure is either weak or entirely absent. Schools in many villages lack trained teachers, learning materials, and even basic sanitation. Parallel to this educational crisis is a widespread deficiency in healthcare access. The World Health Organization (WHO, 2023) notes that 45% of Pakistan's rural population remains deprived of even the most basic healthcare services, such as maternal care, immunizations, and emergency treatment. These systemic gaps contribute to the persistence of poverty, disease, and intergenerational inequality.

A promising and culturally rooted solution to these challenges is the revitalization of the Islamic endowment system known as *Waqf* (وقف). Historically, Waqf has played a pivotal role in funding and sustaining public goods, particularly in education and health sectors across the Muslim world. From the Ottoman Empire to Mughal India, Waqf institutions built and maintained schools, libraries, hospitals, and orphanages, independent of state financing.

In Pakistan, the Waqf system has remained largely dormant and underutilized, with much of its property either unregulated or mismanaged. By modernizing legal frameworks, improving governance, and enhancing transparency, Pakistan could transform idle Waqf assets into sustainable, community-managed resources for rural development. Waqf-funded schools and clinics could be established and operated independently of volatile public budgets or donor cycles, ensuring long-term service provision. Additionally, engaging local stakeholders and religious leaders in managing Waqf initiatives would build community ownership and trust. Bracing Waqf is not just a charitable act, it is a practical, faith-aligned strategy for empowering Pakistan's most underserved populations and closing the rural service delivery gap in a culturally resonant way.

Waqf as a Strategic Tool for Revitalizing Rural Services in Pakistan

Waqf is an Islamic philanthropic institution involving the permanent dedication of assets such as land, buildings, or monetary investments for religious, educational, or social welfare purposes. Once a Waqf is established, the endowed asset remains inalienable, while its revenues are continuously used to benefit communities, often across generations. This model of sustainable giving has historically played a transformative role across Muslim societies.

In Ottoman Turkey, Waqf was instrumental in financing public goods such as universities, hospitals, and soup kitchens, making essential services widely accessible. In Mughal India, prominent educational institutions like Jamia Millia Islamia thrived on Waqf support, offering free learning opportunities to marginalized groups. In contemporary Malaysia, Waqf has evolved to fund affordable housing and modern healthcare clinics, demonstrating its adaptability to today's social needs (Islamic Development Bank, 2022).

In rural Pakistan, the urgency of such support mechanisms cannot be overstated. The education sector faces a severe crisis: only 60% of children in rural areas have access to primary schools, and 35% drop out due to financial hardships (Pakistan Bureau of Statistics, 2023; ASER, 2023). A 40% shortage in trained rural teachers further compromises educational quality (Ministry of Federal Education and Professional Training, 2023). Healthcare is equally deficient about 70% of rural residents live over 10 kilometers from the nearest functioning hospital, while 62% cannot afford basic treatment (WHO, 2023; Pakistan Economic Survey, 2023). A single doctor often serves more than 5,000 people (Pakistan Medical Association, 2023).

Waqf offers a scalable and sustainable solution to these entrenched issues. Dedicated Waqf land can be used to construct low-cost schools and rural clinics. The income generated from Waqf investments can subsidize textbooks, medical equipment, and even staff salaries. Scholarships, teacher training programs, and subsidized healthcare services could all be supported through well-managed Waqf initiatives. By revitalizing and regulating this institution, Pakistan can empower its rural communities with better access to education and healthcare, breaking cycles of poverty and underdevelopment while honoring Islamic principles of social justice and charitable giving.

Lessons from Success Stories and a Path Forward

Across the Muslim world, Waqf has proven to be a powerful mechanism for social development, particularly in underserved communities. In Malaysia, the Waqf-funded Islamic Hospital in Kuala Lumpur has become a beacon of accessible healthcare, offering free treatments to thousands annually. In Turkey, Awqaf-owned universities

provide scholarships that enable rural and low-income students to pursue higher education, significantly reducing urban-rural educational disparities. In Bangladesh, Waqf-based microfinance models have empowered rural women by funding their education and small enterprises, contributing to both gender equity and local economic growth (Islamic Finance Forum, 2023).

For Pakistan to replicate and expand such successes, modernization of the Waqf system is essential. One of the first steps should be the digitization of Waqf management. A blockchain-enabled digital registry, as suggested by the State Bank of Pakistan (2023), would ensure transparency and protect assets from mismanagement or encroachment. Public-private partnerships can also be pivotal, collaboration with NGOs such as the Al-Khidmat Foundation can help mobilize resources, improve governance, and expand outreach. Additionally, integrating Sharia-compliant investment vehicles through Islamic banks can enable the financial growth of Waqf endowments while maintaining religious and ethical principles.

However, certain challenges need to be addressed. A major issue is the lack of transparency in asset use, which can be resolved through digital Waqf registries accessible to the public. Underutilized properties, often lying dormant or mismanaged, require a nationwide audit and strategic planning for development. Moreover, low public awareness about the potential of Waqf limits its growth. This can be tackled through targeted media campaigns, school curricula, and Friday sermons that emphasize the social and spiritual value of contributing to Waqf.

Conclusion

The revival of the Waqf system presents a unique and culturally grounded opportunity to address Pakistan's rural education and healthcare crises. With millions of children out of school and nearly half the rural population lacking access to basic health services, conventional approaches have proven insufficient to bridge these persistent gaps. Waqf, rooted in Islamic principles of perpetual charity, offers a sustainable model to fund and operate essential services independent of government budgets and donor cycles.

Historical precedents from the Muslim world show that Waqf has long been effective in building and sustaining hospitals, schools, and welfare programs. In today's context, countries like Malaysia, Turkey, and Bangladesh demonstrate how well-managed Waqf institutions can drive equitable development. Pakistan has the potential to follow suit by digitizing Waqf management, encouraging public-private partnerships, and investing in Sharia-compliant growth of Waqf funds.

If mobilized effectively, Waqf can finance rural schools, clinics, scholarships, and medical outreach programs, transforming underserved areas into self-reliant communities. Moreover, involving religious leaders, local stakeholders, and civil society in Waqf can enhance transparency and community trust. Revitalizing this traditional institution not only aligns with faith-based values but also offers a scalable, homegrown solution to rural inequality placing Waqf at the heart of Pakistan's inclusive development agenda.

References: UNICEF; WHO; Islamic Development Bank; Pakistan Economic Survey; State Bank of Pakistan; ASER; Ministry of Federal Education and Professional Training; Pakistan Medical Association; Islamic Finance Forum

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Sadaqah: Transforming Islamic Economic Philosophy

Explore how sadaqah transcends charitable relief in Islamic economic philosophy, empowering communities and addressing challenges like poverty and food insecurity. Discover its role in sustainable development and social justice.

Areej

7/16/2025

Sadaqah, derived from the Arabic root *sidq,* meaning truthfulness, is a powerful and voluntary act of charity in Islam that goes beyond mere financial donations. It reflects sincerity and compassion, embracing a broad spectrum of altruistic actions such as offering time, lending a helping hand, sharing knowledge, or even extending a smile. Unlike *Zakat*, which is obligatory and structured with defined recipients and amounts, *Sadaqah* is spontaneous, unrestricted, and inclusive. This flexibility allows it to address a wider range of needs, making it a versatile instrument for social welfare and economic upliftment (Islamic Relief, 2023).

In rural communities, where poverty is compounded by poor infrastructure, limited access to healthcare and education, and chronic underdevelopment, Sadaqah offers a unique mechanism for positive change. The World Bank (2022) reports that more than 80% of the world's extremely poor live in rural regions, underscoring the urgency for adaptable and community-centric development strategies. Sadaqah, when organized strategically through local institutions, NGOs, or community networks, can serve both immediate relief and long-term empowerment. It can fund school supplies, support small-scale farming, enable healthcare initiatives, or build clean water systems, investments that directly impact livelihoods and build self-reliance.

Moreover, the spiritual dimension of Sadaqah reinforces social cohesion, empathy, and collective responsibility. In contexts where formal economic systems fall short, Islamic philanthropy especially Sadaqah can be a transformative force, nurturing hope, dignity, and resilience among rural populations while aligning with ethical and faith-based values.

The Role of Sadaqah in Advancing Islamic Economic Principles in Rural Development

Sadaqah, a cornerstone of Islamic charity, embodies the principles of compassion, social justice, and wealth redistribution. Within the framework of Islamic economics, which emphasizes equitable distribution of resources and communal welfare, Sadaqah plays a pivotal role. The Quran (2:267) encourages believers to give from the good they earn, reinforcing the ethical imperative to uplift the less fortunate. The Hadith of the Prophet Muhammad (PBUH), "Charity does not decrease wealth" (Sahih Muslim 2588), further illustrates the reciprocal spiritual and material rewards of giving. Unlike Zakat, which is obligatory and structured, Sadaqah is voluntary and flexible making it an adaptable tool for socioeconomic transformation, especially in under-resourced rural communities.

According to the International Islamic Charitable Foundation (2023), Muslims around the world contribute over $200 billion annually in Sadaqah. This staggering figure highlights the untapped potential of Islamic philanthropy to support sustainable development goals. When strategically directed, especially in rural settings where deprivation is most acute, Sadaqah can fund initiatives that provide both immediate relief and long-term empowerment.

One key area for Sadaqah intervention is addressing basic needs such as food and healthcare. The FAO (2023) reports that rural households often spend more than 60% of their income on food, leaving little for education, health, or savings. Sadaqah-funded food programs, community kitchens, and agricultural assistance can significantly reduce hunger and malnutrition. Similarly, the World Health Organization (2022) reveals that nearly half of the rural global population lacks access to essential healthcare services. Sadaqah can fund mobile health units, vaccination programs, and maternal care, thereby improving health outcomes and lowering mortality rates.

Economic empowerment is another critical dimension. Interest-free microloans, consistent with Islamic financial ethics, have proven effective in boosting entrepreneurship in rural areas. According to Grameen-Jameel (2023), Islamic microfinance has increased small-scale business activities by 35%, especially among women. Sadaqah contributions can be used to provide capital for small enterprises, livestock farming, and home-based industries. In agriculture, where livelihoods depend heavily on environmental and technical inputs, Sadaqah can support training in sustainable farming, provision of improved seeds, and irrigation systems, boosting yields and food security.

Education and digital literacy are equally transformative. UNESCO (2023) notes that over 70 million rural children lack access to basic education. Sadaqah can help build schools, offer scholarships, and supply educational materials. As technology becomes central to development, the World Economic Forum (2023) emphasizes that digital skills increase rural employability by 40%. Establishing rural IT centers through Sadaqah funding can bridge the digital divide and connect marginalized communities to the global economy.

Infrastructure and environmental sustainability are also pressing concerns. Access to clean water, renewable energy, and reliable transportation can vastly improve living conditions. UNICEF

(2023) reports that 2 billion people still lack safe drinking water, mostly in rural areas. Sadaqah can support water wells, filtration plants, and sanitation projects. Likewise, investments in solar power, as highlighted by IRENA (2023), can raise productivity and reduce energy poverty. Environmental programs such as tree planting and waste management, guided by UNEP (2023) data, can restore ecosystems and mitigate rural land degradation.

To implement these initiatives effectively, a robust framework is necessary. First, local needs assessments should be conducted in collaboration with NGOs and community leaders to identify urgent priorities. Second, transparency in fund allocation can be ensured through digital platforms like Sadaqah Crowdfunding (Islamic Aid, 2023), which enhance donor confidence. Lastly, long-term monitoring and evaluation, tracking indicators like poverty rates, school attendance, and healthcare access, are essential for sustained impact. In essence, Sadaqah, when aligned with Islamic economic values and strategically deployed, is not merely charity, it is a powerful force for inclusive development, resilience, and dignity in rural communities.

Conclusion

Sadaqah stands as a transformative pillar within Islamic economic philosophy, offering far more than charitable relief, it represents a holistic approach to social justice, equity, and community empowerment. As a flexible and voluntary form of giving, it transcends monetary aid and addresses the multifaceted challenges rural communities face, including poverty, food insecurity, inadequate healthcare, and limited educational opportunities. The collective power of global Muslim contributions, estimated at over $200 billion annually, presents an extraordinary opportunity to drive sustainable development in under-resourced regions.

By funding targeted interventions such as microfinance, agricultural support, education, and clean water infrastructure, Sadaqah can alleviate immediate suffering while also fostering long-term resilience and self-reliance. The integration of modern tools like digital crowdfunding and impact monitoring ensures transparency and scalability, aligning charitable action with strategic development outcomes. Moreover, the spiritual essence of Sadaqah reinforces social cohesion and a shared moral responsibility to uplift the most vulnerable.

As formal economic systems struggle to meet the growing demands of rural populations, Sadaqah emerges as a viable and value-driven alternative. When thoughtfully implemented, it embodies the ethical and spiritual vision of Islam, building a just, compassionate society where no one is left behind. Harnessing its full potential could be a defining step toward inclusive global progress.

References: FAO; Islamic Relief; UNDP; World Bank; International Islamic Charitable Foundation; WHO; Grameen-Jameel; UNESCO; World Economic Forum; UNICEF; IRENA; UNEP

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Islamic Microfinance: Uplifting Rural Economies

Discover how Islamic microfinance serves as a powerful tool for rural economic upliftment. With real-world success in countries like Pakistan, Indonesia, Palestine, and Sudan, it offers a socially viable solution for poverty reduction.

Zainab Lashari

7/22/2025

In impoverished communities around the world, Islamic microfinance has emerged as a transformative force in promoting rural economic development and alleviating poverty. Rooted in the ethical and inclusive principles of Islamic finance such as risk-sharing, social justice, and the prohibition of interest (riba) it offers a compelling alternative to conventional financial systems that often exclude marginalized populations. Its adaptability to rural contexts, where access to traditional banking is often limited, makes Islamic microfinance particularly effective in addressing economic vulnerability.

Islamic microfinance empowers smallholder farmers, artisans, and women entrepreneurs by providing financial services that uphold dignity and self-reliance. Through Shariah-compliant instruments, it enables participants to access capital without incurring exploitative debt. Murabaha, a cost-plus financing model, allows clients to purchase essential assets with a known markup instead of interest. Mudarabah promotes entrepreneurship by enabling profit-sharing between an investor and a manager. Musharakah supports cooperative ventures through joint investment and risk-sharing. Qard al-Hasan, or benevolent lending, offers interest-free credit for social and emergency needs, embodying the Islamic principle of mutual assistance.

Evidence from countries such as Indonesia, Sudan, and Pakistan shows that Islamic microfinance contributes significantly to rural livelihoods. For instance, the Akhuwat Foundation in Pakistan has disbursed over PKR 180 billion in interest-free loans using Qard al-Hasan, helping lift thousands of families out of poverty. Such models have improved income stability, food security, and educational attainment, while also empowering women economically and socially. Academic studies underscore its role in fostering inclusive development, reducing dependency, and encouraging ethical entrepreneurship. As rural economies around the world continue to grapple with inequality, Islamic microfinance stands out as a culturally relevant, socially responsible, and financially sustainable solution that aligns with both spiritual values and practical needs of underserved communities.

Transformative Impact of Islamic Microfinance

Islamic microfinance has demonstrated tangible, transformative outcomes across diverse geographies, particularly in rural and underserved communities. Several successful initiatives illustrate its potential to reduce poverty, empower marginalized groups, and stimulate inclusive economic growth while adhering to Shariah principles.

In Pakistan, the Akhuwat Foundation stands out as a beacon of interest-free microfinance. Founded in 2001 by Dr. Muhammad Amjad Saqib, it has grown to become one of the largest institutions of its kind globally. As of 2024, Akhuwat has disbursed over 5.2 million loans totaling PKR 150 billion (approximately $537 million), directly benefiting 3.8 million families. Its flagship Family Enterprise Loan constitutes 92% of its portfolio and supports micro-enterprises with mentoring and training. The Ehsaas Naujawan Programme empowers youth through startup loans, while women, making up 42% of its borrowers have launched thousands of small businesses. According to the International Finance Corporation (IFC), Akhuwat has reduced poverty by 23% among recipient households.

In Indonesia, Baitul Maal Wat Tamwil (BMT) offers a unique model combining commercial Islamic microfinance with social finance tools like zakat and qard al-hasan. More than 4,000 BMTs serve over 5 million clients, 60% of whom are women. BMTs are instrumental in agricultural development, offering farmers seeds, tools, and training, boosting yields by 30%. Women who access BMT financing report household income increases of up to 35%, according to UNDP.

Palestine's DEEP (Deprived Families Economic Empowerment Program), funded by the Islamic Development Bank, uses Salam contracts to empower women cooperatives producing maftoul (Palestinian couscous). Over 1,200 women have gained stable incomes, with many exporting to the EU. Value-chain integration under this program has increased revenues by 50%.

In Sudan, the Abu Halimah Greenhouse Project, financed by the Bank of Khartoum and IsDB, created employment for 125 agricultural graduates. Producing off-season vegetables at a 20% internal rate of return, the project secured contracts with supermarket chains and lifted rural incomes by 40%.

The Impact and Promise of Islamic Microfinance

Islamic microfinance is increasingly recognized as a transformative force in advancing rural development, financial inclusion, and social equity across Muslim-majority and underserved regions. Anchored in principles of equity, risk-sharing, and ethical investment, this faith-based financial system not only provides access to capital for the poor but also supports livelihood creation in line with Shariah values. Recent evidence

highlights its growing role in alleviating poverty and empowering communities.

Studies by CGAP (2023) indicate that Islamic microfinance can reduce poverty by 15% to 25% in rural areas of countries like Pakistan, Indonesia, and Sudan. By offering interest-free or profit-sharing financial products tailored to community needs, it enables poor households to build assets, generate income, and withstand economic shocks. Women's empowerment is another notable achievement, nearly 60% of borrowers are women, many of whom use microloans to start home-based or small-scale enterprises. According to the OECD (2023), this has led to significant improvements in women's decision-making power, savings habits, and access to education and healthcare for their children.

Furthermore, Islamic microfinance contributes meaningfully to job creation. The International Labour Organization (ILO, 2023) finds that small and medium enterprises (SMEs) financed through Islamic modes create three times more employment opportunities compared to traditional credit systems. In the agricultural sector, Islamic financial tools such as Salam and Musharakah have helped smallholder farmers access inputs and markets, resulting in a 25–40% increase in crop yields in parts of Africa and Asia (IFAD, 2023).

Despite these successes, challenges persist. Limited awareness and financial literacy in remote rural areas constrain uptake. High operational costs, due to dispersed populations and the need for personalized services, make scalability difficult. Additionally, the lack of regulatory support and standardized Shariah-compliant frameworks in some countries hampers growth and innovation in the sector.

Looking forward, the future of Islamic microfinance lies in strategic investment in awareness campaigns, digital technologies, and inclusive regulatory reforms. Public-private partnerships, blended finance models, and regional knowledge exchanges can enhance scalability while preserving religious integrity. By strengthening institutional capacity and integrating Islamic finance into national rural development plans, countries can unlock the full potential of this ethical financial tool turning Islamic microfinance into a cornerstone of inclusive and sustainable economic transformation.

Conclusion

Islamic microfinance has proven to be a powerful catalyst for rural economic upliftment, offering a socially responsible and spiritually grounded alternative to conventional financial models. Through real-world applications in countries like Pakistan, Indonesia, Palestine, and Sudan, it has demonstrated measurable success in reducing poverty, empowering women, supporting agricultural development, and promoting entrepreneurship.

Institutions like the Akhuwat Foundation and BMTs exemplify how ethical finance can drive large-scale impact without compromising religious principles. Despite challenges such as limited awareness, high operational costs, and regulatory hurdles, the successes of Islamic microfinance underscore its viability and scalability when supported by strong institutions and strategic partnerships.

Moving forward, enhancing financial literacy, investing in digital delivery mechanisms, and fostering enabling policy environments will be critical. By bridging ethical values with inclusive development, Islamic microfinance not only addresses immediate financial needs but also contributes to broader goals of social justice, community resilience, and sustainable livelihoods. It offers a path forward where finance serves people, upholds dignity, and aligns economic action with moral purpose, making it a vital tool in reshaping rural economies and achieving equitable growth in the decades to come.

References: Rahman; Akhuwat Foundation; Islamic Development Bank; World Bank; CGAP; OECD; ILO; IFAD

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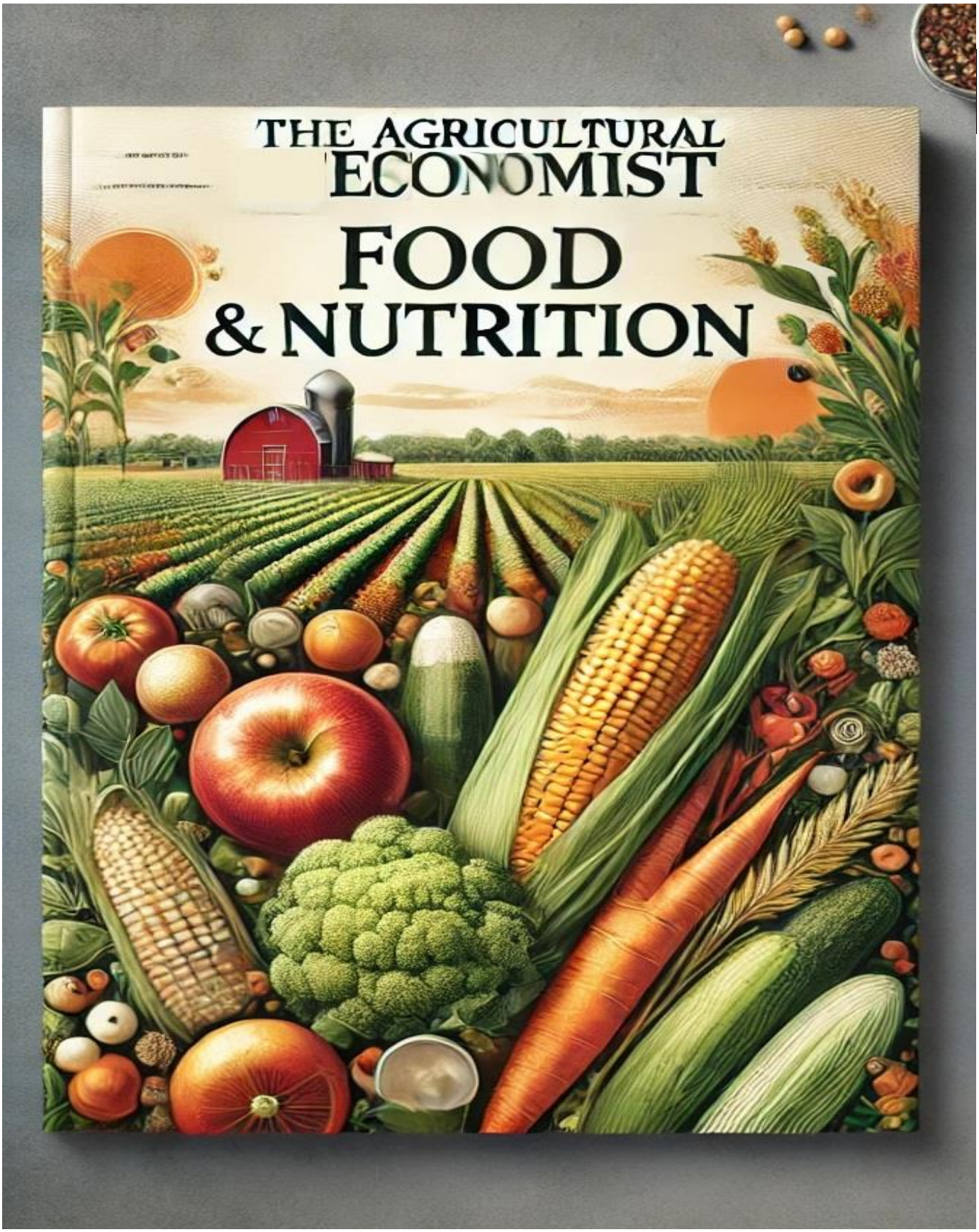

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Pulses and Grains: The Future of Plant-Based Diets

Explore the resurgence of pulses and grains as essential components of plant-based diets. Learn how these crops address climate change, health crises, and food insecurity while promoting sustainability and nutrition.

Mithat Direk

7/4/2025

Pulses and grains have sustained human civilization for thousands of years, forming the backbone of diets since the earliest days of settled agriculture. As societies transitioned from hunting and gathering to farming during the Neolithic era, the cultivation of legumes such as lentils, chickpeas, and beans became central to food security and nutrition. These crops were not only easy to store and cultivate, but also provided essential proteins, vitamins, and minerals to support growing populations. For centuries, especially in Asia, Africa, and the Middle East, pulses were a dietary staple alongside grains like wheat, millet, and rice.

The global rise in meat consumption, especially in post-medieval Europe and throughout the industrialized world, gradually shifted dietary preferences toward animal protein. This shift was often associated with economic prosperity and urbanization. However, mounting evidence linking excessive red and processed meat intake to chronic health issues such as cardiovascular disease, Type 2 diabetes, and obesity has catalyzed a renewed global focus on plant-based diets.

In response, international organizations have begun advocating for a return to traditional food systems that emphasize legumes. The United Nations' designation of 2016 as the International Year of Pulses marked a turning point in global awareness. The FAO highlighted pulses not only as environmentally sustainable crops due to their nitrogen-fixing properties and low water requirements but also as potent allies in the fight against malnutrition and non-communicable diseases. Their high protein, fiber, and micronutrient content, along with low glycemic index and absence of cholesterol, make them ideal for promoting heart health and managing weight.

Today, in the face of climate change, rising food insecurity, and health crises, pulses and grains are regaining their place at the center of global food systems. Their affordability, sustainability, and nutritional density position them as critical components of a resilient, healthy, and equitable food future.

Legume Consumption and Production in Türkiye

Türkiye, situated in the historic Fertile Crescent, is renowned as a center of origin and biodiversity for many legume species. The country maintains a deep-rooted cultural and culinary tradition of consuming legumes, and its population continues to rely heavily on them for daily nutrition. According to the Turkish Statistical Institute (TÜİK, 2023), annual per capita consumption remains robust, averaging 3 kg of beans, 4.5 kg of lentils, and 5.5 kg of chickpeas. These figures place Türkiye among the world’s top consumers of legumes, reflecting their central role in national diets, especially in rural households where pulses serve as affordable and protein-rich food options.

Despite this strong domestic demand, Türkiye's legume production faces significant challenges. In 2023, the total area under dry legume cultivation stood at 878,712 hectares, representing just 4.33% of the country’s total agricultural land (TEPGE, 2024). Chickpeas dominated with 458,771 hectares (52.20%), followed by red lentils at 278,152 hectares (31.65%), dry beans at 88,456 hectares (10.06%), and green lentils at 44,778 hectares (5.09%). However, despite favorable climatic conditions and a long-standing tradition of legume farming, yields have declined in recent years. Key contributing factors include the growing preference for more profitable crops, reduced support prices, low market access for smallholder farmers, and limited mechanization in legume farming.

This stagnation in production has resulted in Türkiye increasingly turning to legume imports to meet consumer demand. According to the Turkish Grain Board (TMO, 2023), import reliance has grown steadily, especially for red lentils and chickpeas. This trend not only threatens national food security but also undermines the potential for rural income generation and agrobiodiversity preservation. Reinvigorating the legume sector through targeted policies, improved value chains, and sustainable farming incentives will be essential to bridging the production-consumption gap and enhancing Türkiye’s food sovereignty.

Addressing Challenges and Unlocking Opportunities

Türkiye’s legume sector, once a global benchmark for pulse production and biodiversity, now faces mounting challenges that threaten its long-term sustainability and self-sufficiency. One of the foremost concerns is declining domestic production. Between 2010 and 2023, the total area dedicated to legume cultivation contracted by 15%, a decline attributed largely to stagnant yields and outdated farming practices (TZOB, 2023). The lack of innovation in seed technology, poor irrigation infrastructure, and limited access to mechanization have further compounded the problem, pushing farmers toward alternative, more profitable crops such as cereals and industrial cash crops.

This production shortfall has made Türkiye increasingly reliant on imports. In 2023 alone, the country imported over 200,000 tons of lentils and chickpeas,

mainly from Canada and Kazakhstan (TURKSTAT, 2024). Such dependence not only threatens national food security but also undermines local agricultural resilience. A major driver behind this trend is the relatively lower government support for legume growers. Compared to cereal farmers, those cultivating pulses receive fewer subsidies and have limited access to guaranteed procurement, leading to declining profitability and disincentivizing long-term investment (Ministry of Agriculture, 2023).

Yet, the legume sector holds immense potential for renewal. Global trends indicate a surge in demand for plant-based proteins, with the international legume market now valued at over $40 billion (FAO, 2023). In addition to their dietary benefits, legumes are essential for sustainable farming systems, as they fix atmospheric nitrogen, thereby improving soil fertility and reducing dependence on chemical fertilizers (ICARDA, 2022). Türkiye's strategic location, diverse agro-ecological zones, and historical reputation for quality pulses position it well for export growth, especially to the Middle East and European Union.

To harness this potential, Türkiye must prioritize revitalizing its legume sector through supportive policy interventions. These should include increasing subsidies for inputs such as fuel, fertilizer, and certified seeds; implementing a difference payment support system to protect farmer incomes from market fluctuations; promoting modern cultivation techniques through extension services and training; and expanding export incentives targeting high-potential markets. With a coordinated strategy that aligns economic, health, and environmental goals, Türkiye can reestablish itself as a competitive and sustainable leader in global legume production.

Conclusion

Pulses and grains are experiencing a timely resurgence as global food systems face intersecting challenges of climate change, health crises, and food insecurity. Historically central to human diets, these crops are regaining prominence for their affordability, sustainability, and rich nutritional profile. The renewed global emphasis on plant-based diets, bolstered by international campaigns like the UN's International Year of Pulses, has highlighted their role in combating malnutrition, chronic diseases, and environmental degradation.

In Türkiye, the cultural and dietary significance of legumes remains strong, but production has not kept pace with demand. Declining cultivation, limited government support, and rising imports have eroded the country's traditional strength in pulse farming. This trend poses risks to both food security and rural livelihoods, particularly for smallholder farmers.

Yet, Türkiye is well-positioned to lead a legume revival. Its geographic advantages, agrobiodiversity, and growing global demand present a unique opportunity. With targeted investment in modern farming techniques, policy reforms, and export-driven incentives, Türkiye can revitalize its pulse sector. By bridging the production-consumption gap, the country can reduce import dependency, enhance rural incomes, and contribute to global sustainability goals. Legumes are more than historical staples, they are strategic assets for a healthier, more resilient future.

References: FAO; TEPGE; TÜİK; Ministry of Agriculture and Forestry; ICARDA; TMO; TZOB; TURKSTAT

Please note that the views expressed in this article are of the author and do not necessarily reflect the views or policies of any organization.

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Pakistan's Food Security: A National Challenge

Pakistan’s food security crisis is a national emergency shaped by climate change, population growth, and water scarcity. These overlapping pressures threaten agriculture, livelihoods, and public health. Urgent, integrated, and long-term reforms are essential to ensure a sustainable future.

Farah Gilal

7/8/2025

In recent years, Pakistan has found itself at the intersection of three intensifying and interconnected crises: climate change, rapid population growth, and deepening food insecurity. These challenges are not distant policy dilemmas or theoretical projections; they are pressing realities that millions of Pakistanis confront daily. The impacts are stark. Farmers grapple with erratic rainfall, prolonged droughts, and extreme heatwaves that disrupt planting and harvesting cycles. At the same time, a growing urban population faces surging food prices and declining access to nutritious staples, fueling malnutrition and social discontent.

The agricultural sector, employing over 35% of the labor force and contributing around 19% to GDP, has been severely affected by climate-induced shocks. Water availability has become increasingly unpredictable due to melting glaciers, declining groundwater, and mismanaged irrigation. Meanwhile, Pakistan’s population is projected to exceed 270 million by 2030, escalating demand for food, water, and land. This demographic pressure, if left unaddressed, will outpace the country’s capacity to produce and distribute essential food commodities.

This article urges policymakers, researchers, and citizens alike to view food security not in isolation, but as a nexus issue that connects environmental sustainability, demographic dynamics, economic stability, and public health. Addressing food insecurity requires more than increasing crop yields, it demands climate-resilient farming systems, investment in rural infrastructure, responsible water governance, and inclusive policy frameworks that prioritize vulnerable communities. The path forward lies in recognizing that food security is not just a sectoral issue, it is a national imperative.

Understanding the Food Security Challenge

The concept of food security, as defined by the FAO, revolves around four pillars: availability, access, utilization, and stability. In Pakistan, all four pillars are under strain.

According to the Global Hunger Index 2023, Pakistan ranks 102 out of 125 countries, placing it in the “serious” hunger category. The Pakistan Bureau of Statistics and the World Food Program estimate that over 36.9% of the population faces moderate to severe food insecurity. In rural areas, where agriculture is the primary source of livelihood, chronic undernourishment is most severe. The National Nutrition Survey 2018 further reveals that over 40% of children under five are stunted, and nearly 18% are wasted as a consequence of both insufficient food and poor nutrition.

While Pakistan produces substantial quantities of staple crops such as wheat, rice, and sugarcane, it has increasingly struggled with distribution, affordability, and climate-related losses. What we are witnessing is not merely a failure of production, but of systems, resilience, and foresight. Despite being an agricultural country, Pakistan imported wheat and pulses in recent years to meet domestic needs, a clear indication of systemic stress.

Navigating Demographic, Environmental, and Economic Pressures on Pakistan’s Food Security

Pakistan stands at a critical juncture where population dynamics, climate volatility, and systemic inefficiencies are converging to threaten national food security. The country’s population has surged from 33 million in 1950 to over 241 million in 2024, and at a steady growth rate of 2%, projections suggest this figure could surpass 330 million by 2050. While such growth is often framed as a demographic dividend, it also imposes tremendous strain on food systems, land, water, and energy. The agricultural sector, contributing just 22.2% to GDP and employing 37% of the workforce (Economic Survey of Pakistan, 2023), is under increasing pressure to meet the dietary needs of a swelling population without corresponding reforms in land use, mechanization, or productivity.

Urbanization, fueled by rural-to-urban migration, compounds this challenge. By 2023, 37% of Pakistan’s population lived in urban areas, a figure expected to rise to 50% by 2050. This shift increases demand for high-value perishables such as milk, vegetables, and fruit, which require reliable logistics and cold chains, facilities still largely underdeveloped. As infrastructure struggles to keep pace, supply bottlenecks and post-harvest losses worsen food availability.

Meanwhile, climate change quietly exacerbates every aspect of this crisis. Ranked among the world’s most climate-vulnerable nations, Pakistan endured 152 extreme weather events between 1999 and 2018, with economic losses averaging $3.8 billion annually. The 2022 floods alone displaced over 33 million people, destroyed crops on more than 9.4 million acres, and caused damages worth $30 billion. Rising temperatures, erratic rainfall, and heat

stress are particularly harmful to wheat, Pakistan's primary staple, with a 1°C temperature rise slashing yields by up to 5%, according to the Pakistan Agricultural Research Council. These disruptions ripple through supply chains, inflating food prices and deepening rural poverty.

Water scarcity further complicates matters. Agriculture consumes over 90% of Pakistan's freshwater, primarily sourced from the Indus River System. Yet per capita water availability has plunged from 5,260 cubic meters in 1951 to under 1,000 cubic meters, below the global scarcity threshold. Inefficient canal systems, declining groundwater, and erratic rainfall endanger water-intensive crops like sugarcane, cotton, and rice. The growing water gap not only jeopardizes food production but fuels interprovincial tensions and rural unrest, especially where tail-end farmers receive disproportionately less water.

Simultaneously, Pakistan's fertile agricultural land is vanishing under expanding urban footprints. In Punjab and Sindh, housing schemes, commercial zones, and infrastructure projects encroach upon some of the country's most productive farmland. The Pakistan Council of Research in Water Resources warns of a 1% annual loss of arable land due to urban sprawl. This land-use transformation not only reduces the country's food-producing capacity but also disrupts peri-urban agriculture, which supplies cities with essential vegetables and perishables.

Even when food is available, access remains a pressing issue. In April 2023, food inflation reached a staggering 40.2% year-on-year, according to the Pakistan Bureau of Statistics. Basic items like wheat flour, pulses, and cooking oil have become unaffordable for millions. These spikes are not solely climate-driven; they are exacerbated by market inefficiencies, speculative hoarding, and policy missteps. Delays in wheat imports or poor crop forecasts can create artificial shortages, triggering panic buying and further price hikes. The urban poor and daily wage earners bear the brunt, with many forced to cut meal portions or reduce diet quality. These coping strategies have lasting consequences: rising malnutrition, increased school dropout rates, and the perpetuation of child labor.

Together, these interconnected trends represent more than a food crisis, they reflect a national development emergency. Solving it requires moving beyond short-term fixes and embracing integrated reforms. That means improving agricultural productivity through better seeds, mechanization, and research. It demands investment in climate-resilient infrastructure, water-efficient technologies, and rural logistics. Equally crucial is the political will to regulate land use, reform markets, and deliver timely support to vulnerable populations.

Strategies to Secure Pakistan's Food Future

Pakistan's food security crisis, though complex and urgent, is not beyond resolution. A transformative approach rooted in cross-sector collaboration, political will, and strategic investments can shift the trajectory toward long-term sustainability. Agricultural reform must be the starting point. Investing in climate-smart technologies such as drought-tolerant seeds, drip irrigation, conservation tillage, and crop diversification can enhance productivity while mitigating environmental impact. Digital advisory services and mechanization can also close the yield gap, particularly for smallholders.

Equally important is water governance. With agriculture consuming over 90% of available freshwater, better resource management is imperative. Introducing pricing mechanisms, lining canals to reduce seepage, regulating groundwater extraction, and expanding drip and sprinkler systems are practical steps toward preserving this dwindling resource.

Modernizing the food supply chain is essential to reduce inefficiencies. Post-harvest losses, currently 15–20% for many crops, can be curbed through investments in cold storage, rural road networks, and market access. Stabilizing strategic reserves and buffer stocks will cushion price volatility and enhance resilience against external shocks.

Population stabilization is another cornerstone. Improving access to family planning, reproductive healthcare, and education, especially for girls will help manage demographic pressure on food systems. Public awareness campaigns are needed to normalize and promote these services.

Building resilience through disaster preparedness must also be prioritized. Strengthening early warning systems, crop insurance, and social protection can safeguard livelihoods from climate extremes. These are critical to preventing hunger and displacement in a warming world.

Lastly, strong institutional coordination is vital. Ministries of agriculture, climate change, water, and planning must operate in concert. Food security should be central to national development, with policies like the National Food Security Policy (2018) updated, funded, and transparently implemented. A secure food future for Pakistan hinges not on rhetoric, but on unified, sustained action.

Conclusion

Pakistan's food security dilemma is not just an agricultural or environmental issue, it is a national development challenge demanding immediate, integrated, and long-term solutions. The convergence of climate stress, rapid population growth, water scarcity, and systemic inefficiencies is placing unprecedented strain on food systems, livelihoods, and public health. From vanishing arable land to rising food inflation, the evidence is clear: the current trajectory is unsustainable.

But within this crisis lies an opportunity to transform agriculture into a climate-resilient, inclusive, and productive sector. This requires a shift in thinking: from reactive responses to proactive planning, from isolated interventions to coordinated action. The adoption of

climate-smart farming, investment in rural infrastructure and market systems, and reforms in land and water governance are not optional, they are essential.

Equally vital is investing in human capital, especially youth and women through education, healthcare, and economic empowerment. Demographic transition, supported by robust family planning and nutrition strategies, will ease pressure on natural resources and improve resilience.

Above all, food security must be embedded at the heart of Pakistan's national development agenda. With strong political will, evidence-based policymaking, and sustained public engagement, the country can move beyond crisis management toward food sovereignty, social equity, and environmental sustainability. The time to act is now.

References: FAO, GHI, NNS, Economic Survey of Pakistan; Pakistan Agricultural Research Council; PCRWR

Please note that the views expressed in this article are of the author and do not necessarily reflect the views or policies of any organization.

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Food Safety in Peri-Urban Agriculture in Pakistan

Explore the critical issue of food safety in peri-urban agriculture within water-stressed cities like Faisalabad, Pakistan. This study reveals alarming levels of microbial, chemical, and pesticide contamination entering the food chain, posing serious health risks.

Uswa Babar & Raza Ullah

7/15/2025

Food safety remains a critical public health challenge globally, particularly in developing countries where infrastructural deficiencies, weak regulatory oversight, and growing urban demands intersect with limited water availability. In Pakistan, rapid urbanization and agricultural intensification have increased reliance on untreated wastewater for crop irrigation, especially in water-scarce peri-urban areas like Faisalabad. This study investigates the food safety risks associated with wastewater irrigation using a mixed-methods approach involving survey data from 100 randomly selected households and statistical analysis through binary logistic regression.

The results reveal widespread concerns about bacterial and viral pathogens such as *E. coli* and *Salmonella* as well as agrochemical contaminants including heavy metals like lead and cadmium and residual pesticides. These contaminants enter the food chain through raw or insufficiently washed vegetables, posing both acute and long-term health risks. Findings indicate that socioeconomic status, education level, and access to information significantly shape household perceptions of food safety. More educated and better-informed households are more likely to identify and avoid contaminated produce.

At the national level, the problem is alarming. Nearly 40% of vegetables in urban Pakistani markets test positive for fecal coliforms, and Faisalabad's dependency on wastewater irrigation, affecting 60% of its peri-urban farms, underscores the urgent need for policy action. Globally, an estimated 10% of the population suffers from foodborne illnesses annually, with South Asia experiencing a disproportionately high burden (WHO, 2023).

To mitigate these risks, the study recommends a multi-pronged policy response: rigorous water quality monitoring, construction of localized wastewater treatment plants, and improvement of irrigation canal infrastructure. Additionally, farmer training programs and public awareness campaigns on food hygiene and safe agricultural practices are essential. Without these interventions, the cycle of contamination and health vulnerability will persist, undermining both public health and sustainable food systems in Pakistan.

Health and Economic Consequences of Contaminated Agriculture in Pakistan

The excessive use of pesticides and the widespread reliance on untreated wastewater for crop irrigation in Pakistan have led to severe health and economic repercussions. Agricultural practices in peri-urban and rural areas, particularly those involving wastewater irrigation, have significantly compromised food safety and public health. According to the FAO (2023), pesticide overuse in Pakistan has resulted in residue levels up to three times above internationally accepted safety limits in commonly consumed crops. These residues, when ingested over time, contribute to a range of chronic health conditions, including hormonal imbalances, neurological disorders, and reproductive issues.

Moreover, heavy metal contamination such as arsenic, cadmium, and mercury commonly found in industrial wastewater used for irrigation, has emerged as a silent but deadly threat. Prolonged exposure to such contaminants through food intake can lead to life-threatening conditions like kidney failure, liver damage, cancers, and developmental disorders in children (Journal of Environmental Science, 2023). Vulnerable populations, particularly children and the elderly, face the highest risks due to weaker immune systems and nutritional vulnerabilities.

The economic burden of these health impacts is equally alarming. In Punjab alone, annual healthcare costs attributed to foodborne diseases have surpassed PKR 12 billion, placing immense strain on an already overburdened public health system (Ministry of National Health Services, 2023). These costs encompass not only direct medical expenses but also lost productivity, absenteeism, and reduced earning capacity among affected individuals. Addressing these issues through improved regulation, farmer education, and investment in safe water infrastructure is vital for safeguarding both human health and economic stability.

Understanding Food Safety Risks and Perceptions in Peri-Urban Faisalabad

The findings from a household-level survey in peri-urban Faisalabad highlight critical insights into food safety perceptions, contamination exposure, and the socio-economic dynamics shaping consumer behavior. Women comprised 78% of respondents, reflecting their central role in food purchasing and preparation. Most participants were between 25 and 34 years old, with varying education levels while 33% held bachelor’s degrees, 7% were illiterate. The average household income stood at PKR 97,380 per month, pointing to a modest lower-middle-income demographic.

Despite economic pressures, a striking 90% of households were aware of

contamination risks in food. Yet, affordability emerged as a dominant factor driving consumer choices. About 70% of respondents sourced their fruits and vegetables from open-air markets, which are cheaper but more likely to sell produce irrigated with untreated wastewater. Weekly household expenditure on fresh produce averaged PKR 4,492 for 10 kg, underlining cost sensitivity in food purchasing decisions.

Food safety concerns were widespread, with respondents identifying bacterial and viral contamination (72%), chemical toxins (65%), and pesticide residues (58%) as major hazards. Alarmingly, 65% of households reported at least one case of foodborne illness, commonly resulting in symptoms such as vomiting and diarrhea. The average treatment cost per illness episode was PKR 5,289, an avoidable burden for many families already managing tight budgets.

Regression analysis revealed that perceptions of chemical contamination were significantly influenced by age, education, and access to information. Women and higher-income households were more likely to identify pesticide residues as a concern, while bacterial risk perceptions were closely tied to education levels and market source, particularly the risks posed by open-air vendors.

Ultimately, the findings emphasize that food safety awareness alone does not lead to behavior change when affordable, clean alternatives are lacking. The absence of accessible treated water for irrigation, weak enforcement of environmental regulations, and the unavailability of low-cost food testing facilities exacerbate exposure to contaminated food. Strengthening infrastructure, policy enforcement, and consumer protection systems is essential to bridge the gap between awareness and safe consumption practices in Pakistan's urban and peri-urban areas.

Policy Recommendations for Enhancing Food Safety in Peri-Urban Agriculture

Addressing the food safety crisis in peri-urban regions like Faisalabad requires a multi-pronged policy approach that tackles infrastructural deficits, regulatory gaps, awareness limitations, and economic disincentives. Infrastructure development must be prioritized, particularly the expansion of wastewater treatment facilities. Currently, only about 5% of Punjab's wastewater is treated before reuse, leaving a vast majority of agricultural water sources contaminated. Additionally, investing in canal networks and clean water delivery systems can reduce farmers' reliance on untreated effluents and improve irrigation quality.

Regulatory frameworks also need urgent strengthening. Mandatory water quality testing should be enforced for all irrigation sources, especially those in high-risk zones near industrial areas. Moreover, tighter controls on pesticide use are essential. The banning of WHO Class I pesticides, which are highly hazardous, must be accompanied by strict enforcement and penalties to deter misuse.

Awareness and education play a pivotal role in behavioral change. Farmers need targeted training on safe irrigation practices, such as appropriate intervals between wastewater application and harvesting. Consumers, too, should be engaged through mobile platforms like Pakistan's Kisan Portal, which can disseminate hygiene tips and contamination alerts.

Finally, economic incentives are critical for encouraging safer practices. Subsidies should be provided for farmers transitioning to organic agriculture or adopting bio-pesticides. Low-interest loans can help smallholders invest in safer irrigation technologies, such as drip systems and lined water storage tanks. Together, these policy measures can significantly reduce foodborne health risks and contribute to a safer, more sustainable agricultural system in Pakistan.

Conclusion

Food safety in peri-urban agriculture is an escalating concern in Pakistan, particularly in water-stressed cities like Faisalabad, where untreated wastewater is widely used for irrigation. This study underscores the alarming extent of microbial, chemical, and pesticide contamination entering the food chain, posing serious health risks including gastrointestinal illnesses, chronic diseases, and long-term developmental issues. With over 65% of households surveyed reporting foodborne illnesses and average treatment costs imposing a considerable financial burden, the need for urgent intervention is clear.

Despite high public awareness, most households continue to rely on unsafe food sources due to economic constraints and the lack of viable alternatives. Contamination risks are further compounded by limited access to treated water, weak enforcement of environmental regulations, and the absence of affordable food quality testing at the local level. The findings reveal that while education and income levels shape risk perceptions, they are insufficient in driving behavioral change without broader structural support.

To address these challenges, a comprehensive policy response is needed. This includes investment in wastewater treatment infrastructure, stricter regulatory enforcement, targeted farmer training, and economic incentives to promote safer agricultural practices. Without these coordinated efforts, the cycle of contamination will persist, undermining public health, burdening healthcare systems, and threatening food security across urban and peri-urban Pakistan.

References: WHO; PCRWR; FAO; Punjab Irrigation Dept; Journal of Environmental Science; Ministry of National Health Services

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Urban Agriculture: A Solution for Food Deserts

Discover how urban agriculture can transform food deserts into thriving community spaces. Explore the benefits of community gardens, rooftop farms, and innovative urban planning for sustainable, resilient cities.

Zara Kashif

7/17/2025

Urban food deserts and thriving urban gardens offer a stark contrast in cityscapes, revealing deep-rooted disparities in access to nutritious food and community resilience. On one hand, urban food deserts are neighborhoods where residents face limited or no access to affordable and healthy food due to the absence of full-service grocery stores (CDC, 2023). These areas are most often found in low-income and minority communities, where structural inequalities, underinvestment, and limited transportation options compound the problem.

As a result, residents often rely on convenience stores and fast food, which contributes to higher rates of diet-related illnesses such as obesity, hypertension, diabetes, and cardiovascular disease (Health Affairs, 2024). Even with the growth of online grocery services, many of these communities remain underserved due to technological, logistical, or economic barriers (USDA, 2023).In contrast, urban gardens have emerged as innovative, community-based responses to food insecurity and environmental degradation. Built on vacant lots, rooftops, or underutilized spaces, these gardens provide more than just fresh produce, they offer safe, green spaces that promote social cohesion, education, and empowerment (Frontiers in Sustainable Cities, 2025). Urban gardens are also beneficial to the environment, helping to manage stormwater runoff, improve air quality, and reduce the urban heat island effect (Nature Sustainability, 2024). Beyond nutrition, they become platforms for teaching sustainable agricultural practices, healthy eating habits, and civic engagement (Journal of Urban Agriculture, 2024).

The dichotomy between food deserts and urban gardens underscores the urgent need for equitable urban planning and inclusive food policies. By integrating urban agriculture into zoning laws, investing in community-based food systems, and addressing transportation and economic barriers, cities can transition from inequity to empowerment. Urban gardens exemplify how grassroots efforts can reclaim food sovereignty and foster healthier, more resilient urban communities.

Understanding Urban Food Insecurity in a Changing World

Urban food insecurity is a growing concern shaped by complex socioeconomic and environmental dynamics. According to the Food and Agriculture Organization (FAO, 2023), food security exists when all people have consistent access to sufficient, safe, and nutritious food for an active and healthy life. However, in urban areas, the foundational pillars of food security, availability, accessibility, stability, and utilization, are frequently undermined by the pressures of rapid urbanization, widening income inequality, climate volatility, and fragmented food systems (World Bank, 2024).

Between 2021 and 2025, research has highlighted several interlinked drivers of urban food insecurity. First and foremost is poverty. Low-income urban residents are disproportionately affected by higher food prices, inadequate public transportation, and limited access to grocery stores that offer healthy options (AJCN, 2023). A 2024 study published in *The Lancet* found a strong correlation between urban poverty, poor dietary diversity, and increased risks of non-communicable diseases.

Another major contributor is the spatial distribution of food environments. Many low-income neighborhoods are categorized as either food deserts (areas lacking access to nutritious food) or food swamps (areas inundated with fast food and processed options) (Health Equity, 2024). A 2023 study by Johns Hopkins University found that food stamps are even more strongly associated with obesity than food deserts alone.

Urban food supply chains also present critical vulnerabilities. Cities depend heavily on long-distance transportation networks, which are susceptible to disruptions from climate-related disasters, fluctuating fuel prices, and infrastructural breakdowns (Food Systems Journal, 2025). In many regions, such as Sub-Saharan Africa, poor urban planning has further fragmented food distribution networks, exacerbating malnutrition (UN-Habitat, 2024).

Compounding all these challenges is climate change. Elevated CO_2 levels are reducing the nutrient content of staple crops, potentially leading to widespread micronutrient deficiencies (Nature Climate Change, 2024). Meanwhile, extreme weather events and rising temperatures degrade food quality and disrupt urban agriculture (IPCC, 2023).

Urban Agriculture: A Multifunctional Pathway to Sustainable Cities

Urban agriculture has emerged as a powerful tool to address pressing urban challenges, from food insecurity to climate resilience. Drawing on global studies conducted between 2021 and 2025, urban agriculture is increasingly recognized not just for its food production capacity, but for its broader social, economic, and environmental impacts.

Community gardens remain at the heart of urban agriculture. These shared green spaces enhance food access, improve mental well-being, and foster social

cohesion, as shown in the Edmonton Urban Health Study (2024). Atlanta's Urban Food Forest at Browns Mill is a leading example, where residents harvest fresh produce while engaging in environmental education (Eater Atlanta, 2024).

Rooftop farms offer another innovative solution by transforming underutilized urban surfaces into productive landscapes. In addition to reducing urban heat and improving air quality, they maximize limited space. Montreal's Lufa Farms operates the world's largest rooftop greenhouse using hydroponics and electric vans for low-emission food distribution (Wired, 2024).

Vertical farming, characterized by stacked, climate-controlled systems, provides high yields using minimal land and water. Although high energy demands remain a challenge, advancements in AI automation are improving their efficiency and viability (Frontiers in Agritech, 2025).

Hydroponic and aquaponic systems, which grow food without soil, conserve water and enable year-round production in urban settings. These approaches are ideal for cities facing water scarcity, offering a 44% reduction in water use compared to traditional methods (Journal of Cleaner Production, 2024; FAO, 2023).

Urban food forests and pollinator gardens mimic natural ecosystems, supporting biodiversity and climate action. While integrated beehives boost yields, they must be carefully managed to avoid disrupting native pollinators (Ecological Applications, 2025).

Ultimately, urban agriculture boosts local food availability, lowers costs through shorter supply chains, promotes healthier diets, creates jobs, and supports environmental goals. Its diverse forms make it a cornerstone of resilient, sustainable urban futures.

Overcoming Barriers to Scale Urban Agriculture

Urban agriculture holds tremendous promises for enhancing food security, sustainability, and resilience in cities, but its widespread adoption faces several challenges. One of the foremost barriers is land scarcity, exacerbated by rapid urbanization and competing demands for space (Urban Studies, 2024). Limited access to affordable urban land often pushes urban farms to marginal or temporary spaces, reducing their long-term viability. Additionally, high startup costs, including infrastructure, equipment, and water management systems combined with restrictive zoning regulations, further hinder the growth of urban agriculture initiatives (Journal of Urban Policy, 2025).

To address these challenges, several scaling strategies are gaining traction. Policymakers are increasingly recognizing the potential of urban farming and implementing supportive frameworks. Innovative approaches like "agri-urban" zoning designate land specifically for food production within city boundaries. Financial tools such as tax incentives, subsidies, and municipal land grants can help reduce costs and attract investment in community and commercial farms (World Resources Institute, 2025).

Technology plays a pivotal role in scaling urban agriculture efficiently. Smart farming techniques powered by the Internet of Things (IoT) and AI-driven automation allow real-time monitoring of crops, precision irrigation, and predictive analytics for yield optimization (Frontiers in Agritech, 2025). Closed-loop indoor farms, controlled by AI systems, minimize water, energy, and labor inputs while maximizing output in compact spaces (MIT Tech Review, 2025). Moreover, cutting-edge innovations like solar-powered electro-agriculture are paving the way for off-grid, soil-free production, expanding possibilities for food production even in dense urban centers (Science Advances, 2025).

Conclusion

As urban populations continue to swell and traditional food systems strain under socioeconomic and environmental pressures, urban agriculture emerges not merely as a stopgap, but as a strategic imperative for resilient, inclusive, and sustainable cities. The stark contrast between food deserts and urban gardens reveals the deeply embedded inequities in urban food access, inequities that can be addressed through deliberate urban planning, community-driven innovation, and policy reform. Urban agriculture, in its diverse forms, community gardens, rooftop farms, vertical systems, and hydroponics, not only improves food availability but fosters education, entrepreneurship, environmental restoration, and social cohesion.

Yet, for urban agriculture to fulfill its transformative potential, systemic challenges must be tackled. Land scarcity, zoning restrictions, and high initial costs continue to limit expansion. However, as cities begin adopting agri-urban zoning policies and integrating smart technologies like AI-driven automation and solar-powered systems, a scalable, tech-enabled future for urban food production becomes increasingly viable.

Ultimately, bridging the urban food divide requires holistic interventions that merge grassroots innovation with institutional support. Urban agriculture exemplifies how communities can reclaim agency over food systems, improve public health, mitigate climate risks, and build local resilience. If nurtured through inclusive governance, equitable investment, and adaptive infrastructure, urban farming can become a foundational pillar of 21st-century food security and ecological sustainability.

References: CDC; Health Affairs; FAO; Nature Sustainability; Eater Atlanta; Science Advances; World Resources Institute; USDA; Frontiers in Sustainable Cities; Journal of Urban Agriculture; AJCN; Health Equity; UN-Habitat; Food Systems Journal; IPCC; Journal of Cleaner Production

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Tackling Food Waste to Combat Global Hunger

Food waste is a significant yet preventable contributor to global hunger, with over 828 million people affected. Learn how addressing food waste can help solve food insecurity, reduce economic losses, and combat climate change.

Minahil Safdar

7/24/2025

Food insecurity continues to plague millions globally, even as advances in agricultural productivity enable the world to produce enough food to nourish more than the current population. According to the FAO (2021), food security is achieved when all individuals always have physical, social, and economic access to sufficient, safe, and nutritious food. However, in 2022, more than 828 million people experienced an alarming increase of 150 million since the outbreak of the COVID-19 pandemic (FAO, 2023). This disconnects between abundance and access exposes a deep-rooted systemic failure. The real challenge lies not in the quantity of food produced, but in ensuring equitable distribution and access, factors heavily influenced by poverty, income disparity, supply chain inefficiencies, and weak policy frameworks.

A critically under-acknowledged contributor to this crisis is food waste. Globally, nearly one-third of all food produced is wasted, amounting to approximately 1.3 billion tons each year (UNEP, 2021). This wastage occurs at every stage of the food supply chain from production and post-harvest handling to retail and household consumption. Ironically, while millions suffer from hunger, massive quantities of edible food are discarded due to cosmetic standards, poor infrastructure, and consumer behavior.

Addressing food waste presents a powerful opportunity to improve food security, reduce environmental degradation, and create a more sustainable food system. Reducing losses in agricultural production and improving cold storage, transportation, and market access in developing regions can significantly enhance food availability. In wealthier nations, consumer awareness campaigns, food redistribution programs, and regulatory interventions targeting retailers can help redirect surplus food to those in need. In the face of rising global hunger, combating food waste must become a central strategy in the broader agenda of ensuring food security for all.

The Paradox of Plenty: Food Waste Amid Global Hunger

Despite producing more than enough food to nourish the global population, the world continues to grapple with chronic hunger and malnutrition. A staggering one-third of all food produced, around 1.3 billion tons, is wasted each year (UNEP, 2021), equating to nearly 2.6 trillion meals lost. This occurs while 2.4 billion people face moderate to severe food insecurity and nearly 900 billion meals would suffice to end global hunger (FAO, 2023; WFP, 2023). This paradox highlights profound inefficiencies and inequities in our global food systems.

Food waste spans the entire supply chain. In developed countries, most waste arises at the retail and consumer levels, often due to over-purchasing, bulk buying, and strict aesthetic or quality standards that result in perfectly edible food being discarded. Conversely, in developing nations, losses typically occur at the production, storage, and transportation stages due to poor infrastructure, lack of cold chains, and inefficient logistics (World Bank, 2022). Perishable items such as fruits and vegetables account for 45% of this waste, followed by cereals (30%) and dairy products (20%) (FAO, 2021).

This waste has significant repercussions for food security. First, it squanders valuable natural resources: approximately 28% of the world's agricultural land is used to produce food that is never consumed, and 250 cubic kilometers of water, roughly the volume of three Lake Genevas, is wasted annually (WWF, 2023). Such inefficiencies intensify pressure on ecosystems and limit the capacity to expand food access sustainably.

Second, large-scale food waste contributes to rising food prices. When significant portions of food are lost or discarded, the available supply decreases, driving up costs. In Pakistan, for instance, avocado prices soared to Rs. 2,100 per kilogram, rendering nutritious food inaccessible to many (Trading Economics, 2023). In Kenya, post-harvest losses of up to 40% in potato crops have led to price surges, compounding the burden of food insecurity (World Bank, 2022).

Third, food waste directly reduces availability and contributes to malnutrition. In countries like South Sudan, food insecurity affects 61% of the population, and nearly a third of children under five suffer from stunting due to inadequate nutrition (WFP, 2023). Meanwhile, developed countries confront the dual burden of obesity and waste, reflecting an uneven distribution of food and nutrition.

Lastly, the ethical and environmental costs are stark. Wasting food while millions go hungry is a moral failure. Moreover, food waste is responsible for 8–10% of global greenhouse gas emissions, surpassing the combined emissions from aviation and maritime transport (UNEP, 2021). Addressing food waste is thus not only a humanitarian imperative but also an environmental necessity. Reducing it could simultaneously fight hunger,

lower food prices, conserve resources, and combat climate change.

Tackling Food Waste: A Global Call to Action

Addressing the global food waste crisis requires coordinated, multi-level efforts from governments, the private sector, farmers, consumers, and international organizations. Each actor plays a pivotal role in transforming how food is produced, distributed, and consumed, ensuring that fewer resources are wasted and more people are fed.

Government action is critical to driving large-scale change. France, through its Garot Law (2016), has set a precedent by requiring supermarkets to donate unsold edible food to charities, significantly curbing food waste at the retail level. Similarly, South Korea's innovative "Pay as You Trash" policy has led to a 30% reduction in food waste by incentivizing consumers to waste less (Reuters, 2022). Additionally, investing in infrastructure such as cold storage and efficient supply chains particularly in developing nations can dramatically cut post-harvest losses, which are a major cause of food waste in low-income regions (World Bank, 2023).

The private sector also has a key role to play. Supermarkets and food retailers can adopt strategies like discounting near-expiry items or donating surplus food via mobile apps like *Too Good to Go*. Emerging technologies such as AI-powered inventory management can optimize logistics, reducing spoilage across the supply chain (McKinsey, 2023).

Farmers and producers can benefit from improved harvesting methods and access to shared storage facilities, helping to reduce on-farm losses. These solutions are especially effective when supported by agricultural extension services and rural development programs (FAO, 2022). Consumers can also make a difference. Small actions like meal planning, buying "ugly" produce, and composting organic waste collectively led to substantial reductions in household food waste (NRDC, 2023).

Finally, global partnerships are vital. The United Nations' "Food Is Never Waste" coalition and Sustainable Development Goal 12.3 aim to halve global food waste by 2030. Organizations such as the FAO, WFP, and UNEP provide technical and financial support to help countries develop waste-reduction policies and practices. By working together, stakeholders can build a more just, efficient, and sustainable global food system.

Conclusion

Food waste represents one of the most preventable yet overlooked drivers of global hunger. Despite the world producing enough food to nourish every individual, over 828 million people still face hunger, while nearly one-third of that food is wasted. This paradox underscores a broken food system, where inefficiencies in production, distribution, and consumption perpetuate food insecurity, economic loss, and environmental harm. Addressing food waste must become a central pillar in the global fight against hunger, poverty, and climate change.

The impacts of food waste are staggering it squanders vast natural resources, raises food prices, and contributes up to 10% of global greenhouse gas emissions. These outcomes deepen inequality and undercut the progress toward food justice. Importantly, food waste is a solvable problem. With coordinated policy reforms, private sector innovation, consumer behavioral change, and global cooperation, meaningful reductions can be achieved.

Strategies such as investing in cold chains, mandating food donations, optimizing logistics with technology, and promoting awareness at the household level are already showing promising results. A collective, multi-stakeholder approach is essential to transform this challenge into an opportunity. Reducing food waste not only ensures that more people are fed, but it also builds a more resilient, equitable, and sustainable future for all.

References: FAO; UNEP; WFP; World Bank; WWF; Trading Economics; Reuters; McKinsey; NRDC

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Empowering Women for Global Food Security

Women play a crucial role in achieving global food security and sustainable agriculture. Despite their contributions, they face significant barriers in access to land, finance, and technology. Bridging this gender gap is essential for enhancing food systems and promoting resilience in agriculture.

Amna Bibi

7/28/2025

Food security, as defined by the FAO (2004), rests on three pillars: the availability, accessibility, and utilization of food. Within this framework, gender plays a critical role. Women are central to food systems, they are farmers, processors, traders, and household nutrition managers. Yet, despite their immense contributions, systemic gender disparities continue to hinder progress toward equitable and sustainable food security.

In developing countries, women represent about 43% of the agricultural labor force, with this figure exceeding 50% in some regions of sub-Saharan Africa and South Asia (FAO, 2021). However, their access to productive resources such as land, credit, extension services, and technology remains significantly lower than that of men. Globally, women own less than 20% of agricultural land. In Nepal, only 14% of landowners are women, while in Ghana, the figure drops to just 10% (World Bank, 2023). These disparities in landownership not only restrict women's productivity and income but also limit their decision-making power in agriculture and household food management.

Closing the gender gap in agriculture could yield transformative benefits. According to FAO estimates, if women had the same access to resources as men, farm yields could increase by 20–30%, lifting to 150 million people out of hunger. Empowering women through land rights reforms, gender-sensitive extension services, targeted credit programs, and inclusive agricultural policies is crucial. Moreover, recognizing and valuing unpaid care and farm work by women can enhance their agency and improve nutritional outcomes for entire communities.

Achieving gender equality in agriculture is not just a matter of fairness, it is a strategic imperative for ensuring global food security. Sustainable progress demands that women are no longer seen as marginal participants, but as equal partners in shaping resilient and equitable food systems.

Empowering Women in Agriculture for Food Security and Economic Growth

Women are indispensable to the agricultural economy, particularly in rural areas of the Global South. Their labor spans the entire food value chain, from subsistence farming and cultivating cash crops like tea, cotton, and coffee to managing livestock and fisheries. In developing nations, women contribute to 60–80% of food production. In South Asia, countries such as Pakistan and Bangladesh have seen women's participation in agriculture triple since the 1980s. Yet, despite performing up to 75% of farm labor, women receive just 26% of agricultural income, largely due to their underrepresentation in land ownership and formal economic structures (Oxfam, 2023; IFPRI, 2022).

Persistent structural barriers restrict women's productivity in agriculture. In India, only 12.8% of operational landholdings are managed by women. Access to credit remains minimal, only 10% of agricultural loans are directed toward women. These constraints are compounded by a lack of access to mechanization, forcing many women to rely on time-consuming manual labor. As a result, yields from female-managed farms are 20–30% lower than those managed by men (FAO, 2021), not due to ability but due to unequal resource access.

Beyond fieldwork, women play a vital role in ensuring household food security. They are responsible for 90% of food decisions at home, influencing dietary diversity and nutrition outcomes. Educated mothers are 30% more likely to ensure their children receive a balanced diet, significantly reducing malnutrition risks (Lancet, 2021). Traditional food preservation techniques like sun-drying and fermentation further enhance year-round food availability. When women control income, studies show child nutrition improves by 15% (World Bank, 2023). However, when women contribute over 50% of household income, the diversity of food may decline due to time constraints from added economic burdens (IFPRI, 2022). Empowering women with resources, education, and policy support is essential to achieving sustainable agriculture and resilient food systems.

Empowering Women for Resilient and Inclusive Food Systems

Achieving sustainable food systems requires the meaningful inclusion and empowerment of women across agricultural value chains. Women are not only key contributors to food production but also essential agents of change in ensuring household nutrition, community resilience, and climate adaptation. However, unlocking their full potential calls for transformative interventions at both policy and grassroots levels.

Policy frameworks must prioritize gender equality in land ownership. Land titling programs, such as those successfully implemented in Rwanda, have doubled female land ownership since 2010, demonstrating the power of legal reform. Financial inclusion is equally vital. Gender-responsive microcredit initiatives like Bangladesh's Grameen Bank have empowered millions of women to invest

in productive assets, agricultural inputs, and small-scale enterprises. Furthermore, targeted education and agroecological training programs help women adopt sustainable practices that improve yields while preserving ecosystems.

At the grassroots level, solutions are taking root. Backyard gardening programs, such as Nigeria's "Women in Agriculture" initiative, are boosting household food security and incomes. Women-led cooperatives like Kenya's dairy groups enhance collective bargaining and reduce exploitation. Digital inclusion is another game-changer. Mobile platforms such as India's Kisan Suvidha app provide women farmers with real-time market prices, weather updates, and advisory services, enhancing decision-making and income.

Yet women continue to face systemic barriers in food supply chains. In Africa, they dominate informal food retail, managing 60% of street-level sales but often under exploitative conditions. In West Asia, only 5% of women participate in formal agri-trade due to gender biases and mobility constraints (ILO, 2023).

Despite these challenges, successful examples offer hope. In Ghana, shea butter cooperatives have increased women's incomes by 40%, while in Vietnam, female-led rice mills have improved market access and value chain integration. Scaling such initiatives can help create more equitable, sustainable, and resilient food systems worldwide.

Conclusion

Women are indispensable to achieving global food security and sustainable agriculture. Their roles span food production, household nutrition, and economic development, yet they remain significantly disadvantaged in access to land, finance, technology, and markets. This systemic inequality not only limits their individual potential but also undermines the effectiveness of food systems. Bridging the gender gap is therefore not only a matter of justice but a strategic imperative for resilience and productivity.

Evidence shows that if women had the same access to resources as men, agricultural yields could increase substantially, lifting millions out of hunger and poverty. Empowering women through land rights, targeted credit, inclusive policies, and grassroots initiatives such as cooperatives and mobile technology can dramatically improve food availability, dietary quality, and community well-being. Additionally, recognizing women's unpaid labor and supporting their participation in food value chains will ensure more equitable outcomes.

As climate change, conflict, and economic volatility intensify, women's empowerment must be central to agricultural transformation. By placing gender equity at the heart of food security strategies, we can create more inclusive, sustainable, and resilient food systems that benefit everyone. The path to ending hunger and achieving sustainable development is only possible when women farmers are recognized, supported, and empowered as full partners in progress.

References: FAO; World Bank; IFPRI; Oxfam; Lancet; ILO

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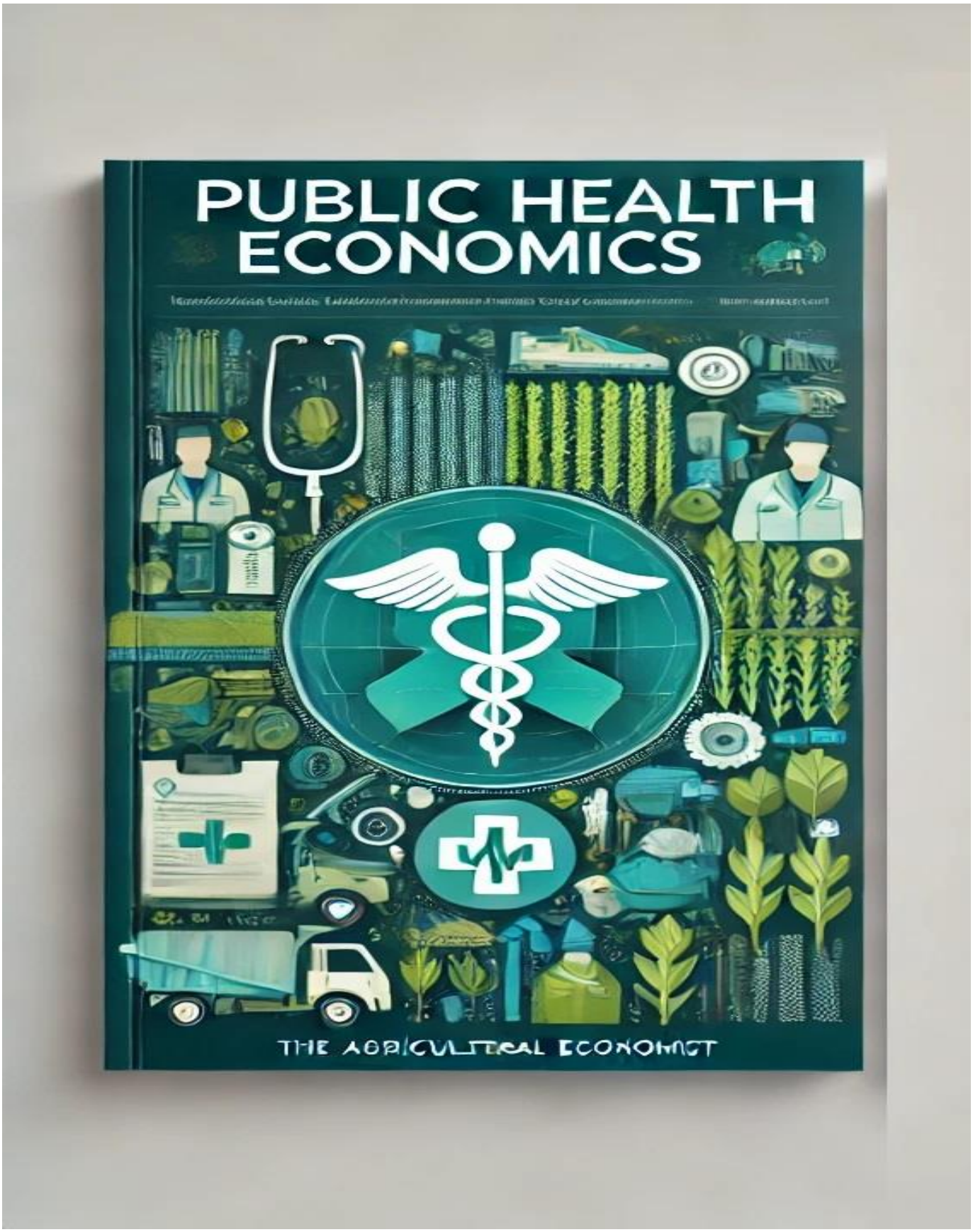

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Pakistan's Rural Health System: Addressing Inequalities

Pakistan's rural health system faces significant challenges, including health disparities and high maternal mortality rates. Despite excellent initiatives, persistent inequalities and system inefficiencies continue to leave millions vulnerable to preventable illness.

Sehar Gul

7/1/2025

Rural communities in Pakistan continue to grapple with a multitude of health challenges, including infectious diseases, maternal and child health disparities, non-communicable diseases (NCDs), mental health concerns, and climate-induced health risks. These issues are intensified by limited healthcare infrastructure, financial barriers, low health literacy, and restricted access to quality medical services. With 62.7% of the population living in rural areas (Pakistan Bureau of Statistics, 2023), addressing these issues is central to achieving national health and development goals.

While programs like the Sehat Sahulat Program (SSP) and polio eradication campaigns mark important milestones, rural health indicators reveal ongoing systemic inequities. For instance, maternal mortality rates in rural areas are alarmingly high at 272 deaths per 100,000 live births, compared to 158 in urban settings (PDHS, 2023). Similarly, 40% of rural children under five are stunted (UNICEF, 2023), reflecting chronic undernutrition and poor maternal health services.

This paper evaluates the current rural health policy framework and identifies critical areas for reform. Strengthening primary healthcare (PHC) systems through investment in rural clinics, workforce training, and supply chain management is essential. Expanding the reach and capacity of the Lady Health Worker (LHW) Program can improve maternal and child health outcomes. Enhancing healthcare financing mechanisms, particularly through universal health coverage schemes, can ease the financial burden on low-income households.

Incorporating digital health technologies, such as telemedicine and mobile diagnostics, offers a scalable solution to bridge rural-urban health divides. Moreover, improving disaster preparedness and climate resilience in health systems is crucial given increasing environmental threats.

Ultimately, achieving equitable rural health outcomes requires a holistic, multi-sectoral approach that integrates governance, community participation, and cross-institutional collaboration. A resilient rural health system is not only a public health priority, but also a cornerstone of inclusive and sustainable national development.

Understanding Rural Health Challenges in Pakistan

Rural Pakistan is home to over 60% of the country's population, yet it faces persistent and multifaceted health challenges that threaten the well-being of millions. From infectious diseases to non-communicable conditions and climate-induced health risks, the burden is disproportionately high in these underserved areas.

Infectious diseases such as tuberculosis (TB), malaria, and diarrheal illnesses remain widespread due to poor sanitation, inadequate clean water, and limited preventive healthcare services. Maternal and child health indicators are particularly alarming rural maternal mortality stands at 272 per 100,000 live births, and neonatal mortality is 42 per 1,000 live births (PDHS, 2023). These figures point to systemic gaps in antenatal care, delivery services, and postnatal follow-up. Meanwhile, non-communicable diseases (NCDs) such as diabetes and hypertension are rising at an alarming rate, with one in four rural adults affected (WHO, 2023).

Mental health is another neglected crisis. Cultural stigma, gender inequality, and lack of mental health infrastructure contribute to the silent suffering of thousands particularly rural women are facing depression and anxiety. The situation is further exacerbated by climate-related events; the 2022 floods, which affected 33 million people, led to increased malnutrition, vector-borne infections, and psychological trauma (NDMA, 2023).

Access to healthcare remains deeply unequal. Geographic isolation means that 28% of rural residents live over 10 km from the nearest health facility (World Bank, 2023). Healthcare worker shortages are stark, with just one doctor serving 5,000 people in rural areas, compared to one per 1,200 in cities (PMDC, 2023). Infrastructure is critically underfunded, only 15% of the national health budget is allocated to rural healthcare (Ministry of Health, 2023). Cultural barriers, including restrictive gender norms and vaccine hesitancy, further limit healthcare utilization.

From Fragmented Interventions to Integrated Care

Pakistan's current rural health policy framework includes a range of initiatives addressing primary care, disease-specific responses, and community-based interventions. However, fragmented implementation, under-resourced systems, and limited rural outreach hinder their effectiveness.

Primary Healthcare (PHC) remains the cornerstone of rural service delivery through Basic Health Units (BHUs) and Rural Health Centers (RHCs), yet these facilities are plagued by chronic understaffing, medicine shortages, and poor infrastructure. The Sehat Sahulat

Program (SSP), a flagship universal health insurance initiative, was expanded in 2023 to include 100 million low-income citizens. Despite its potential, rural enrollment is disproportionately low due to digital, linguistic, and awareness barriers (State Bank of Pakistan, 2023).

Disease-specific efforts show mixed progress. The Polio Eradication Initiative reduced wild poliovirus cases from 147 in 2019 to just 6 in 2023 (GPEI, 2024), but vaccine hesitancy continues to limit coverage. The Expanded Program on Immunization (EPI) has improved rural immunization rates to 75%, yet regional inequities persist (UNICEF, 2023). Community outreach through the Lady Health Worker (LHW) Program, now over 130,000 strong, offers vital maternal and child services, but faces logistical and financial constraints.

Learning from global examples is essential. Brazil's Family Health Strategy demonstrates how community health teams can halve maternal mortality. Rwanda's digitized health worker network shows how technology can revolutionize outreach, while India's Ayushman Bharat scheme offers insights for scaling SSP coverage.

Policy reforms must prioritize strengthening PHC infrastructure through upgrades to BHUs with telemedicine capabilities and increased health budget allocations to meet WHO benchmarks. Incentivizing rural health postings, expanding LHW roles to include NCDs and mental health, and adopting mobile and GIS technologies will enhance service delivery. Furthermore, integrating climate resilience into disaster response planning and involving communities in health education and vaccination drives will foster trust and sustainable impact.

Conclusion

Pakistan's rural health system stands at a crossroads. Despite commendable efforts such as the Sehat Sahulat Program, Lady Health Worker outreach, and progress in immunization, persistent inequalities and system inefficiencies continue to leave millions vulnerable to preventable illness, maternal mortality, and health-related poverty. With rural areas home to nearly two-thirds of the population, addressing health disparities is not just a social obligation but a national development imperative.

This article has highlighted both the pressing challenges ranging from infectious diseases and non-communicable conditions to climate-induced health risks and the systemic barriers that hinder effective care, including underfunded infrastructure, workforce shortages, and cultural constraints. It also proposes actionable pathways: strengthening primary healthcare, enhancing financing and outreach, digitizing rural health delivery, and improving community engagement and disaster preparedness.

Looking ahead, Pakistan must transition from fragmented interventions to a coordinated, equity-driven rural health policy that integrates public health with broader goals of education, gender equity, and environmental sustainability. Only through strategic investment, evidence-based policy, and inclusive governance can rural health be transformed into a pillar of national resilience. A healthier rural population will not only drive productivity and food security but also ensure a more just and thriving society for all Pakistanis.

References: Pakistan Bureau of Statistics; PDHS; WHO; UNICEF; NDMA; PMDC; Ministry of Health; World Bank; State Bank of Pakistan; GPEI

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Addressing Time Poverty for Gender Equality in Punjab

Explore how time poverty affects gender equality, nutritional well-being, and rural development in Punjab. Learn about the disproportionate burden on women and its impact on health outcomes, caregiving, and food production.

Ayesha Rouf & Tahira Sadaf

7/4/2025

Time poverty, the chronic shortage of discretionary time for rest, leisure, or self-care, has emerged as a critical but under-recognized dimension of rural development, especially in agricultural regions like Punjab, Pakistan. While agriculture sustains livelihoods for millions, it also reinforces deeply entrenched gender roles that skew time allocation within households. In rural Punjab, women often carry the dual burden of contributing to agricultural production and performing unpaid domestic labor, including cooking, cleaning, childcare, and water or fuel collection. These overlapping responsibilities leave little time for self-care, education, or income-generating activities.

Recent surveys by the Pakistan Bureau of Statistics (2023) reveal that rural women in Punjab spend up to 10-12 hours daily on unpaid labor, compared to 3-4 hours by men. This time burden limits their ability to access health services, engage in nutritional planning, or participate in community decision-making. As a result, time poverty exacerbates food insecurity and poor dietary practices, especially among women and children.

Moreover, time-constrained women often resort to quick, energy-dense meals with low nutritional value, contributing to rising rates of anemia, stunting, and undernutrition in rural households. Children's nutritional health is particularly compromised when caregivers lack the time or energy to prepare balanced meals or attend health clinics.

Addressing time poverty requires a multi-sectoral approach. Interventions should include expanding rural infrastructure (such as clean water access and fuel-efficient stoves), promoting labor-saving technologies in agriculture, and investing in childcare and social protection schemes. Additionally, shifting social norms through gender-sensitive policy frameworks and community awareness programs is essential to redistribute unpaid labor more equitably.

Tackling time poverty not only enhances gender equality but also strengthens household nutrition and well-being. Recognizing and valuing women's time is a crucial step toward inclusive and sustainable rural development in Punjab.

Understanding Time Poverty and Gendered Labor

Time poverty refers to the scarcity of time available for personal well-being due to excessive work demands. In rural Punjab, women experience acute time poverty resulting from their dual responsibilities in farming and unpaid domestic labor. The Pakistan Social and Living Standards Measurement (PSLM) Survey (2022–23) reports that rural women spend an average of 6 to 8 hours daily on agricultural tasks, followed by another 4 to 5 hours on household chores, cooking, water collection, and childcare. This adds up to nearly 12 to 13 hours of work per day, leaving little to no time for rest, self-care, or participation in community or economic development activities (Pakistan Bureau of Statistics, 2023).

In contrast, rural men primarily engage in income-generating agricultural work for 7 to 8 hours per day, with minimal involvement in unpaid domestic responsibilities ILO, (2023). This gendered division of labor reflects deep-rooted cultural norms that assign caregiving and household management exclusively to women, reinforcing systemic inequalities.

The implications of time poverty extend beyond individual exhaustion. Women's limited time availability undermines their ability to access healthcare, maintain balanced nutrition, or pursue educational and entrepreneurial opportunities. It also restricts their participation in extension services, farmer training programs, or local governance, perpetuating both economic and social marginalization.

Furthermore, time constraints contribute to poor dietary practices within households, as women, despite being primary caregivers, lack the time to prepare diverse and nutritious meals. This can lead to increased malnutrition, especially among children and pregnant or lactating women, intensifying the intergenerational cycle of poor health.

Addressing time poverty in rural Punjab requires recognition of unpaid labor in policy frameworks and promotion of gender-equitable labor sharing. Without tackling this foundational issue, broader goals related to rural development, nutrition, and gender equity will remain difficult to achieve.

Time Poverty, Gender Roles, and Nutritional Well-being in Rural Punjab

In rural Punjab, the entrenched gender division of labor and resulting time poverty have significant implications for nutritional outcomes, particularly for women and children. Women, despite their vital contributions to agricultural productivity and household management, face an unequal time burden that severely limits their ability to maintain healthy dietary practices. The Food and Agriculture Organization (FAO, 2023) highlights that women in Punjab report consistently lower Dietary Diversity Scores (DDS) than men, largely due to time constraints and unequal access to food resources.

Although women spend 3 to 4 hours each day on meal preparation, their own nutritional needs are frequently

deprioritized in favor of those of other family members. This pattern of self-sacrifice is exacerbated by chronic stress and fatigue stemming from continuous work without adequate rest or leisure, as reported by the Asian Development Bank (ADB, 2023). Such conditions contribute to poor dietary habits, skipped meals, and long-term nutritional deficiencies.

Furthermore, households where domestic responsibilities are more equitably shared show marked improvements in maternal and child nutrition (UN Women, 2023), suggesting that redistributing household labor could directly benefit public health outcomes. In contrast, the Pakistan Economic Survey (2023) shows that women engaged in both agricultural and domestic tasks average up to 14 hours of labor daily, leaving them with less than an hour of leisure, time essential for self-care and proper meal planning.

These findings are reinforced by data from the National Nutrition Survey (2023), which shows that 38% of rural women in Punjab are underweight, with high levels of micronutrient deficiencies. The World Bank (2023) further notes that increased leisure time for women correlates positively with better family nutrition, emphasizing the importance of reducing time poverty.

Policy Implications for Reducing Gendered Time Poverty and Improving Nutrition

Tackling gendered time poverty in rural Punjab requires a comprehensive policy approach that targets the root causes of unequal labor distribution and supports women's access to time, resources, and opportunities. Labor reallocation is a critical first step. Policies that promote men's involvement in unpaid domestic work through mass awareness campaigns, school-based gender sensitization, and community dialogues can help shift cultural norms and reduce women's disproportionate workload. When men share household and caregiving duties, women gain time for rest, income-generating activities, and self-care, all of which contribute to improved family well-being.

Another priority is expanding rural childcare services. Establishing accessible, affordable daycare centers near farms and villages can significantly ease women's caregiving responsibilities. By ensuring safe environments for children, these facilities allow women to engage more productively in agriculture and other sectors without compromising care work.

Adopting time-saving technologies can also help alleviate time poverty. Distributing efficient cookstoves, water-saving devices, and mechanized farming equipment to rural women can drastically reduce the hours spent on repetitive tasks like cooking, water collection, and manual farming.

Government-led nutritional education campaigns are equally important. These should focus on building knowledge around balanced diets, meal planning, and nutrient-rich local foods. When paired with time-saving strategies, such education can improve dietary outcomes for entire households.

Finally, gender-sensitive agricultural policies are essential. Providing women with equal access to training, farm inputs, and extension services ensures they can adopt modern, efficient farming practices and participate fully in decision-making. Such inclusion improves not only productivity but also economic autonomy and time use. A combination of these targeted interventions can reduce time poverty, advance gender equality, and enhance nutrition in rural communities, laying the foundation for healthier, more resilient households across Punjab.

Conclusion

Time poverty is a critical but under-addressed barrier to achieving gender equality, nutritional well-being, and rural development in Punjab. As this article has shown, the burden of excessive, gendered labor, spanning agricultural work and unpaid domestic responsibilities, disproportionately falls on rural women. This imbalance limits their time for rest, health care, self-care, and nutritious meal planning, contributing directly to undernutrition and poor health outcomes for women and children alike. Despite playing a central role in food production and caregiving, women often eat last and least, while fatigue and stress further erode their well-being.

The consequences of this time poverty are far-reaching: lower dietary diversity scores among women, higher rates of maternal malnutrition, and restricted opportunities for education, participation in agricultural training, or economic advancement. Evidence clearly shows that equitable sharing of household labor, improved access to time-saving technologies, affordable childcare, and nutrition education are not only necessary but effective measures for improving both gender equity and public health outcomes.

Tackling time poverty must therefore be a policy priority. It is not simply a matter of efficiency; it is a matter of justice and sustainability. Recognizing women's unpaid labor and redistributing it fairly is essential to building healthier households, empowered communities, and an inclusive rural economy in Punjab.

References: Pakistan Bureau of Statistics; ILO; FAO; WFP; ADB; UN Women; World Bank; NNS

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Pakistan's Climate Crisis: Agriculture & Health Threats

Discover how Pakistan's climate crisis is impacting the agricultural sector and public health systems. Rising temperatures and erratic weather are threatening food security and health, particularly for vulnerable populations. Learn about the challenges and potential solutions.

Abdul Rehman

7/9/2025

Climate change is emerging as one of the most pressing threats to Pakistan's food security and public health, dramatically transforming the country's environmental and socio-economic landscape. Shifting temperature patterns, unpredictable rainfall, glacial melting, and more frequent extreme weather events are disrupting ecosystems and livelihoods. The devastating 2022 floods, which displaced over 33 million people and caused more than $30 billion in economic damage (UNDP, 2023), serve as a stark reminder of the country's vulnerability.

One of the sectors most affected is agriculture, which contributes 22.7% to the national GDP and employs nearly 37% of the labor force (Pakistan Economic Survey 2023–24). Erratic monsoon cycles, increased frequency of droughts, and rising heatwaves have led to declining crop yields, especially for key staples such as wheat, rice, and maize. Water scarcity is intensifying due to declining river flows and groundwater depletion, undermining irrigation and livestock production in rural areas. Without urgent adaptation measures, these trends threaten the livelihoods of millions of smallholder farmers and the stability of national food systems.

Simultaneously, climate change is accelerating the spread of climate-sensitive diseases. Rising temperatures and stagnant floodwater have contributed to an uptick in vector-borne illnesses such as dengue, malaria, and chikungunya, particularly in urban slums and flood-affected regions. Waterborne diseases like cholera and typhoid have also surged due to contamination of drinking water sources. These growing health threats place an enormous burden on Pakistan's overstretched and under-resourced healthcare system.

Addressing this dual challenge requires integrated action that links agricultural resilience with public health preparedness. Investments in climate-smart agriculture, early warning systems, clean water infrastructure, and disease surveillance are essential. Without coordinated policy interventions, climate change will continue to erode Pakistan's developmental gains and exacerbate existing vulnerabilities across rural and urban populations.

Climate Change Impacts on Agriculture and Public Health in Pakistan

Climate change is reshaping Pakistan's agricultural and public health landscapes in increasingly severe and interconnected ways. Agriculture, which underpins both food security and rural livelihoods, is facing alarming disruption due to rising temperatures, erratic rainfall, and intensifying climate extremes. Wheat production is projected to decline by 8–10% by 2050 due to higher temperatures and shortened growing seasons (World Bank, 2023), while water scarcity threatens rice cultivation, potentially reducing yields by 15% (FAO, 2023). In 2024, Sindh experienced an unprecedented 53°C heatwave, leading to widespread crop failures in cotton and maize. Livestock systems are equally vulnerable, dairy cattle exposed to prolonged heat stress have shown a 20–30% drop in milk output (LUMS, 2023), and recurring droughts are limiting fodder availability, resulting in widespread livestock malnutrition.

Infrastructure is also at risk. The catastrophic floods of 2022 wiped out 4.4 million acres of cropland (NDMA, 2023), while glacial lake outburst floods (GLOFs) in northern regions endanger vital irrigation systems and water supply networks.

On the public health front, climate change is driving a surge in disease and malnutrition. Warmer temperatures and stagnant floodwaters have fueled a 70% rise in dengue cases in 2023 (Pakistan Health Ministry), and waterborne illnesses like diarrhea continue to claim the lives of one in five children under five (UNICEF, 2023). Meanwhile, food insecurity exacerbated by climate-induced crop failures has intensified malnutrition, with 40% of Pakistani children under five suffering from stunting (WFP, 2023). Air pollution linked to winter smog in Punjab has caused a 30% increase in asthma cases (WHO, 2023), and extreme summer heatwaves have led to more frequent heatstroke-related deaths.

Integrated Adaptation Strategies for Agriculture and Public Health

Adapting to the growing threats of climate change requires Pakistan to adopt a multi-pronged approach that addresses both agricultural sustainability and public health preparedness. In the agricultural sector, climate-smart farming practices are at the forefront of resilience-building. The adoption of drought- and heat-tolerant crop varieties in Sindh, particularly climate-resilient wheat, is already helping reduce vulnerability to temperature extremes. Precision irrigation methods, such as drip and sprinkler systems increasingly seen in Punjab, are significantly improving water use efficiency and

minimizing waste in water-scarce regions.

Agroforestry and afforestation efforts also contribute to climate adaptation. The national "10 billion Tree Tsunami" campaign is combating desertification and restoring degraded land, while intercropping systems such as wheat grown alongside chickpeas improve soil fertility and reduce reliance on chemical inputs. On the livestock front, shading structures, fans, and evaporative cooling systems are helping farmers reduce heat stress in cattle. Similarly, rainwater harvesting structures are being implemented to ensure water availability during drought periods.

Public health adaptation strategies are equally critical. Disease surveillance systems are being strengthened, and dengue vaccination trials are expanding in high-risk urban zones. Mobile health clinics are reaching displaced communities after floods, while climate-health education programs are being integrated into schools, mosques, and community forums to raise awareness. Early warning systems for extreme weather events, particularly heatwaves and flash floods are being deployed through SMS alerts and radio broadcasts.

Policy and infrastructure reform form the foundation for sustainable adaptation. Stricter enforcement of air pollution control laws aims to reduce the frequency and severity of smog episodes, particularly in urban Punjab. Water infrastructure investments under initiatives like the Clean Green Pakistan Program are enhancing access to safe drinking water and sanitation, reducing disease incidence. Together, these agricultural and health interventions form a comprehensive strategy to build climate resilience across Pakistan's most vulnerable communities.

Conclusion

Pakistan's climate crisis represents a dual challenge, endangering both the agricultural sector that feeds the nation and the public health systems that protect its people. The convergence of rising temperatures, erratic rainfall, and extreme weather events is threatening crop yields, damaging rural infrastructure, and accelerating the spread of disease. Left unchecked, these changes could severely undermine food security, economic stability, and the health of millions, especially among the most vulnerable populations.

However, this crisis also presents an opportunity to strengthen resilience through coordinated, forward-looking action. Climate-smart agricultural practices such as drought-tolerant crops, precision irrigation, and intercropping offer immediate and scalable solutions to reduce vulnerability. Simultaneously, targeted public health interventions including disease surveillance, vaccination campaigns, and improved sanitation infrastructure are essential to reduce the human toll of climate-related illnesses.

Adaptation must be embedded across policy, planning, and investment frameworks. This means greater collaboration between ministries of agriculture, health, water, and climate change, and a focus on community-level implementation. It also demands enhanced public awareness and education to build a culture of resilience. Ultimately, by aligning agricultural sustainability with public health preparedness, Pakistan can not only mitigate the risks of climate change but also safeguard its developmental future, ensuring a healthier, more secure, and climate-resilient society for generations to come.

References: UNDP; World Bank; FAO; Pakistan Health Ministry; NDMA; Pakistan Economic Survey; LUMS; UNICEF; WFP; WHO

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Improving Healthcare Access for Rural Workers in Pakistan

Enhancing healthcare access for rural workers in Pakistan is crucial for both moral and economic reasons. With over 60% of the population living in rural areas, inequities in healthcare delivery hinder national development and well-being, leading to untreated illnesses and perpetuated poverty.

Amina Ishaq

7/10/2025

Access to quality healthcare in Pakistan remains alarmingly unequal, especially for rural populations who face systemic challenges in receiving timely and effective medical care. Rural communities account for approximately 63% of the population (Pakistan Bureau of Statistics, 2023), yet they remain underserved in nearly every aspect of the healthcare system. Mortality rates, disability prevalence, and chronic illnesses are consistently higher in rural areas compared to urban counterparts, driven by a combination of poverty, low education levels, inadequate infrastructure, and limited awareness. Additionally, occupational risks particularly in agriculture, construction, and mining compound health vulnerabilities. High rates of tobacco use, poor sanitation, and unsafe drinking water further worsen health outcomes (WHO, 2022).

An equitable healthcare system should ensure that rural workers have access to essential services, including primary care, maternal and child health, dental care, mental health support, and emergency services. However, the current state of rural healthcare in Pakistan is far from this ideal. Over 30% of Basic Health Units (BHUs) lack qualified doctors, and many are without functional diagnostic equipment or consistent medicine supply (World Bank, 2023). The shortage of female healthcare providers and transportation barriers also restrict access for rural women, contributing to high maternal mortality rates.

To address this crisis, strategic investments are needed in rural health infrastructure, human resources, and telemedicine. Expanding mobile health units, strengthening community health worker programs, and ensuring better coordination between provincial and federal health authorities can help close the gap. Additionally, integrating health education and preventive care into rural development agendas will reduce long-term healthcare costs and improve productivity among rural workers. Without such reforms, Pakistan risks perpetuating a cycle of poor health and economic stagnation in its rural heartlands, undermining both social equity and national development.

The Economic Toll of Inadequate Healthcare in Rural Pakistan

Poor access to healthcare in rural Pakistan has far-reaching economic consequences, significantly undermining productivity, increasing household financial burdens, and widening regional disparities. When rural workers lack timely medical attention, even minor illnesses or injuries can escalate into chronic conditions, diminishing their capacity to work and earning a stable income. The International Labor Organization (2023) estimates that increasing the number of rural doctors by just 1% per 100,000 people could result in a 5% rise in rural income levels. However, due to the persistent healthcare access gap, urban workers continue to benefit disproportionately, by as much as 10% more in income gains, further entrenching economic inequality.

One of the most direct consequences of healthcare inaccessibility is the rise in long-term medical costs. Without early diagnosis and treatment, preventable conditions such as hypertension, diabetes, and respiratory illnesses become more severe and expensive to manage. According to the Pakistan Health Research Council (2023), rural households spend up to 30% of their income on healthcare, a financial strain that frequently leads to asset depletion and debt accumulation. In many cases, families must choose between basic needs like food or education and healthcare expenses, perpetuating intergenerational poverty.

The broader macroeconomic impact is equally concerning. Poor healthcare access contributes to high absenteeism, underemployment, and low productivity, particularly in agriculture and informal sectors where most rural labor is concentrated. These effects exacerbate the existing rural-urban economic divide. Rural populations are left more vulnerable to shocks, less able to invest in education or businesses, and increasingly dependent on public welfare. Addressing healthcare inequalities is not just a matter of social justice but a critical step toward inclusive economic growth. Without urgent reforms, the economic potential of rural Pakistan will remain severely underutilized.

Barriers to Healthcare Access for Rural Workers in Pakistan

Rural workers in Pakistan face persistent and multifaceted barriers to accessing quality healthcare. Chief among these is financial insecurity. A significant portion of rural households lack any form of health insurance, making them highly vulnerable to healthcare-related financial shocks. According to the Pakistan Economic Survey (2022–23), only 18% of rural residents are covered under any health protection scheme, compared to 35% in urban areas. With out-of-pocket expenses accounting for most healthcare costs, many rural workers are compelled to delay or completely avoid necessary medical

treatment. This often leads to worsened health conditions and greater long-term economic hardship.

Geographic isolation further compounds the problem. Rural areas typically have fewer healthcare facilities and medical professionals per capita than urban centers (Ministry of National Health Services, 2023). In remote regions, workers must travel long distances to reach the nearest Basic Health Unit or hospital incurring transport costs and losing a day's wages. Specialized services are especially scarce, forcing rural residents to depend on general practitioners, often with limited diagnostic resources.

Low health literacy is another critical barrier. Many rural workers have limited formal education and struggle to navigate the healthcare system, especially when medical consultations are delivered in Urdu or English rather than regional dialects. Cultural mistrust, coupled with misinformation about vaccines or modern medicine, leads to low uptake of preventive care (Pakistan Medical Association, 2023).

Due to gaps in primary healthcare, rural workers disproportionately use emergency departments for non-urgent care. A 2023 study published in *The Lancet Global Health* reported that 22% of rural adults in Pakistan visited emergency departments annually, with 8% seeking care for conditions that could have been managed in outpatient clinics compared to only 5% in urban areas.

To overcome these barriers, Pakistan must prioritize expanding rural health infrastructure, promoting telemedicine, and developing occupational health programs tailored to rural industries. Strengthening health education through community outreach and leveraging Lady Health Workers can also improve healthcare-seeking behavior. These interventions are essential not only for improving health outcomes but also for enhancing workforce productivity and rural economic resilience.

Conclusion

Improving healthcare access for rural workers in Pakistan is both a moral imperative and an economic necessity. As over 60% of the population resides in rural areas, the inequities in healthcare delivery disproportionately affect national development and human well-being. The consequences of this divide are severe: preventable illnesses go untreated, productivity is lost, household incomes are depleted, and intergenerational poverty is perpetuated. Rural workers who drive the country's agriculture, construction, and informal sectors deserve access to timely, affordable, and quality care.

Addressing these challenges requires a multi-tiered strategy that includes strengthening rural healthcare infrastructure, increasing the availability of trained medical personnel, and integrating digital solutions such as telemedicine. Financial protection through expanded health insurance schemes, particularly for informal and agricultural workers, is also vital. Community-based education programs and the mobilization of Lady Health Workers can help bridge cultural and literacy gaps while promoting preventive care.

Ultimately, healthcare equity is a foundation for inclusive growth. When rural populations are healthy, they are more productive, resilient, and capable of contributing to the national economy. Ignoring this crisis will not only widen social and regional disparities but also limit Pakistan's potential for sustainable development. It is time to bridge the healthcare divide and make rural health a national priority.

References: Pakistan Bureau of Statistics; WHO: World Bank; Ministry of National Health Services; The Lancet Global Health; ILO; Pakistan Health Research Council; Pakistan Medical Association

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Investing in Rural Human Capital for Pakistan's Growth

Investing in rural human capital is vital for Pakistan's economic future. With 40% of the population in rural areas, enhancing education, healthcare, and job opportunities is crucial for reducing poverty and inequality.

Rimsha Iftikhar

7/18/2025

Human capital investment is the foundation of sustainable rural development, yet Pakistan continues to face systemic gaps in education, healthcare, infrastructure, and economic inclusion. With 39.2% of Pakistan's population living in rural areas (World Bank, 2024), addressing these disparities is not just a socioeconomic necessity but a strategic imperative for national progress.

The rural population in Pakistan faces serious developmental deficits. Education remains uneven, only 54% of rural children complete primary school compared to 72% in urban areas (ASER Pakistan, 2023). A lack of trained teachers, electricity, and access to digital tools further undermines learning outcomes. Similarly, healthcare services are alarmingly scarce, with just one doctor available per 10,000 rural residents versus one per 1,200 in urban areas (Pakistan Medical Association, 2024). This shortage contributes to higher maternal and child mortality rates and poor disease management in rural regions.

Economic exclusion also remains a significant barrier. Over 80% of rural workers are engaged in informal employment without legal protections, job security, or access to finance (Labour Force Survey, 2023). Female labor force participation is only 18.5% in rural Pakistan, and just 12% of rural women have access to vocational training (ILO, 2024; Aurat Foundation, 2024). Moreover, only 28% of rural households have internet access, limiting digital inclusion and access to new job opportunities (PTA, 2024).

Despite these challenges, evidence-based solutions offer hope. Expanding mobile schools, incentivizing rural health postings, scaling up vocational training, improving road connectivity, and offering tax breaks to companies investing in rural human capital can yield transformative results. For instance, a 10% rise in rural literacy has the potential to boost GDP by 6% (State Bank of Pakistan, 2023). Therefore, investing in rural people is not charity, it's smart economics.

Bridging the Rural Human Capital Gap in Pakistan

The state of human capital in rural Pakistan reflects deep-rooted structural inequalities that continue to hinder the nation's broader development trajectory. With nearly 40% of Pakistan's population residing in rural areas, the gaps in education, healthcare, employment, and infrastructure not only perpetuate poverty but also slow down inclusive economic growth.

Education remains a major concern. Only 54% of rural children complete primary school compared to 72% in urban centers (ASER Pakistan, 2023). Many schools lack electricity, and overcrowded classrooms, with student-teacher ratios exceeding 50:1, impede learning (Ministry of Education, 2024). In provinces like Balochistan, where dropout rates soar to 65%, children often travel long distances to attend school, causing many to leave education altogether (BISP, 2023). This educational failure traps generations in cycles of poverty, with limited prospects for upward mobility.

Healthcare services are similarly deficient. In rural regions, there is just one doctor per 10,000 people, compared to one per 1,200 in urban areas (Pakistan Medical Association, 2024). Maternal mortality remains alarmingly high at 186 deaths per 100,000 births, substantially worse than the urban figure of 112 (NIPS, 2024). These preventable deaths and chronic illnesses reduce life expectancy and severely affect labor productivity.

Rural economies are dominated by informal employment, which accounts for 80% of the labor force and provides no job security or social protection (Labour Force Survey, 2023). Women are particularly marginalized, with only 18.5% participation in the labor force and just 12% receiving vocational training (Aurat Foundation, 2024). Limited access to economic opportunities undermines household resilience and gender equity.

Moreover, infrastructure remains underdeveloped. Around 60% of villages lack paved roads, and only 28% of rural households have internet access (Pakistan Infrastructure Report, 2024 and PTA, 2024). These deficiencies isolate communities from essential services, markets, and technology, further widening the rural-urban divide.

Why Investing in Rural Human Capital Matters

Investing in rural human capital is not just a moral obligation, it is an economic necessity for Pakistan's long-term development. With nearly 40% of the population residing in rural areas, the country cannot afford to overlook the transformative potential of its rural workforce. Evidence strongly supports that rural human capital development can unlock substantial gains in GDP, poverty reduction, social equity, and national resilience.

The economic returns are striking. A 10% increase in rural literacy could raise Pakistan's GDP by 6%, while skilled rural workers earn up to 35% more than their unskilled counterparts (State Bank of Pakistan, 2023; UNDP, 2024). These gains extend beyond income. Expanded vaccination programs have already reduced child mortality by 22%, and

microfinance initiatives such as Karandaaz Pakistan's PKR 12 billion in disbursements have empowered women and fostered grassroots entrepreneurship.

Human capital investments also foster social stability and gender equity. Educated women reinvest up to 90% of their income back into their families, improving nutrition, health, and education outcomes for the next generation (World Bank, 2024). Moreover, vocational training programs help reduce youth unemployment and slow rural-urban migration, addressing both labor shortages and urban overcrowding.

To realize this potential, a multi-sectoral reform strategy is essential. In education, organizations like The Citizens Foundation (TCF) are making inroads through 1,800 rural campuses and mobile schools, while digital learning initiatives in Sindh have shown a 20% improvement in student test scores (JICA, 2023). Policy reforms must also increase education budgets and enforce accountability measures.

Healthcare requires innovation, with telemedicine platforms such as Sehat Kahani already reaching half a million rural patients. Punjab's "Doctor for Villages" scheme incentivizes rural postings with bonuses and career development support. Economic empowerment hinges on vocational hubs and land reforms, enabling access to skills and credit.

Infrastructure upgrades such as paved roads, reliable electricity, and affordable internet are critical enablers of these reforms. Partnerships with telecom providers and private firms can accelerate connectivity and mobility.

Punjab's rural transformation offers a blueprint. With a 200% rise in agro-tech startups, supported by IT bootcamps and partnerships like Nestlé's Dairy Training Institute, the province has seen higher incomes and reduced outmigration. The momentum is clear.

To scale success nationwide, Pakistan must triple rural education budgets, expand telehealth, mandate CSR funding for skills training, and promote public-private partnerships for infrastructure. Investing in rural human capital today ensures a resilient, inclusive, and prosperous Pakistan tomorrow.

Conclusion

Investing in rural human capital is not merely an act of social justice, it is a strategic economic imperative for Pakistan. With rural communities comprising nearly 40% of the population, continued neglect of education, healthcare, and employment opportunities will only deepen poverty and inequality. The data is clear: targeted investments in literacy, vocational training, maternal health, and digital connectivity deliver measurable returns in GDP growth, poverty reduction, and gender equity. Initiatives like mobile schools, telemedicine services, and vocational hubs have already shown success in parts of the country, especially Punjab, which offers a replicable model for nationwide rural transformation.

Empowering women, bridging infrastructure gaps, and creating inclusive labor markets will build household resilience and unlock untapped economic potential. However, achieving this vision demands bold, coordinated policy action, tripling rural education budgets, incentivizing rural healthcare placements, promoting CSR investments, and forging public-private partnerships. Rural Pakistan is not a burden on the economy; it is a growth engine waiting to be activated. By placing human capital at the heart of rural development, Pakistan can ensure a more inclusive, equitable, and sustainable future, where opportunity is not determined by geography, but by potential.

References: World Bank; Ministry of Finance; UNDP; ASER Pakistan; Labour Force Survey; Pakistan Medical Association; ILO; Aurat Foundation; PTA; State Bank of Pakistan Ministry of Education; BISP; NIPS; JICA

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Mental Health Crisis in Pakistan's Agriculture

Explore the urgent mental health crisis facing smallholder farmers in Pakistan's agriculture sector. Climate change, financial instability, and systemic neglect are leading to rising distress and suicidal intentions. Farmers' wellbeing is not just humanity, but it is strategic for food security.

Qadir Bux Aghani

7/21/2025

Pakistan's agricultural sector, a vital engine of economic stability and food security, contributes 23% to the national GDP and employs 37.4% of the labor force (Economic Survey of Pakistan, 2023). Yet, behind these figures lies a growing mental health emergency that remains dangerously overlooked. Smallholder farmers who form the backbone of rural Pakistan are increasingly grappling with psychological distress, often in silence and without support.

Recent research by Aga Khan University (2023) highlights a disturbing reality: nearly 68% of smallholder farmers experience moderate to severe levels of psychological distress. The stressors are many including rising input costs, erratic weather patterns, water scarcity, indebtedness, land disputes, and volatile crop prices. With minimal social safety nets and limited access to mental health services, these burdens accumulate, leading to chronic anxiety, depression, and burnout. In many cases, the toll becomes fatal. According to WHO (2022), suicide rates in farming communities are 40% higher than in urban areas, a stark indicator of how deep the crisis runs.

Cultural stigma surrounding mental illness only worsens the situation, silencing those who suffer and discouraging families from seeking help. Rural health centers are poorly equipped to offer psychological care, and there is a shortage of trained mental health professionals, particularly in agricultural districts. Meanwhile, policy discussions continue to focus on physical inputs such as fertilizer, seeds, water while neglecting the human input that drives the sector: the well-being of farmers themselves.

Addressing this crisis requires urgent, multi-sectoral action. Integrating mental health into agricultural extension services, training community health workers, launching awareness campaigns, and developing support networks can provide a lifeline. If Pakistan is to build a resilient, productive, and sustainable agricultural future, it must begin by protecting the mental health of those who feed the nation.

The mental health crisis gripping Pakistan’s agricultural communities is not the result of a single factor, but rather a perfect storm of stressors that converge relentlessly on already vulnerable rural populations. At the forefront is climate trauma. Pakistan ranks as the 8th most climate-vulnerable country globally (Global Climate Risk Index, 2023), and the toll on farming households is devastating. Extreme weather events like floods, droughts, and heatwaves are not rare occurrences but seasonal threats. In the flood-affected districts alone, farmers reported a 63% loss in crop yield, leading to both financial ruin and psychological distress (NDMA, 2023). According to a LUMS Rural Psychology Study (2023), climate-related anxiety among farmers has surged by 50%, illustrating how environmental shocks have now become deeply personal, mental health crises.

Layered onto this ecological stress is a growing sense of economic desperation. With limited access to formal banking and insurance systems, 82% of farmers rely on informal lenders, often paying average interest rates as high as 34% (State Bank of Pakistan 2023). In districts across Punjab, cotton growers battling pink bollworm infestations have seen a 17% increase in debt-related stress, as crop failures push them further into high-interest borrowing cycles (PARC, 2023).

Yet perhaps most damaging is the systemic neglect that leaves farmers with nowhere to turn. Rural Pakistan has just 0.3 psychiatrists per 100,000 people, compared to 4.2 in urban areas (Mental Health Atlas, 2023). In this vacuum, 92% of distressed farmers never seek professional help not due to choice, but due to sheer unavailability and stigma (Sindh Health Department Survey, 2023). This triad of climate pressure, economic vulnerability, and institutional abandonment is driving a mental health emergency that threatens not only individuals, but the very backbone of Pakistan’s agricultural economy.

Mental Health Solutions for Pakistan’s Farmers

Pakistan’s agricultural sector is beginning to confront a long-ignored crisis: the mental wellbeing of its farmers. Encouragingly, a wave of promising interventions is emerging to tackle the psychological strain plaguing rural communities. Integrated care models are at the forefront. In Punjab, the government’s “Kisan Dost” program has trained 1,200 agricultural extension workers in basic mental health first aid, allowing them to recognize distress and refer cases appropriately (Punjab Agriculture Department, 2023). Meanwhile, telepsychiatry platforms like PakTelemed now serve 47 remote farming communities, bringing professional care to areas once unreachable by mental health services.

Economically targeted financial tools are beginning to reduce stress levels among smallholders. The Kissan Card initiative has delivered direct subsidies that have reduced financial anxiety by 31% among beneficiaries (Finance Division, 2023). In addition, index-based crop insurance schemes now cover 1.2 million acres,

shielding farmers from devastating losses caused by climate shocks (SECP, 2023). These safety nets provide vital relief from the pressures that often spiral into mental health breakdowns.

Equally transformative are grassroots, community-based approaches. Female-led support circles in drought-hit Thar have lowered post-drought depression by 28% (Thar Foundation, 2023), while FM-93's "Sukoon Ki Baat" radio program reaches 3.8 million rural listeners with mental health awareness and coping strategies.

Yet isolated interventions are not enough. A systematic response is needed. Mental health should be integrated into national agriculture policies, with 5% of provincial agriculture budgets allocated to farmer wellness programs. Dedicated mental health units should be set up within all Agriculture Extension Departments. To better understand and address the problem, a National Agriculture Mental Health Survey and suicide surveillance mechanism linked with NADRA must be launched.

Finally, women must be centered in the response. Training 10,000 Lady Health Workers in agricultural stress management and establishing women-friendly spaces at grain markets will foster inclusivity and accessibility.

As Pakistan advances its $200 million National Agriculture Emergency Plan and World Bank's REAP program (2023–2028), embedding psychosocial support is essential. The emotional health of farmers is not a side issue; it's the foundation of resilient food systems.

Conclusion

Pakistan's agricultural prosperity rests not only on the health of its soils and seeds but also on the wellbeing of the millions who till its land. The growing mental health crisis among smallholder farmers, fueled by climate change, financial precarity, and systemic neglect, demands urgent and sustained attention. The evidence is irrefutable: from rising suicide rates to widespread psychological distress, rural communities are bearing an invisible burden that threatens to destabilize food security and rural resilience.

While promising interventions like telepsychiatry, community support groups, and integrated wellness programs are beginning to make inroads, these must move beyond pilot stages and be institutionalized within agricultural policy frameworks. Governments must recognize that mental health is not a peripheral issue but a foundational pillar of sustainable development. This includes reallocating agricultural budgets to include mental wellness programs, training frontline workers in psychological first aid, and ensuring that women farmers, often doubly burdened, receive targeted support.

If Pakistan truly seeks to build a future-ready, climate-resilient agricultural sector, the emotional and psychological health of its farmers can no longer be overlooked. Investing in farmer wellbeing is not just humanity, it is strategic, sustainable, and central to nourishing the nation.

References: Economic Survey of Pakistan; WHO; State Bank of Pakistan; LUMS; Punjab Agriculture Department; Aga Khan University; Global Climate Risk Index; NDMA; PARC; Mental Health Atlas; Sindh Health Department Survey; Finance Division; SECP; Thar Foundation

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Integrating Spatial Analysis for Urban Road Safety

This study highlights the need for spatial analysis in urban road safety planning. Using GIS and regression tools, it maps accident hotspots in major Pakistani cities, revealing key risks like poor road design, unsafe pedestrian zones, and reckless driving amid rapid urban growth.

Aftab Karim Mengal

7/23/2025

Urbanization in Pakistan has surged in recent years, with the urban population rising from 37.2% in 2015 to 41.5% by 2024 (World Bank, 2024). This rapid demographic shift has strained the infrastructure of major cities, particularly in terms of traffic management and road safety. Cities like Karachi, Lahore, Islamabad, Peshawar, and Quetta face mounting challenges, including traffic congestion, poor road conditions, lack of pedestrian infrastructure, and inadequate enforcement of traffic laws. According to the Pakistan Bureau of Statistics (2023), more than 15,000 people lose their lives annually in road accidents, while another 30,000 suffer serious injuries. These accidents not only cause human suffering but also impose an economic burden of approximately 3% of the national GDP due to medical costs, lost productivity, and property damage (Asian Development Bank, 2023).

While road safety has become a pressing issue in Pakistan's urban areas, academic and policy discourse remains limited in its analytical depth. Most existing studies rely on descriptive or temporal data, missing the critical spatial dimensions that could uncover localized risk patterns and high-incidence zones. This study seeks to address this analytical gap by utilizing advanced spatial analysis techniques including Geographic Information Systems (GIS), hotspot identification, and spatial regression modeling to systematically map road accident distribution across major Pakistani cities.

By pinpointing high-risk zones and understanding the geographical correlates of accidents, this article aims to offer actionable insights for urban planners, transportation authorities, and law enforcement agencies. Spatially informed road safety interventions such as traffic calming measures, redesign of accident-prone intersections, and targeted enforcement can substantially reduce fatalities and improve urban mobility. The study ultimately supports a data-driven approach to urban development, fostering safer, more resilient cities amid Pakistan's rapid urban expansion.

Advancing Spatial Understanding of Road Accidents in Pakistan's Urban Centers

Spatial analysis has become a pivotal tool globally for understanding the dynamics of road traffic accidents. In developed countries such as those in Europe and North America, Geographic Information Systems (GIS) and advanced clustering methods like Kernel Density Estimation (KDE) and Getis-Ord Gi* are widely employed to identify accident-prone zones and guide urban safety interventions (Li et al., 2022). In South Asia, nations like India and Bangladesh have used spatial autocorrelation techniques, including Moran's I, to explore accident patterns near highways, intersections, and high-density urban corridors (Das & Ahmed, 2021). These approaches have enabled policymakers to target infrastructure improvements and enforcement in high-risk areas.

In contrast, Pakistan's research on road safety has been limited, often relying on temporal and descriptive statistical methods rather than spatially grounded analysis. Some recent studies have begun to fill this gap. For example, Ahmed and Abbas (2018) mapped accident hotspots in Lahore, while Khan and Fatima (2021) explored high-risk corridors in Karachi. However, such studies are typically restricted to single cities and lack the integration of spatial econometrics, multi-city comparisons, and longitudinal data analysis.

The pressing need for more advanced spatial research in Pakistan is underscored by multiple systemic issues contributing to road accidents. These include deteriorating road infrastructure, with nearly 40% of national highways lacking proper signage (NHA, 2023), prevalent risky driver behaviors such as over-speeding and lane violations, and a lack of robust enforcement. 30% of traffic laws are consistently applied (Punjab Police, 2024). Additionally, pedestrian infrastructure remains severely inadequate, with less than 20% of urban roads equipped with functional footpaths (Karachi Urban Lab, 2023).

This study builds on and extends prior research by applying sophisticated spatial analytical tools across five major Pakistani cities. It uses geocoded accident data from 2015 to 2024 to identify spatial clusters and statistically significant risk factors, aiming to inform smarter urban design and policy interventions tailored to Pakistan's evolving urban landscapes.

Geospatial Analysis Framework for Urban Road Safety in Pakistan

A recent study focused on understanding the spatial patterns and determinants of road traffic accidents across five major Pakistani cities i.e. Karachi, Lahore, Islamabad, Peshawar, and Quetta. These urban centers were chosen based on their high population density, rapid urban expansion, and the availability of comprehensive traffic data. Karachi, for instance, is characterized by a complex

and often informal road network, with 30% of its traffic flow estimated to be unregulated (Sindh Transport Authority, 2024). Lahore presents a hybrid infrastructure of historical roads and modern highways, recording the highest motorcycle accident rate in Pakistan. Islamabad, despite being a planned city, struggles with an 8% annual vehicle growth rate, which overwhelms its existing road infrastructure (ICT Administration, 2024). Meanwhile, Peshawar and Quetta, experiencing swift urbanization, lack essential road safety infrastructure and enforcement mechanisms (KP & Balochistan Transport Departments, 2023).

The research uses a combination of primary and secondary data sources, including police accident reports, Rescue 1122 records, hospital trauma registries, road network data from OpenStreetMap, and census-based population and infrastructure statistics. Key variables collected for each accident include GPS location, severity classification, vehicle types involved, and contextual factors such as weather, time, and road conditions.

Three spatial analysis techniques were employed to extract meaningful insights. Moran's I measured overall spatial autocorrelation, confirming statistically significant clustering of accidents ($p < 0.01$). Hotspot analyses using Getis-Ord Gi* and Kernel Density Estimation helped identify high-risk corridors, while spatial regression modeling assessed how road type, traffic volume, and urban infrastructure impacted accident rates. Results showed that Karachi reported the highest annual accident figures (approximately 9,200), with critical clusters around Shahrah-e-Faisal and Korangi industrial zone. Lahore followed with 7,500 incidents annually, notably along Ferozepur Road and Ring Road junctions. Islamabad's hotspots were concentrated in the Blue Area and Faizabad, while Peshawar and Quetta reported lower but rising trends.

Notable risk factors include inadequate road design (60% of hotspots lacked proper signage), traffic violations such as speeding (35%) and illegal U-turns (20%), and pedestrian vulnerability, where only 15% of crossings were signalized. These findings underscore the urgency of data-driven policy interventions. Recommendations include upgrading infrastructure with smart traffic signals and pedestrian bridges, enhancing enforcement via e-challan systems and increased patrolling, and implementing public safety campaigns. Additionally, real-time GIS-based monitoring systems should be developed to proactively identify and manage future risk zones, fostering safer urban mobility across Pakistan.

Conclusion

This study underscores the urgent need to integrate spatial analysis into urban road safety planning in Pakistan. As urbanization intensifies, cities like Karachi, Lahore, Islamabad, Peshawar, and Quetta are experiencing rising traffic volumes, deteriorating infrastructure, and inadequate enforcement—factors that contribute to thousands of fatalities and injuries annually. By leveraging Geographic Information Systems (GIS), hotspot analysis, and spatial regression techniques, this research identifies critical accident-prone zones and the underlying risk factors, such as poor road design, pedestrian unfriendliness, and reckless driving behaviors.

Findings confirm statistically significant clustering of accidents, with urban centers like Karachi and Lahore showing pronounced hotspots along major commercial and industrial corridors. The study offers actionable insights for policymakers, emphasizing infrastructure upgrades, smart enforcement tools like e-challans, and public awareness campaigns. Importantly, it advocates for real-time, spatially informed monitoring systems that can proactively reduce accident rates rather than relying solely on reactive measures.

This spatially grounded approach provides a roadmap for urban planners, traffic authorities, and local governments to adopt data-driven solutions tailored to each city's unique risk profile. As Pakistan's cities continue to grow, embracing such evidence-based strategies is essential to ensure safer, more resilient, and more sustainable urban mobility systems for the future.

References: ADB; Khan & Fatima; World Bank; Punjab Emergency Service; Pakistan Bureau of Statistics; Asian Development Ban; Li et al; Das & Ahmed; Ahmed & Abbas; NHA; Karachi Urban Lab; Sindh Transport Authority; ICT Administration KP & Balochistan Transport Departments

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