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**EDITORIAL**

## February's Focus: Equity, Innovation, and Sustainability—The Path to Rural Resilience

February highlights pressing global issues in agricultural economies, public health, equity, and food security. Key dates include Women's and Girls' Day in Science, advocating for social justice, and raising awareness about food security through pulses.

Muhammad Khalid Bashir

2/1/2025

The month of February brings global attention to some of the most pressing issues shaping our agricultural economies, rural livelihoods, and public health. From recognizing the role of women and girls in science (Feb 11) to advocating for social justice in economic policies (Feb 20), and from raising awareness about food security through pulses (Feb 10) to emphasizing the importance of wetlands in sustainable agriculture (Feb 2), this month serves as a reminder that progress in these domains is interconnected.

Agriculture remains the backbone of rural economies, yet its sustainability and resilience are increasingly tested by socio-economic disparities, environmental pressures, and public health challenges. Rural communities, particularly in developing countries, face persistent barriers—limited access to healthcare, gender gaps in scientific research and innovation, lack of financial inclusion, and the growing impact of climate change on food production. Addressing these issues requires a holistic approach that integrates equity, innovation, and sustainability into policy frameworks and grassroots initiatives.

### Equity: Breaking Barriers to Social and Economic Justice

Fair economic policies and labor rights are fundamental to ensuring that rural communities thrive. Yet, many smallholder farmers, women, and marginalized groups continue to face economic exclusion due to systemic barriers such as limited access to credit, unequal land ownership rights, and inadequate representation in policymaking. In many developing

countries, rural workers, particularly women, earn significantly less than their urban counterparts and often lack social protections such as minimum wages, pension schemes, or health insurance.

Recognizing the World Day of Social Justice (Feb 20), we must push for policies that promote financial inclusion, fair wages, and equitable access to agricultural resources. Governments and financial institutions should create targeted microfinance programs, cooperative farming models, and digital banking solutions that enable rural populations to participate fully in economic activities. Additionally, strengthening labor laws for agricultural workers—many of whom face exploitative working conditions—can contribute to long-term rural economic stability.

Similarly, International Mother Language Day (Feb 21) highlights the importance of preserving indigenous languages and ensuring knowledge dissemination in local dialects. Many agricultural extension programs and financial literacy initiatives fail to reach their full potential due to language barriers. Providing training, advisory services, and educational content in native languages can significantly improve the adoption of modern farming techniques, access to government subsidies, and informed decision-making among farmers.

### Innovation: Women's Role in Science and Agricultural Development

Scientific innovation in agriculture cannot reach its full potential without the active participation of women and girls. Historically, women have played a crucial

role in farming, food production, and resource management, yet they remain underrepresented in agricultural research, technology, and entrepreneurship. The International Day of Women and Girls in Science (Feb 11) serves as a reminder that closing the gender gap in these fields is not just about equality—it is essential for achieving food security, rural development, and climate resilience.

Women-led innovations in precision farming, climate-smart agriculture, and food processing hold immense potential for transforming rural economies. Female scientists and agripreneurs have pioneered techniques in water-efficient irrigation, organic pest control, and sustainable soil management, directly benefiting smallholder farmers. However, many women face limited access to education, funding, and leadership opportunities in agricultural sciences. Bridging this gap requires targeted policies, including scholarships for women in STEM fields, mentorship programs, and access to investment for female-led agribusinesses.

Moreover, empowering women in agricultural research fosters more inclusive and community-driven solutions. Studies have shown that when women farmers gain access to modern technologies, crop yields and household incomes rise, leading to broader economic growth. Governments, universities, and the private sector must work together to dismantle barriers that prevent women from contributing to agricultural innovation. By ensuring their full participation, we can unlock groundbreaking solutions for sustainable farming, food security, and climate



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adaptation—securing a better future for all.

### **Sustainability: The Need for Resilient Food Systems and Environmental Conservation**

Environmental sustainability and food security are central to the well-being of rural communities. As climate change continues to threaten agricultural productivity, it is crucial to build resilient food systems that support both farmers and ecosystems. World Pulses Day (Feb 10) highlights the vital role of pulses such as lentils, chickpeas, and beans in improving soil fertility, reducing dependence on chemical fertilizers, and providing affordable, protein-rich nutrition. These crops are not only climate-resilient but also contribute to sustainable agriculture by fixing nitrogen in the soil, reducing the need for synthetic inputs that harm the environment.

Likewise, World Wetlands Day (Feb 2) underscores the importance of conserving wetlands, which serve as natural water reservoirs, flood control systems, and biodiversity hotspots. Wetlands also support sustainable irrigation, fisheries, and carbon sequestration, all of which are critical for long-term agricultural productivity. However, rapid urbanization, industrial pollution, and unsustainable farming practices are leading to wetland degradation, threatening water availability for rural communities.

Investing in climate-smart agricultural practices, wetland restoration, and sustainable land management can help secure food production and protect rural livelihoods. Policies promoting agroecology, water-efficient irrigation, and biodiversity conservation must be prioritized to ensure a balanced approach to food security and environmental conservation. Strengthening these efforts will not only enhance rural resilience but also contribute to a more sustainable and equitable agricultural system for future generations.

### **Health and Nutrition: Strengthening Rural Well-being**

A healthy population is the backbone of a productive rural economy, yet millions of agricultural workers and smallholder farmers struggle with limited access to essential healthcare services. The physical demands of farming, exposure to harmful pesticides, and lack of medical facilities in remote areas put rural populations at greater risk of chronic illnesses, occupational hazards, and malnutrition.

This February, several global observances remind us of the need to strengthen rural healthcare systems. World Cancer Day (Feb 4) and International Childhood Cancer Day (Feb 15) highlight the urgent need for early detection, affordable treatment, and cancer care accessibility in rural areas, where healthcare infrastructure is often inadequate. Similarly, Rare Disease Day (Feb 28/29) emphasizes the challenges faced by individuals with uncommon medical conditions, who struggle to access proper diagnosis and treatment due to limited awareness and healthcare resources in rural regions.

In addition to healthcare, nutrition remains a critical concern for rural communities. World Pulses Day (Feb 10) underscores the role of protein-rich, nutrient-dense pulses in combating malnutrition and improving dietary diversity among low-income farming households. Pulses are not only an affordable and sustainable food source but also enhance soil fertility, contributing to both food security and environmental sustainability.

To improve rural well-being, governments and stakeholders must invest in mobile health clinics, telemedicine, nutritional education, and improved agricultural policies. Ensuring access to quality healthcare and nutritious food will help rural communities thrive, fostering a healthier, more resilient workforce for sustainable agricultural development.

### **Moving Forward: A Collective Responsibility**

The path to sustainable agriculture and resilient rural economies lies in a

balanced and inclusive approach—one that fosters equity, leverages innovation, and upholds environmental and social sustainability. Rural communities, which form the backbone of food production, face persistent challenges, including economic disparities, climate change, gender inequality, and limited healthcare access. Addressing these issues requires a coordinated effort from governments, researchers, policymakers, agricultural practitioners, and rural communities themselves.

Equitable policies that ensure fair wages, financial inclusion, and access to resources for smallholder farmers and marginalized groups must be prioritized. Investing in rural healthcare is equally critical, as a healthy workforce directly impacts agricultural productivity and economic stability. Furthermore, empowering women and girls in science and agriculture can drive innovation, enhance food security, and promote climate-smart farming solutions.

At the same time, sustainable agricultural practices—such as integrated soil and water conservation, organic farming, and biodiversity protection—must be actively promoted and implemented to combat environmental degradation and ensure long-term food security.

As we navigate these challenges, The Agricultural Economist remains committed to fostering meaningful discussions and sharing knowledge that contributes to a just, innovative, and sustainable agricultural landscape. This edition invites experts, researchers, and practitioners to reflect on these themes and propose actionable solutions for a better, more resilient future. Only through collective responsibility and cooperation can we build a thriving, inclusive, and environmentally sustainable agricultural sector for generations to come.

*Together, let us champion resilience and inclusivity for rural economies across the globe.*

Send your submissions to: [editor@agrieconomist.com](mailto:editor@agrieconomist.com)

Muhammad Khalid Bahir, Managing Editor

**SPOTLIGHT**

## Wetlands: Key to Sustainable Farming in Pakistan

Discover the vital role of wetlands in sustainable farming in Pakistan. They enhance soil fertility, support biodiversity, and protect against floods, yet face threats like habitat destruction and climate change. Learn how to safeguard this essential resource for agriculture.

Farah Gilal

2/4/2025

Pakistan, a land of diverse landscapes, harbors a rich network of wetlands, ranging from the Himalayas' high-altitude glacial lakes to the Indus Delta's mangrove forests. These vital ecosystems, often overlooked, play a crucial role in supporting sustainable farming practices and ensuring the nation's food security. While Pakistan faces significant challenges related to water scarcity and land degradation, its wetlands offer valuable resources and ecosystem services that can be leveraged for a more resilient and productive agricultural sector.

Pakistan is home to approximately 780,000 hectares of wetlands, covering 9.7% of the country's total land area. These wetlands include 225 nationally significant sites, of which 19 have been designated as Ramsar sites due to their global ecological importance. Recognized under the Ramsar Convention, an international treaty dedicated to the conservation and sustainable use of wetlands, these 19 wetlands span a total area of 1,343,807 hectares. Wetlands play a very critical role in conserving biodiversity, supporting a diverse range of flora and fauna by providing shelter to numerous endemic and threatened species.

Pakistan's diverse geography sustains various wetland ecosystems spread across its provinces. The riverine wetlands along the Indus River and its tributaries, along with other important lakes such as the Head Balloki and Harike Wetland Complex, which are vital for migratory birds, characterize the Punjab provincial wetlands. The vast mangrove creeks and mudflats of the Indus River Delta in Sindh are of optimum ecological interest for fisheries and coastal protection. The largest

province, Baluchistan, has unique coastal wetlands along the Arabian Sea, including the Jiwani Coastal Wetlands, and inland seasonal wetlands such as Hamal Lake, important for resident and migratory waterfowl. Khyber Pakhtunkhwa, being a mountainous region, consists of high-altitude glacial lakes and alpine meadows, which play an important role in regulating the water flow downstream. These varied wetlands contribute immensely to provincial biodiversity, ecosystem services, and the livelihoods of local communities.

### Understanding Pakistan's Diverse Wetland Ecosystems

Pakistan's wetlands are as varied as its geography, encompassing a range of ecosystems that play a crucial role in biodiversity conservation, water security, and climate resilience. With over 225 significant wetlands covering approximately 780,000 hectares, these ecosystems are critical for sustaining agriculture, fisheries, and local communities. Pakistan is home to 19 Ramsar-designated wetlands, highlighting their international importance for ecological balance and migratory bird populations.

The Indus River and its tributaries form the backbone of the country's riverine wetlands, sustaining a vast network of floodplains that support over 60% of Pakistan's agricultural activity. These wetlands act as natural filters, improving water quality by removing pollutants, while also serving as breeding grounds for diverse fish species, which are essential for food security and local economies. However, increased water diversion for irrigation, pollution, and habitat destruction threaten their sustainability.

Lacustrine wetlands, including natural and man-made lakes such as Manchar Lake (Pakistan's largest freshwater lake) and Keenjhar Lake, are vital ecosystems supporting migratory birds like flamingos and pelicans. Manchar Lake alone sustains thousands of fishing families, providing both sustenance and income. Yet, pollution from agricultural runoff and reduced inflows from the Indus River have led to ecological degradation, threatening fisheries and livelihoods.

Palustrine wetlands, consisting of marshes, swamps, and floodplain vegetation, play a key role in water storage, filtration, and carbon sequestration. Pakistan loses nearly 39,000 hectares of agricultural land annually due to flooding, and these wetlands help mitigate such risks by absorbing excess water during heavy monsoons. However, rapid urban expansion and land reclamation have significantly reduced their capacity to buffer against climate extremes.

The Indus Delta, one of the largest deltaic ecosystems in the world, represents Pakistan's most extensive coastal wetland system, with over 600,000 hectares of mangrove forests. These mangroves are vital for protecting shorelines from erosion, sustaining 80% of Pakistan's marine fisheries, and sequestering large amounts of carbon. However, rising sea levels, freshwater shortages, and industrial pollution pose severe threats to this fragile ecosystem.

In high-altitude regions, glacial lakes and alpine wetlands regulate water flow for downstream areas, providing irrigation for millions. With over 3,044 glaciers and 7,000 glacial lakes in Pakistan's north, these wetlands are



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crucial for climate adaptation. Yet, rising temperatures have accelerated glacial melt, increasing the risk of floods and long-term water shortages.

### **The Interconnectedness of Wetlands and Sustainable Farming**

Wetlands and sustainable farming are deeply interconnected, providing essential ecosystem services that enhance agricultural productivity while ensuring environmental resilience. Pakistan, with its diverse wetland ecosystems, heavily depends on these natural landscapes for water regulation, soil fertility, biodiversity conservation, and climate resilience. The role of wetlands in sustainable farming is particularly significant in a country where over 90% of freshwater resources are used for agriculture, making efficient water management a top priority.

One of the most critical benefits wetlands offer is water regulation and availability. Wetlands act as natural reservoirs, storing water during the monsoon season and slowly releasing it during dry spells, ensuring a stable supply for irrigation. This function is particularly vital for 60% of Pakistan's farmland, which relies on irrigation from the Indus Basin. Wetlands also contribute to groundwater recharge, which sustains agriculture in areas facing declining water tables.

Another key function of wetlands is nutrient cycling and soil fertility. By trapping sediments and organic matter, wetlands naturally enrich soil, reducing dependence on synthetic fertilizers. This process is crucial in Pakistan, where around 40% of soil is degraded due to intensive farming practices and excessive chemical use. The biodiversity within wetlands further supports soil health by fostering microbial activity that enhances nutrient absorption.

Wetlands also serve as natural pest control systems, hosting insect species that prey on agricultural pests, reducing reliance on harmful pesticides. Additionally, they act as flood buffers, absorbing excess water and minimizing damage to farmlands. Pakistan has

suffered over \$38 billion in agricultural losses due to floods in the past two decades, highlighting the need to preserve wetlands for flood mitigation.

Biodiversity within wetlands supports pollination services crucial for crop production. Pakistan's horticulture sector, contributing about 12% to agricultural GDP, depends on pollinators like bees and butterflies that thrive in wetland habitats. Furthermore, wetlands sustain fisheries and aquaculture, benefiting over 1 million people employed in Pakistan's fishing industry and providing an essential protein source for rural communities.

Preserving wetlands is vital for Pakistan's agricultural sustainability. Integrated conservation strategies, improved land-use planning, and sustainable farming practices can ensure that wetlands continue to support food security, rural livelihoods, and ecological balance in the face of climate change.

### **Challenges Facing Wetlands and Their Impact on Agriculture**

Pakistan's wetlands are vital for agriculture, yet they face increasing threats that undermine their ability to support sustainable farming. The conversion of wetlands for agriculture and urban expansion is one of the biggest challenges, reducing natural flood control, water filtration, and biodiversity. For instance, rapid urbanization in Sindh and Punjab has led to the degradation of major wetlands, including Manchar Lake, the largest freshwater lake in Pakistan, which has shrunk significantly due to encroachments and pollution.

Water abstraction and diversion are also critical concerns. Over 90% of Pakistan's freshwater resources are allocated to agriculture, leading to excessive groundwater pumping and river water extraction. This has resulted in reduced water flow to wetlands, causing them to dry up and lose their ability to regulate water for farmlands. The Ramsar-listed wetlands in Pakistan, such as Haleji Lake, have suffered from

severe water shortages, affecting their ecological functions and agricultural benefits.

Pollution further threatens wetlands, with an estimated 80% of Pakistan's wastewater discharged untreated into natural water bodies. Agricultural runoff containing pesticides and fertilizers contaminates wetlands, harming aquatic ecosystems and reducing water quality for irrigation. Polluted wetland water used for farming can degrade soil quality and pose health risks.

The spread of invasive species is another growing problem. Species such as water hyacinth in Sindh's wetlands disrupt native biodiversity, block waterways, and alter the ecosystem balance, negatively affecting fisheries and irrigation channels.

Climate change is amplifying these challenges, with Pakistan experiencing a 0.6°C rise in average temperatures over the last century. Changing rainfall patterns and extreme weather events, such as floods and droughts, further threaten wetlands, reducing their capacity to support agriculture. Addressing these challenges is crucial to maintaining the balance between wetlands and sustainable farming in Pakistan.

### **Integrating Wetlands into Sustainable Farming Strategies**

Pakistan's wetlands play a critical role in sustainable agriculture, yet they remain underutilized due to poor management and environmental threats. Integrating wetlands into farming strategies requires a comprehensive approach that balances conservation with agricultural productivity. Integrated Water Resource Management (IWRM) is essential, as over 90% of Pakistan's freshwater resources are used for agriculture, often at the expense of wetlands. Efficient irrigation techniques, such as drip irrigation and water-efficient cropping systems, can help reduce pressure on wetland ecosystems while ensuring a stable water supply for farmers.

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Sustainable aquaculture and fisheries management offer another opportunity. Pakistan's inland fisheries contribute significantly to livelihoods, with annual fish production exceeding 700,000 metric tons. Promoting wetland-friendly aquaculture in regions like the Indus Delta can enhance food security and economic opportunities while preserving biodiversity.

The establishment of buffer zones and agroforestry systems around wetlands is crucial for reducing pollution from agricultural runoff. Studies indicate that wetland buffer zones can filter up to 50% of agricultural pollutants, improving water quality. Additionally, conservation agriculture practices, including no-till farming and cover cropping, can minimize soil erosion, benefiting both farmland and adjacent wetlands.

Empowering local communities in wetland conservation is vital for long-term sustainability. Pakistan has over 220 wetland sites, many of which are located near farming communities. Community-led initiatives, such as those seen in Haleji and Keenjhar Lakes, demonstrate how traditional knowledge can be used to sustainably manage wetlands while supporting agriculture.

Finally, strengthening policy and regulatory frameworks is necessary to ensure wetland protection. Despite

Pakistan being a signatory to the Ramsar Convention, wetland degradation continues due to weak enforcement. Introducing incentives for farmers adopting wetland-friendly practices and enforcing stricter land use and water management policies can help integrate wetlands into Pakistan's sustainable farming future.

### **The Way Forward: A Collaborative Approach**

Realizing the full potential of wetlands for sustainable farming requires a collaborative approach involving government agencies, farmers, researchers, and local communities. Investing in research to better understand the complex interactions between wetlands and agriculture is essential. Furthermore, raising awareness among farmers and the general public about the importance of wetlands for sustainable agriculture is crucial.

By recognizing the vital role of wetlands and implementing integrated management strategies, Pakistan can enhance its agricultural productivity, improve food security, and build a more resilient and sustainable agricultural sector. Protecting these invaluable ecosystems is not just an environmental imperative; it is a crucial investment in the future of Pakistani agriculture.

### **Conclusion**

Wetlands are a vital yet often overlooked resource for sustainable farming in Pakistan. They regulate water, enhance soil fertility, support biodiversity, and protect agricultural lands from floods. However, threats like habitat destruction, pollution, and climate change endanger their ability to sustain agriculture.

A collaborative approach involving policy reforms, sustainable farming practices, and community engagement is essential to protect and restore wetlands. By recognizing wetlands as a key asset rather than an afterthought, Pakistan can enhance water security, improve soil fertility, mitigate floods, and sustain biodiversity, ultimately paving the way for a more productive, climate-resilient, and food-secure future. Protecting wetlands is not just an environmental obligation but it is also an economic and agricultural necessity.

*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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## Agriculture in Türkiye: Key to Economy & Food Security

Explore the vital role of agriculture in Türkiye's economy and culture. Despite challenges like climate change and water scarcity, the sector is crucial for food security and sustaining rural livelihoods. Discover the need for targeted policies and innovations for long-term sustainability.

Mithat Direk

2/7/2025

Agriculture is a cornerstone of Türkiye's economy, serving as both a primary source of employment and a crucial contributor to the country's food security and economic stability. With around 3 million agricultural enterprises across the country and an estimated six people per household, approximately 18 million people are directly involved in farming and related activities. This means that nearly one-fourth of Türkiye's population depends on agriculture for their livelihood, emphasizing its deep socio-economic significance.

Beyond its direct impact on employment, agriculture influences several other sectors, including food processing, trade, transportation, and manufacturing. Türkiye is one of the world's leading producers of various crops, such as wheat, barley, hazelnuts, and apricots, and plays a significant role in global agricultural exports. The sector also supports a vast rural economy, sustaining smallholder farmers, agribusinesses, and supply chains that extend from local markets to international trade.

In addition, agriculture remains integral to Türkiye's cultural heritage and rural identity, with traditional farming practices being passed down through generations. However, the sector faces numerous challenges, including climate change, water scarcity, rising input costs, and market fluctuations. These factors necessitate strong policy interventions and modernized agricultural practices to enhance sustainability and productivity.

Before delving into the structure of agriculture in Türkiye, it is essential to recognize the critical impact of government policies, subsidies, and technological advancements in shaping the industry. The right initiatives can bolster resilience, improve rural

livelihoods, and ensure long-term food security, making agriculture not just a pillar of the economy but a strategic sector for national development.

### Agriculture's Role in the Economy

Agriculture's importance in an economy is often assessed through criteria such as employment, contribution to GDP, impact on foreign trade, provision of raw materials to industries, and resource transfer to non-agricultural sectors. In Türkiye, agriculture remains a vital sector, contributing 15-20% to the economy on average. However, its relative share in GDP has declined over the years. In 1980, agriculture accounted for 25.8% of national income, but by 2022, this share had dropped to 4.8%, according to the Turkish Statistical Institute (TÜİK). Despite this decline, agriculture remains a strategic sector, employing 15.8% (4.9 million) of the total workforce (30.8 million) as of 2022. However, employment in agriculture has been decreasing, with a shift toward the services and construction sectors. By the first quarter of 2023, the share of agricultural employment fell to 14.9% (4.7 million) of total employment (31.6 million).

Agriculture's contributions extend beyond GDP and employment. It provides raw materials to industries, serves as a market for industrial goods, and meets the nutritional needs of society. For instance, the agricultural sector is the largest buyer of industrial products, fostering a symbiotic relationship between agriculture and industry. A developing agricultural sector supports industrial growth, while a growing industry, in turn, bolsters agriculture, creating a balanced economic development cycle.

### Global Context and Türkiye's Position

Globally, agriculture remains a critical sector, with 3.26 trillion dollars in agricultural added value, accounting for 4.1% of the global national income of 96.4 trillion dollars as of 2021. The top 20 countries, which produce 78% of global national income, also account for 56% of agricultural production. In 2022, global agricultural exports totaled 2 trillion dollars, while imports reached 2.1 trillion dollars. The largest exporters of agricultural products include the USA, Brazil, the Netherlands, Germany, and China, which together account for 32% of global agricultural exports.

In Türkiye, agriculture has maintained its strategic importance despite a declining share in GDP. The sector recorded a modest growth of 0.6% in 2022, contributing limitedly to the overall economic growth of 5.4%. However, the first quarter of 2023 saw a 3.8% contraction in the agricultural sector, the sharpest decline since the third quarter of 2021. By the second quarter of 2023, the sector rebounded slightly, growing by 1.2%, with its share in GDP standing at 4.4%.

### Employment and Rural Population Dynamics

Agriculture is a significant employer in Türkiye, particularly in rural areas. As of 2021, 43% of the global population (3.4 billion people) lived in rural areas, down from 66% in 1960. In Türkiye, the rural population constitutes 23% of the total population, slightly below the European Union average of 25%. Countries like India (909 million) and China (529 million) account for 42% of the world's rural population. Globally, 891 million people were employed in agriculture in 2022, representing 26% of total

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employment. In least developed countries, this figure rises to 63%, while in developed countries, it drops to 3%. Türkiye's agricultural employment rate of 15.8% in 2021 is below the global average but significantly higher than the EU average of 5%.

The rural-to-urban migration trend is evident in Türkiye, driven by industrialization and urbanization. While the general population has grown rapidly, the agricultural population has declined both relatively and absolutely. For instance, Türkiye's population increased from 13.6 million in 1927 to 56.5 million in 1990 and 62.6 million in 1997. The annual population growth rate has fluctuated between 1.1% and 2.8%, with the highest rates recorded in the 1955-60 and 1960-65 periods. However, rapid population growth in developing countries like Türkiye often leads to structural challenges, including unemployment and unplanned urban expansion.

### Structure of Agricultural Enterprises

The structure of agricultural enterprises in Türkiye is characterized by small landholdings and fragmented ownership. According to the 2006 Agricultural Enterprise Structure Research, 78.9% of agricultural holdings are smaller than 100 decares, accounting for 34.3% of total agricultural land. In contrast, 21.1% of enterprises, with holdings of 100 decares or more, control 65.7% of the land. The average agricultural enterprise in Türkiye has 5 parcels of land, which are often small, scattered, and irregular, reducing productivity and labor efficiency.

Crop production and animal husbandry are the primary activities in Türkiye's agricultural sector. 62.3% of enterprises engage in both activities, while 37.2% focus solely on crop production, and 0.5% specialize in animal husbandry. Land use is predominantly agricultural, with 97% of land used for farming. However, only 24.1% of agricultural land is irrigated, with higher irrigation rates in vegetable and flower gardens (72.7%) and lower rates in cultivated fields (27.8%).

### Production and Yield Trends

Türkiye is one of the few countries globally that meets most of its food and textile needs through domestic production while also engaging in significant agricultural exports. Over the years, production of key crops like wheat, oranges, and milk has increased, despite challenges such as the phylloxera pest, which significantly reduced vineyard areas after 1980. However, high productivity in newly established vineyards has offset this decline.

In 2009, grain production increased by 14%, while vegetable and fruit production saw slight declines. Wheat production rose by 15.4% to 20.5 million tons, barley by 21.6% to 7.2 million tons, and grain corn decreased by 0.6% to 4.2 million tons. Legume production also saw significant growth, with red lentils increasing by 221.4% and green lentils by 11.7%.

### Agricultural Industry and Inputs

The agricultural industry in Türkiye relies heavily on raw materials from the agricultural sector, with significant exports of raw and processed agricultural products. The food and textile industries are the primary sectors processing agricultural raw materials. However, the industry has not yet reached its full potential, with challenges such as low capacity utilization and outdated technology.

The use of agricultural inputs like fertilizers, pesticides, and machinery has increased significantly, boosting productivity. For example, tractor production grew tenfold from 1965 to 1992, reaching 725,000 units. By 2008, Türkiye had 1,070,746 tractors of various types. However, excessive use of inputs has led to environmental issues in some regions.

### Contribution to Nutrition and Public Health

Agriculture's primary function is to produce food, ensuring the survival and well-being of the population. In Türkiye, per capita food consumption has improved over the years, with increased consumption of wheat products, potatoes, legumes, milk, eggs, and poultry. However, meat consumption remains low compared to developed countries, with an annual per capita consumption of 31.5 kg in 1984, far below the 70-80 kg in developed nations. The imbalance between plant and animal protein sources (71% vs. 29%) highlights the need for improved nutrition policies.

### Sustainable Development and Environmental Protection

Agriculture also plays a crucial role in environmental sustainability. Forests and green areas, which cover 25% of Türkiye's land, are essential for maintaining ecological balance and public health. However, only 40% of these forests are of good quality, underscoring the need for sustainable development policies. Protecting green areas and preventing pollution are critical for ensuring a healthy environment for future generations.

### Conclusion

Agriculture remains a vital pillar of Türkiye's economy, culture, and rural livelihood, despite its declining share in GDP and employment. The sector plays a crucial role in food security, foreign trade, and industrial development, providing raw materials to major industries and sustaining millions of livelihoods. However, challenges such as climate change, water scarcity, rural-urban migration, and fragmented landholdings necessitate targeted policies and innovations for long-term sustainability.

Moving forward, investment in modern agricultural technologies, efficient water management, and sustainable farming practices will be key to enhancing productivity and resilience. Additionally, strengthening rural infrastructure,

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improving market access, and promoting agribusiness development can help bridge the gap between traditional farming methods and modern agricultural needs.

As Türkiye continues its economic transformation, agriculture must evolve to remain competitive in both local and

global markets. By fostering innovation, ensuring equitable resource distribution, and supporting smallholder farmers, the sector can maintain its critical role in national development while contributing to environmental sustainability and food security.

*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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## Kitchen Gardening Culture in Pakistan for Fresh Organic Produce

Discover the benefits of kitchen gardening in Pakistan, a practical solution to enhance food security and reduce reliance on market-bought produce. Explore various methods like container gardening, vertical setups, raised beds, or advanced hydroponic and aquaponic systems.

Nadeem Riyaz

2/21/2025

Kitchen gardening is a sustainable practice that enables individuals to grow their own vegetables, herbs, and fruits in small spaces such as backyards, balconies, rooftops, and even indoor settings. In Pakistan, where food security and rising inflation pose challenges, kitchen gardening can help households gain access to fresh, organic produce. This not only reduces expenses on groceries but also enables people to consume products free from fertilizers and unnatural stimulants.

There are several challenges to successful kitchen gardening. These include extreme weather conditions, rising temperatures, water scarcity and management, pests and diseases, poor soil quality, a shortage of cultivable space in urban areas, lack of knowledge, difficulty in finding the right seeds, and unsuitable local climatic conditions that may lead to selecting the wrong plants. Kitchen gardening can take several forms, depending on space, resources, and preferences. This article explores some of these forms.

**Traditional in-ground gardening** is the most common form of kitchen gardening, where plants are grown directly in the soil. It is suitable when there is ample outdoor space and access to healthy soil. Its benefits include a low initial cost, a wider variety of plants, and a beneficial soil ecosystem. It requires less frequent watering and offers room for expansion. However, it also has drawbacks, such as issues with soil quality, challenges in weed and pest control, poor drainage, and dependence on the weather.

**Vertical gardening** is a space-saving method that allows plants to grow upwards instead of spreading out. It utilizes walls, trellises, or hanging pots

to maximize space. It is ideal for small areas like balconies, patios, and indoor walls and helps reduce disease risk by keeping plants off the ground. Because of the raised elevation, plants get more sunlight, are easier to maintain, and enhance home and garden décor with lush greenery. However, not all plants thrive in vertical conditions, as deep-rooted plants require additional watering. The initial setup cost is high, and it requires sturdy walls, trellises, or special mounting. Additionally, wet soil and heavy plants can strain walls or trellises

**Container gardening** is ideal for small spaces and is used for growing herbs, vegetables, and small fruits in pots, grow bags, or recycled containers. It requires well-draining soil and nutrient-rich compost, selecting the right container size based on plant type, ensuring proper sunlight exposure (at least 4–6 hours daily), and watering plants adequately while avoiding overwatering. The advantages of container gardening include space-saving, mobility of pots, better pest and weed control, water efficiency, and aesthetic appeal. However, it also has disadvantages, such as limited root growth, greater water and nutrient depletion requiring frequent replenishment, high initial costs for fancy pots and fertilizers, and the risk of small containers heating up or cooling down faster than ground soil, which can affect plant health and productivity.

**Raised bed gardening** involves growing plants in soil contained within a framed structure, usually made of wood, stone, or metal. These beds are elevated above the ground, typically 6–24 inches high, and can be placed in yards, patios, or even rooftops. The benefits of raised bed gardening include better drainage,

which reduces root rot, improved soil quality, higher productivity, less weeding and pest control, and longer growing periods. Being raised, it allows easier access for older people. However, the negatives include higher investment in materials like wood, soil, and compost, intensive labor for proper setup, and the need for frequent watering and soil maintenance.

**Windowsills and indoor gardening** involve growing plants inside the home, usually on windowsills, shelves, or under grow lights. It is suitable for herbs, small vegetables, and ornamental plants. The advantages include year-round gardening, space-saving, better pest and weed control, aesthetic appeal, air purification, easy access to plants, and minimal water usage. However, the disadvantages include limited plant choices, dependence on sufficient sunlight, restricted growing space, humidity and temperature fluctuations, and the additional effort required for indoor plant care.

**Keyhole gardening** uses a circular raised bed with a composting basket in the center. This design allows for efficient water and nutrient distribution, making it ideal for dry or resource-limited areas. The "keyhole" shape provides easy access to all parts of the garden. It is a water- and nutrient-efficient system, making it suitable for poor soil conditions. It requires low maintenance, saves space, and is a sustainable, eco-friendly method. However, the initial setup cost can be high due to the need for layering soil, compost, and materials. It is not suitable for deep-rooted plants like carrots or potatoes, requires compost management, and may not be ideal for wet climates. If



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not maintained properly, it can attract pests.

**Hydroponics and aquaponics** are advanced methods of kitchen gardening. Hydroponics is a soilless gardening method where plants grow in nutrient-rich water, allowing precise control over nutrients and water supply. Aquaponics combines hydroponics with fish farming, where fish waste provides nutrients for plants, and plants filter the water for the fish, creating a self-sustaining ecosystem. The advantages of these methods include faster growth and higher yields, as plants grow up to 30–50% faster due to direct nutrient absorption. They use 90% less water than traditional soil gardening and can be done indoors, vertically, or in compact areas. Without soil, there are fewer soil-borne diseases and pests, and plants can grow in any season with proper climate control. Additionally, fish provide natural nutrients, reducing the need for synthetic fertilizers. The drawbacks include a higher initial cost due to investment in tanks, pumps, grow lights, and nutrient solutions, the need for knowledge of pH levels, nutrients, and system maintenance, and the unsuitability of root vegetables and large plants for these systems.

The best type of kitchen gardening depends on various factors, including the available space, climate, budget, effort level, and knowledge of local conditions. For those living in apartments or homes with limited space, container gardening or vertical gardening is the most suitable option. These methods utilize pots, hanging planters, and wall-mounted structures to maximize small spaces such as balconies, patios, or even indoor areas. They allow for easy mobility and better pest control while maintaining an aesthetically pleasing environment. If there is no outdoor space at all, windowsills and indoor gardening, as well as hydroponics, are excellent choices. These methods enable year-round gardening within homes, making it possible to grow herbs, vegetables, and even certain fruits under controlled conditions.

For those on a tight budget looking for a natural, cost-effective gardening approach, traditional in-ground gardening is the best option. This method requires minimal investment in materials and allows for a wider variety of plants, making it ideal for those with access to healthy soil. In areas where water conservation is a priority, keyhole gardening and aquaponics provide sustainable solutions by efficiently utilizing water and nutrients. Those seeking high-yield and fast-growing plants can opt for hydroponics or raised bed gardening, both of which offer better control over soil and nutrients to enhance plant growth.

Beginners who want an easy and manageable gardening experience should start with container gardening or raised beds, as they require less maintenance while offering better control over soil and plant health. In regions with poor soil quality, raised bed gardening or keyhole gardening is the most practical choice since they provide improved drainage and soil quality management. Ultimately, the best type of kitchen gardening is one that aligns with the grower's resources, environmental conditions, and level of expertise.

### **Which vegetables and fruits are best for a kitchen garden?**

Selecting the right vegetables and fruits for a kitchen garden depends on the season, local climate, and available space. In the summer months, from March to September, heat-tolerant vegetables thrive in warm conditions. Tomatoes, chilies, and bell peppers are excellent choices as they grow well in containers, raised beds, or traditional in-ground gardens. Cucumbers are ideal for vertical gardening, making efficient use of space while providing a continuous harvest. Bhindi (okra) and baingan (eggplant) are widely grown due to their resilience to high temperatures and minimal care requirements. Karela (bitter gourd) and lauki (bottle gourd) are vining plants that perform well in trellised setups, making them suitable for urban kitchen gardens. Leafy greens

such as palak (spinach), basil, and mint are quick-growing options that can be harvested multiple times throughout the season. Lemons are a hardy summer fruit that grows well in pots or in open spaces.

During the cooler months, from October to February, a different set of vegetables and fruits are best suited for kitchen gardening. Root vegetables like carrots, mooli (radish), garlic, and onions thrive in well-drained soil and require minimal maintenance. Leafy greens such as lettuce, coriander, and methi (fenugreek) provide fresh, homegrown options for daily use. Cruciferous vegetables like cauliflower and broccoli are perfect for winter gardens as they require cooler temperatures to develop properly. Peas, another cool-season crop, are easy to grow and provide a nutritious addition to home meals. For fruits, strawberries and oranges are ideal for winter, offering fresh, vitamin-rich produce.

### **Conclusion**

Kitchen gardening is a practical and sustainable solution for individuals and households seeking fresh, organic produce while reducing dependency on market-bought food. In Pakistan, where food security concerns, inflation, and environmental challenges persist, adopting kitchen gardening can offer both economic and health benefits. Whether through traditional in-ground gardening, container gardening, vertical setups, raised beds, or advanced hydroponic and aquaponic systems, there are methods suited to every space, climate, and budget.

Each type of kitchen gardening comes with unique advantages and challenges, making it important for gardeners to choose methods that align with their available space, resources, and level of expertise. From water-efficient keyhole gardens to space-saving vertical gardening, and from high-yield hydroponics to budget-friendly in-ground planting, kitchen gardening provides a customizable approach to food production.

Beyond its economic and nutritional benefits, kitchen gardening promotes

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environmental sustainability by reducing food waste, minimizing pesticide use, and encouraging resource conservation. As more individuals adopt these practices, communities can become more self-sufficient and resilient against food supply disruptions. With proper planning, even small urban households

can cultivate thriving gardens, turning limited spaces into productive green areas. By embracing kitchen gardening, we take a step towards a healthier, greener, and more food-secure future.

*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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**POLICY BRIEFS**

## Rural Youth Migration in Pakistan: Challenges & Opportunities

Explore the challenges posed by rural youth migration in Pakistan and its impact on the agricultural sector. Learn how this trend threatens socio-economic stability and food security while presenting opportunities for transformative change in rural communities.

Fatima Noor

2/5/2025

Rural youth migration, often referred to as urban migration, is the movement of young people from rural areas to cities or abroad in search of better economic, educational, and social opportunities. This phenomenon has significant implications for the social and economic fabric of rural areas, particularly in countries like Pakistan, where agriculture remains a cornerstone of the economy. In Pakistan, rural youth migration is driven by a combination of factors, including unemployment, lack of educational opportunities, poverty, and environmental challenges. This article explores the causes and consequences of rural youth migration in Pakistan, its impact on agriculture, and the strategies needed to create a sustainable future for rural areas and the agricultural sector.

Pakistan is a predominantly rural country, with approximately 63% of its population living in rural areas, according to the Pakistan Bureau of Statistics (PBS). Agriculture is the primary livelihood for 38.5% of the labor force, contributing 22.7% to the national GDP. However, rural areas face significant challenges, including poverty, lack of infrastructure, and limited access to education and healthcare. These factors have led to a growing trend of rural youth migration to urban centers and abroad.

According to the International Organization for Migration (IOM), Pakistan is one of the top 10 countries of origin for international migrants, with an estimated 11 million Pakistanis living abroad. Additionally, internal migration from rural to urban areas is on the rise, with cities like Karachi, Lahore, and Islamabad experiencing rapid population growth. The United Nations Development Programme (UNDP) estimates that 40%

of Pakistan's urban population growth is due to rural-urban migration, with young people constituting a significant proportion of these migrants.

### Why Do Young People Leave Rural Areas?

Young people in rural Pakistan are increasingly choosing to leave their hometowns in search of better opportunities, a trend fueled by a complex interplay of economic, educational, environmental, and social factors. One of the primary reasons is the lack of economic opportunities. According to the Pakistan Economic Survey 2022-23, the youth unemployment rate stands at 11.1%, with rural areas suffering disproportionately due to limited job prospects and underemployment. Many young individuals find it nearly impossible to secure stable, well-paying jobs in their villages, prompting them to move to cities or even abroad in pursuit of financial stability.

In addition, access to quality education is significantly limited in rural regions. UNESCO reports that the literacy rate in rural Pakistan is only 49%, compared to 74% in urban centers, highlighting a stark disparity. Many rural areas lack well-equipped schools, colleges, or vocational training centers, leaving young people with few options to enhance their skills and knowledge. This educational gap pushes them toward urban centers where better learning facilities and diverse academic opportunities exist.

Poverty and food insecurity further compound the migration issue. The World Bank estimates that around 31.3% of the rural population lives below the poverty line, struggling to afford even basic necessities such as food, healthcare, and

education. Faced with persistent economic hardships, many rural families see migration as their only path to a more secure future. Environmental challenges also play a crucial role; Pakistan is among the most vulnerable countries to climate change. Erratic rainfall, frequent droughts, and devastating floods have severely disrupted agricultural productivity in rural areas. The Global Climate Risk Index 2021 ranks Pakistan as the 8th most vulnerable country to climate change, leaving many young people with dwindling prospects in agriculture.

Moreover, insecurity and social instability in regions like Balochistan and Khyber Pakhtunkhwa further drive youth migration. Ongoing conflicts, terrorism, and the aftermath of natural disasters create an atmosphere of uncertainty and danger, compelling young people to leave in search of safer environments. In urban areas, there are not only more job opportunities and better educational facilities but also a promise of stability and a higher quality of life, making them an attractive destination for rural youth. This confluence of factors ultimately pushes young people away from their rural roots, contributing to a growing rural-urban divide in Pakistan.

### Common Destinations for Rural Youth Migration

Rural youth in Pakistan are increasingly migrating both domestically and internationally in search of better opportunities. Within the country, major urban centers such as Karachi, Lahore, and Islamabad have become magnets for young migrants drawn by the promise of economic opportunities, improved infrastructure, and access to education and healthcare. These cities offer a stark

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contrast to rural areas, where job opportunities are limited and basic services are often lacking. The urban environment, with its diverse industries and vibrant economic activity, provides the allure of higher wages and a better standard of living, attracting many from the countryside.

Internationally, Pakistani migrants have long sought employment abroad, with popular destinations including the United Arab Emirates, Saudi Arabia, and the United States. According to the Bureau of Emigration and Overseas Employment, over 11 million Pakistanis are currently working abroad, many of whom are engaged in low-skilled jobs in the Gulf region. These international opportunities, despite often involving challenging work conditions, offer higher earnings compared to what is available in rural areas, making migration an attractive prospect for those struggling with poverty and limited prospects at home.

This migration pattern, both domestic and international, highlights the significant disparities in economic opportunities between rural and urban areas in Pakistan. It also underscores the urgent need for policies that address rural underdevelopment and create sustainable local opportunities. Improving the economic landscape in rural regions could help mitigate the outflow of young talent and contribute to a more balanced national development.

### **Impact of Rural Youth Migration on Agriculture**

The migration of young people from rural areas in Pakistan has a profound impact on the agricultural sector. Agriculture is the backbone of the rural economy, yet the exodus of youth has led to severe labor shortages. With fewer young, able-bodied workers available, older family members are forced to shoulder the demanding tasks of farming. This not only reduces day-to-day productivity but also hampers the overall efficiency and long-term growth of the sector. In rural regions, where agriculture contributes nearly 19.5% to Pakistan's GDP and employs over 38% of the labor force, the shortage

of skilled labor is increasingly detrimental.

The departure of youth also stifles innovation within agriculture. Younger generations tend to be more open to adopting modern technologies and innovative farming practices, such as precision agriculture, digital monitoring systems, and sustainable practices. Their absence slows the adoption of these techniques, leaving traditional methods in place that are less efficient and less competitive on a global scale. This lack of innovation further exacerbates food security challenges in a country where, according to the World Food Programme, 37% of the population is food insecure.

Furthermore, rural youth migration contributes to an aging population in agricultural communities. With younger individuals leaving, the demographic shift results in an older workforce that may struggle to adapt to the physical demands and technological advancements of modern agriculture. This aging rural population undermines the sustainability of farming practices and the long-term viability of rural communities. As a result, the combined effects of labor shortages, reduced innovation, and an aging workforce pose significant challenges to agricultural productivity, potentially leading to increased reliance on food imports and exacerbating economic instability in Pakistan.

### **Strategies to Address Rural Youth Migration**

Rural youth migration in Pakistan poses significant challenges to sustainable development and agricultural productivity, but a comprehensive, multi-faceted approach can reverse this trend. One effective strategy is investing in rural infrastructure to improve connectivity and access to essential services. For instance, only 30% of rural roads in Pakistan are paved, as reported by the Asian Development Bank, which severely limits market access and daily mobility. Upgrading roads, schools, healthcare facilities, and digital connectivity will not only enhance economic opportunities but also improve the overall quality of life,

making rural areas more attractive to young people. Additionally, promoting sustainable agriculture is essential. Encouraging practices such as precision agriculture, organic farming, and agroecology can boost crop yields, conserve natural resources, and increase resilience to climate change. The government can support this transformation by offering training programs, subsidies, and access to modern technologies, ensuring that farmers are well-equipped to adopt these practices.

Empowering rural youth through education, vocational training, and skill development programs is another vital step. Programs similar to the Prime Minister's Youth Programme, which offers skills training and entrepreneurship opportunities, can be expanded to include agricultural innovation and agribusiness. Creating non-farm employment opportunities is also crucial; diversifying the rural economy by developing sectors such as tourism, renewable energy, and value-added agricultural products can provide alternative livelihoods. For example, initiatives like the Punjab government's "Agri-Tourism" project demonstrate how rural tourism can generate jobs and boost local economies. Strengthening social safety nets through programs like the Benazir Income Support Programme (BISP) can provide financial stability for vulnerable populations, helping families withstand economic shocks. Lastly, fostering public-private partnerships can attract investments in rural infrastructure and technology, driving overall development. By coordinating efforts between government agencies and the private sector, Pakistan can build a robust framework that not only curbs youth migration but also revitalizes rural areas, ensuring long-term sustainable growth and improved food security.

### **Conclusion**

In conclusion, the migration of rural youth in Pakistan presents both a formidable challenge and an opportunity for transformative change in the agricultural

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sector and broader rural communities. The exodus of young, capable individuals—driven by limited economic opportunities, inadequate education, pervasive poverty, environmental hardships, and regional instability—has not only created a labor shortage in agriculture but has also stifled innovation and accelerated an aging demographic in rural areas. With agriculture contributing around 22.7% to the national GDP and employing over 38% of the workforce, these trends jeopardize food security and the long-term sustainability of a sector that is vital to the nation's socio-economic stability.

The loss of rural talent hampers the adoption of modern, efficient farming techniques, leaving many producers reliant on outdated practices that struggle to compete in both domestic and

international markets. Meanwhile, urban centers and international destinations continue to attract an increasing share of young talent, further widening the rural-urban divide. However, the challenges identified also illuminate a clear path forward. Strategic investments in rural infrastructure—such as improved road networks, digital connectivity, and educational facilities—coupled with initiatives to promote sustainable agriculture, can revitalize rural economies. Empowering youth through targeted skill development, vocational training, and entrepreneurship programs is essential to transforming agriculture into a dynamic, resilient industry.

Furthermore, diversifying income sources by creating non-farm employment opportunities and strengthening social safety nets can provide the stability

needed to retain young people in rural areas. Public-private partnerships, along with supportive government policies, must drive these efforts to ensure that rural areas become hubs of innovation and sustainable growth. By adopting these comprehensive strategies, Pakistan can not only curb the detrimental effects of rural youth migration but also unlock the full potential of its agricultural sector, ensuring a prosperous and balanced future for all.

*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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## Future of Türkiye's Agricultural Sector: Strategies

Explore how Türkiye's agricultural sector can thrive by addressing challenges like climate change and financial instability through sustainable strategies, policy reforms, and technological advancements and improved risk management tools.

Mithat Direk

2/14/2025

The agricultural sector, often likened to an "open-top factory," is inherently susceptible to various risks, particularly those stemming from unpredictable environmental factors. Over the past century, climate change has intensified these risks, leading to more frequent droughts, erratic rainfall, rising temperatures, and extreme weather events. These challenges pose significant threats to agricultural productivity, food security, and rural livelihoods. In Türkiye, where agriculture contributes 6.5% to the GDP and employs 18.4% of the workforce, such climatic uncertainties have a profound impact on farmers, many of whom rely on traditional farming methods and lack financial buffers against crop losses.

Despite the increasing prevalence of agricultural insurance as a tool for risk mitigation, coverage remains inadequate. Many smallholder farmers either lack awareness or find premiums unaffordable, leaving them highly vulnerable to unexpected climate shocks. Türkiye's Agricultural Insurance Pool (TARSİM) has expanded coverage in recent years, yet the adoption rate among farmers remains below optimal levels. This gap highlights the urgent need for comprehensive risk management strategies, including enhanced insurance accessibility, climate-smart agricultural practices, and stronger government intervention.

Policymakers must prioritize incentives for drought-resistant crops, precision irrigation, and soil conservation techniques to enhance agricultural resilience. Additionally, financial subsidies, technological investments, and farmer education programs can help mitigate risks and ensure long-term

sustainability. Without proactive measures, Türkiye's agricultural sector will continue to face increasing threats, endangering both national food security and economic stability. Strengthening agricultural resilience is not only necessary for protecting farmers but also vital for sustaining the country's overall economic growth.

### Climate Change and Its Impact on Turkish Agriculture

Climate change is increasingly threatening Türkiye's agricultural sector, disrupting long-standing farming practices and creating significant economic and environmental challenges. Rising temperatures, shifting precipitation patterns, and extreme weather events have already had profound impacts on crop yields, water availability, and soil fertility. According to the Turkish Statistical Institute (TÜİK), agricultural production declined by 7.6% in 2021, largely due to erratic weather conditions and droughts. This decline underscores the growing vulnerability of Türkiye's agriculture to climate change.

The Mediterranean and Aegean regions, which are crucial for fruit, vegetable, and olive production, have been severely affected by prolonged droughts and increasing temperatures. Farmers in these regions report declining water resources and deteriorating soil conditions, leading to lower crop productivity. Conversely, the Black Sea region, traditionally known for its tea, hazelnut, and corn production, has faced excessive rainfall and frequent flooding, damaging crops and making farming conditions unpredictable. Such climate extremes have forced many farmers to

alter their planting schedules and adopt costly adaptation measures.

A study by the Turkish Ministry of Environment and Urbanization forecasts a 2-3°C temperature increase by the end of the century, which could worsen water scarcity and accelerate soil degradation. The shift in seasonal patterns has already become evident, with planting and harvesting times altered by up to two weeks. For instance, unseasonably warm winters cause fruit trees to bloom prematurely, only to be damaged by unexpected late frosts, leading to significant economic losses for farmers.

If climate adaptation strategies are not implemented urgently, the long-term sustainability of Türkiye's agricultural sector will be at risk. Policies promoting water conservation, drought-resistant crops, and improved irrigation techniques will be critical in mitigating the negative effects of climate change and ensuring food security and economic stability for the country's rural communities.

### The Role of Agricultural Insurance

Agricultural insurance plays a vital role in protecting farmers from financial losses due to unpredictable weather conditions, pests, and other risks. However, its adoption in Türkiye remains limited, leaving a significant portion of the agricultural sector vulnerable. As of 2022, only 20% of farmers were covered by agricultural insurance, meaning the vast majority still rely on traditional coping mechanisms such as selling assets, taking loans, or reducing input costs, which can further weaken their financial stability. Without proper insurance, farmers face severe income fluctuations that can threaten

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their long-term sustainability and food security.

To mitigate these risks, the Turkish government has introduced initiatives like the Agricultural Insurance Pool (TARSIM), which offers coverage for crops, livestock, and greenhouses. TARSIM has been instrumental in providing farmers with financial protection against climate-related disasters such as droughts, floods, and hailstorms. However, despite these efforts, several barriers hinder the widespread adoption of agricultural insurance. High premium costs, limited awareness, and bureaucratic complexities prevent smallholder farmers—who form the backbone of Türkiye’s agricultural sector—from fully utilizing these financial safety nets.

To enhance the effectiveness of agricultural insurance, the government could consider expanding subsidies to lower premium costs, making insurance more accessible to small-scale farmers. Additionally, awareness campaigns aimed at educating farmers on the benefits of insurance and integrating insurance with access to credit and technical assistance could further encourage participation. Strengthening these measures would help create a more resilient agricultural sector, ensuring that farmers are better prepared for future climate uncertainties.

### Defining Farming as a Profession

A key challenge in Turkish agriculture is the prevailing perception of farming as a supplementary activity rather than a full-fledged profession. Many farmers rely on additional income sources because agricultural earnings alone are often insufficient to sustain their livelihoods. According to the Turkish Statistical Institute (TÜİK), the average monthly income of a farming household is approximately \$500, which is significantly lower than the national average. This economic vulnerability discourages young people from entering the sector, contributing to an aging farming population, with 60% of farmers aged 50 or older. The lack of financial

security and career prospects in agriculture has led to rural-to-urban migration, further shrinking the farming workforce and endangering long-term food security.

To establish farming as a sustainable profession, improving financial literacy and record-keeping practices among farmers is crucial. Implementing an accounting system that tracks income, expenses, and profitability would help farmers analyze their financial performance, identify inefficiencies, and make data-driven decisions. Such measures could improve productivity and ensure that farming remains economically viable.

Additionally, introducing professional certification programs could enhance the sector's credibility and encourage farmers to adopt modern agricultural techniques. These certifications could be linked to access to markets, subsidies, and agricultural credit, creating incentives for farmers to comply with quality and sustainability standards. By recognizing farming as a profession that requires skill, knowledge, and business acumen, Türkiye can revitalize its agricultural sector, attract younger generations, and promote long-term rural development.

### Policy Reforms for Long-Term Resilience

The Turkish Ministry of Agriculture and Forestry plays a crucial role in shaping agricultural policies, but frequent policy shifts, bureaucratic inefficiencies, and short-term planning hinder long-term resilience in the sector. One of the most pressing issues is the lack of stability in subsidy programs and price supports, which creates uncertainty for farmers and discourages investments in modern technology, infrastructure, and sustainable practices. Addressing these challenges requires practical, long-term solutions that enhance resilience and productivity.

One key area of reform is sustainable water management. Türkiye is classified as a water-stressed country, with per

capita water availability below 1,500 cubic meters annually. Despite this, only 25% of irrigable land utilizes modern irrigation techniques such as drip and sprinkler irrigation, leading to inefficient water use. Expanding subsidies for water-saving technologies, offering training on efficient irrigation methods, and enforcing stricter water conservation policies could significantly improve agricultural water efficiency.

Another vital reform is crop diversification and value addition. Farmers who rely on traditional staple crops often face price volatility and climate-related risks. Encouraging high-value crops, such as organic produce, medicinal plants, and drought-resistant varieties, could increase profitability and reduce dependence on weather-sensitive crops. Furthermore, investing in agro-processing industries—such as food packaging, dehydration, and cold storage facilities—would allow farmers to process raw agricultural products, reducing post-harvest losses and increasing market value.

Adopting climate-resilient practices is also essential. The government could expand research and development initiatives to introduce drought-resistant crops, soil conservation methods, and regenerative farming techniques. Additionally, implementing early warning systems for extreme weather events, combined with accessible insurance programs, would help farmers prepare for and mitigate climate-related risks.

Lastly, strengthening farmer cooperatives is critical. Despite their potential, only 10% of Turkish farmers are members of cooperatives. Expanding cooperative networks and offering financial and technical support would enable farmers to access bulk purchasing, shared resources, and collective bargaining power, ensuring better market access and economic stability. By implementing these reforms, Türkiye can create a resilient, sustainable, and competitive agricultural sector.

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### The Need for a Holistic Approach

Effective risk management in agriculture necessitates a comprehensive, multi-faceted approach that goes beyond isolated interventions. A holistic strategy should integrate insurance solutions, policy reforms, and technological advancements to enhance resilience and sustainability. One key component is leveraging digital tools such as precision agriculture, satellite imaging, and artificial intelligence. These technologies enable farmers to monitor crop health, optimize irrigation, reduce input waste, and predict yields, allowing for proactive decision-making that minimizes financial losses.

Beyond technology, public-private partnerships (PPPs) can play a crucial role in addressing infrastructure deficiencies that hinder agricultural efficiency. Investments in rural roads, cold storage, and efficient logistics systems would reduce post-harvest losses and ensure that farmers can access broader markets. Encouraging private sector involvement in rural development projects would mobilize financial and technical resources that the government alone may struggle to provide.

Additionally, collaborations between the Ministry of Agriculture and Forestry, academic institutions, NGOs, and

international organizations could facilitate the development of data-driven policies based on real-world evidence. Sharing best practices, research insights, and innovative solutions would help farmers and policymakers alike adopt sustainable, climate-resilient strategies. By fostering a cooperative ecosystem, Türkiye can strengthen its agricultural sector, ensuring its long-term viability in the face of climate and economic uncertainties.

### Conclusion

The future of Türkiye's agricultural sector depends on its ability to address risks through comprehensive and sustainable strategies. Climate change, financial instability, and outdated farming practices present significant challenges, but with targeted policy reforms, technological advancements, and improved risk management tools, the sector can become more resilient. Expanding agricultural insurance coverage, promoting climate-smart farming techniques, and strengthening farmer cooperatives will play a crucial role in ensuring long-term stability.

Additionally, recognizing farming as a profession by improving financial literacy, introducing certification programs, and enhancing income opportunities will help revitalize rural

communities and attract younger generations to agriculture. Sustainable water management and crop diversification are also essential to mitigate climate risks and ensure food security.

Public-private partnerships, government support, and collaboration with research institutions can drive innovation and infrastructure development, providing farmers with the necessary resources to thrive. By embracing a holistic approach that integrates policy consistency, technological innovation, and financial accessibility, Türkiye can transform its agricultural sector into a more efficient, climate-resilient, and economically viable industry. Without decisive action, the challenges facing Turkish agriculture will continue to grow, threatening not only rural livelihoods but also national food security and economic stability. Investing in resilience today will secure a more sustainable and prosperous future for the country's farmers and consumers alike.

*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 in Türkiye's Agriculture: Challenges & Solutions

Modernization in Türkiye's Agriculture plays a vital role in addressing challenges like climate change, resource depletion, and labor shortages. Discover how modernization, sustainable agricultural practices, and technological advancements can create a resilient future for this essential sector.

Mithat Direk

2/21/2025

Agriculture has been a fundamental aspect of human civilization, enabling the shift from nomadic hunter-gatherer lifestyles to settled communities and the development of complex societies. Early agricultural practices, rooted in the Neolithic period, allowed humans to cultivate staple crops such as wheat, barley, and rice while domesticating animals like cattle, sheep, and goats. This transition provided increased food security, supported population growth, and laid the foundation for trade, governance, and cultural development. Agricultural surpluses allowed communities to expand, leading to the establishment of villages, towns, and eventually, large civilizations.

Over centuries, farming techniques evolved, moving from rudimentary tools and manual labor to more sophisticated methods involving irrigation systems, crop rotation, and selective breeding. Ancient civilizations, such as the Mesopotamians, Egyptians, and Romans, developed extensive irrigation networks and innovative plowing methods, which significantly boosted yields and supported growing populations. The medieval period saw the widespread adoption of the three-field system, which improved soil fertility and enhanced productivity. The introduction of new crops through trade routes, such as maize and potatoes from the Americas, further diversified global agriculture.

With the Industrial Revolution, agriculture underwent a paradigm shift. Mechanization, chemical fertilizers, and improved irrigation techniques dramatically enhanced productivity, reducing reliance on human and animal labor. The invention of the tractor, combined with advancements in pest

control and synthetic fertilizers, revolutionized farming and increased output. However, as industrial and service sectors expanded, agriculture's role in the global economy was redefined, often being perceived primarily as a food production activity rather than a driver of economic growth. Despite this perception, agriculture remains a cornerstone of national economies, particularly in countries like Türkiye, where it continues to provide employment and contribute significantly to GDP. In Türkiye, agriculture plays a crucial role in rural livelihoods, providing income and sustenance to millions. The sector's resilience and adaptability will be essential in addressing future challenges such as climate change, resource depletion, and food security.

### The Impact of Industrialization on Agriculture

Before the Industrial Revolution, agriculture dominated the global economy, employing the majority of the population. Traditional farming methods, reliant on human and animal labor, limited productivity and kept economies largely agrarian. The introduction of mechanization and industrial processes in the 19th and 20th centuries revolutionized agriculture, allowing for mass production of food and a significant reduction in labor dependency.

One of the most transformative innovations in agricultural history was the development of artificial fertilizers. The Haber-Bosch process, pioneered by Fritz Haber and Carl Bosch, enabled large-scale ammonia production, a key component of chemical fertilizers. This breakthrough increased crop yields and

alleviated food shortages. Before this, natural fertilizers such as Chilean Guano were widely used, but their limited availability hindered agricultural expansion. The introduction of synthetic fertilizers like ammonium nitrate and ammonium phosphate significantly improved soil fertility, ensuring higher productivity.

Despite these advancements, industrialization also brought challenges. The shift from agriculture to manufacturing and urban-based industries led to significant rural-to-urban migration, particularly in developing countries. In Türkiye, this transition accelerated after 1950, creating a divide between rural and urban populations. While urbanization spurred economic growth, it also led to challenges such as rising unemployment in rural areas, inadequate housing in cities, and growing socioeconomic disparities.

### Türkiye's Agricultural Landscape: Present and Future

Today, agriculture remains a vital component of Türkiye's economy. The sector contributes approximately 6.5% to the country's GDP and employs around 18% of the workforce as of 2023. Despite its economic significance, Türkiye faces several challenges, including declining agricultural labor due to continued migration to urban centers. Many rural populations are shifting towards urban employment opportunities, leading to concerns about labor shortages in traditional farming practices.

Türkiye is a leading global producer of key agricultural products. It ranks among the top 10 wheat producers, with an annual output exceeding 20 million tons.

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Additionally, it is a dominant producer of hazelnuts, cherries, figs, and apricots, exporting these goods to international markets. The country's agricultural exports play a crucial role in global supply chains, particularly in Europe and the Middle East. However, the agricultural sector is increasingly threatened by climate change, water scarcity, and soil degradation, necessitating sustainable solutions.

The effects of climate change, including rising temperatures and unpredictable weather patterns, have disrupted Türkiye's agricultural productivity. Water scarcity is a growing concern, as many regions experience declining groundwater levels and inconsistent rainfall. Soil degradation due to overuse of chemical fertilizers and intensive farming practices further exacerbates the issue. To address these challenges, Türkiye has been investing in modern irrigation techniques, precision farming, and eco-friendly agricultural policies. Encouraging organic farming, implementing crop diversification, and adopting water conservation methods are crucial steps towards ensuring the long-term sustainability of the agricultural sector.

In response to environmental concerns and shifting consumer preferences, organic farming has gained momentum in Türkiye. The country now has over 1.5 million hectares of certified organic farmland, positioning it as a significant player in the global organic market. While organic agriculture is more expensive and often inaccessible to lower-income consumers, government initiatives and subsidies are helping to expand its reach. The European Union's Common Agricultural Policy (CAP) has also contributed to the growth of environmentally friendly agricultural practices in Türkiye, promoting sustainability.

### **Challenges in Türkiye's Agricultural Sector**

Türkiye's agricultural sector faces numerous challenges that threaten its long-term sustainability and

productivity. One of the most pressing concerns is climate change, which has led to rising temperatures, irregular rainfall patterns, and an increase in extreme weather events. These disruptions have negatively impacted traditional farming cycles, reducing crop yields and threatening food security. Additionally, water scarcity has become a growing issue, with annual per capita water availability dropping below 1,500 cubic meters. To combat these challenges, sustainable irrigation techniques such as drip irrigation, rainwater harvesting, and advanced water management strategies must be implemented to optimize water use and preserve this vital resource.

Soil degradation is another critical issue affecting agricultural productivity. The excessive use of chemical fertilizers, pesticides, and mechanized farming practices has led to soil depletion, reducing its long-term fertility. Monoculture farming has further exacerbated the problem by depleting essential nutrients and increasing vulnerability to pests and diseases. In response, sustainable farming methods such as crop rotation, agroforestry, and organic farming are gaining traction as viable alternatives to improve soil health and maintain agricultural productivity. Transitioning to environmentally friendly practices is essential for ensuring the sector's sustainability while reducing negative ecological impacts.

Rural-to-urban migration has also contributed to the challenges facing the agricultural sector. The movement of young workers from rural areas to urban centers has led to a severe labor shortage in farming communities. This shift has increased reliance on mechanization and seasonal foreign labor to compensate for the declining workforce. However, these solutions are not always sufficient to meet the demands of the industry. Policies that support rural revitalization through financial incentives, technological investments, and improved living standards could help retain young workers in agriculture. Encouraging entrepreneurship in

agribusiness and providing access to training programs on modern farming techniques can also attract a new generation of farmers, ensuring the continued growth and resilience of the agricultural sector.

Addressing these challenges requires a multi-faceted approach that integrates technological advancements, sustainable practices, and targeted policy interventions. By adopting long-term solutions, Türkiye can strengthen its agricultural sector, improve food security, and enhance rural livelihoods while mitigating the adverse effects of climate change and environmental degradation.

### **Global Agricultural Markets and Türkiye's Position**

Türkiye plays a significant role in global agricultural trade, exporting a diverse range of products to Europe, the Middle East, and Asia. The country is one of the world's largest suppliers of hazelnuts, cherries, figs, and apricots, with its agricultural exports contributing substantially to its economy. Turkish agricultural products are highly sought after due to their quality and competitive pricing, and the country's geographical position allows for efficient trade with neighboring regions. The European Union remains one of Türkiye's primary agricultural trade partners, benefiting from established trade agreements that facilitate the flow of goods. Additionally, Türkiye's agribusiness sector has been expanding, focusing on processed agricultural products, such as dried fruits, olive oil, and dairy products, further enhancing its global presence.

Despite its strong export performance, Türkiye remains heavily dependent on imports for several essential agricultural commodities, particularly wheat, sunflower oil, and feed grains. This reliance makes the country vulnerable to global market fluctuations, supply chain disruptions, and geopolitical conflicts. The COVID-19 pandemic exposed vulnerabilities in global food systems, leading to logistical challenges and supply shortages. Similarly, the Russia-

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Ukraine war severely impacted global grain trade, as both countries are major wheat exporters. In 2022, disruptions in supply chains led to record-high global grain prices, directly affecting Türkiye, which imports a significant portion of its wheat from these regions. Consequently, food inflation soared, reaching 85% in 2022, straining household budgets and increasing concerns over food security.

### The Future of Türkiye's Agriculture: Policies and Innovations

The future of Türkiye's agriculture depends on strategic policies and innovations that address key challenges while ensuring long-term sustainability and food security. Modernizing the sector through technological advancements is a crucial step in this transformation. Precision farming, which incorporates AI-driven monitoring systems, satellite-based irrigation planning, and automated machinery, can optimize resource efficiency and significantly boost productivity. Expanding digital platforms that provide farmers with real-time data on weather patterns, soil health, and market trends will enhance decision-making, reducing losses and improving overall agricultural output. Additionally, investing in biotechnology and drought-resistant crop varieties will help Türkiye adapt to climate change and maintain stable production levels.

Strengthening rural development programs is equally important to

counteract rural-to-urban migration, which has led to labor shortages in the agricultural sector. Policies that offer financial incentives, low-interest agricultural loans, and subsidies for sustainable farming practices can encourage young entrepreneurs to pursue careers in agriculture. Furthermore, improving rural infrastructure—including road networks, cold storage facilities, and modern irrigation systems—will enhance market accessibility and reduce post-harvest losses. By fostering innovation and entrepreneurship in rural areas, Türkiye can make agriculture a more attractive and viable profession for the next generation.

Ensuring food security requires a balanced approach that integrates increased productivity with sustainable agricultural practices. Government policies should prioritize climate-resilient farming techniques, promote agroecology, and encourage farmers to adopt regenerative agriculture. Reducing food waste and improving supply chain efficiency through public-private partnerships will further strengthen Türkiye's food security. Additionally, collaborations with international organizations and research institutions can accelerate the adoption of sustainable practices and innovative solutions. By integrating technology, rural development initiatives, and sustainable farming methods, Türkiye can secure a resilient agricultural future

that meets both domestic and global demands while preserving natural resources for future generations.

### Conclusion

Agriculture remains a vital sector for Türkiye, deeply rooted in its history and economic structure. While modernization and industrialization have transformed agricultural practices, challenges such as climate change, resource depletion, and labor shortages persist. Addressing these challenges requires a multifaceted approach that embraces technological advancements, sustainable practices, and inclusive policies.

By investing in agricultural innovation, promoting rural development, and enhancing food security, Türkiye can strengthen its agricultural resilience and continue to be a major player in global markets. The balance between productivity and sustainability will be key to ensuring long-term food security and economic stability, not just for Türkiye but for the global agricultural landscape. The future of agriculture lies in its ability to adapt, innovate, and sustain itself in an ever-changing world.

*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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## Land Governance in Pakistan: Key Challenges

Explore the critical issues surrounding land governance in Pakistan, including economic stability, social justice, and environmental sustainability. Addressing feudal structures, land fragmentation, and gender disparities is essential for equitable development and poverty alleviation.

Madeeha

2/25/2025

Land is one of Pakistan's most vital resources, serving as the foundation of its agrarian economy and a key determinant of social and economic power. However, the country's land governance system is plagued by inefficiencies, inequalities, and corruption, undermining both agricultural productivity and rural livelihoods. Despite employing 37.4% of the labor force, agriculture contributes only 22.7% to the national GDP, highlighting deep-rooted structural challenges.

A major issue is the extreme concentration of land ownership. Just 5% of landowners control over 64% of arable land, while millions of rural households either remain landless or own plots too small for meaningful agricultural production. This disparity fuels rural poverty, limits economic mobility, and perpetuates feudal structures that hinder equitable development. At the same time, tenancy arrangements often leave small farmers vulnerable to exploitation, with little security or access to credit for investment in their land.

Adding to these challenges, rapid urbanization is encroaching on fertile agricultural land, leading to the expansion of informal settlements and haphazard real estate development. Meanwhile, climate change exacerbates land degradation, water scarcity, and desertification, further threatening agricultural sustainability. Weak land administration systems, outdated land records, and lack of transparency in property transactions make matters worse, enabling corruption and land grabbing.

Addressing these issues requires a comprehensive reform agenda, including land redistribution policies, digitalization of land records, stronger legal protections for tenant farmers, and climate-resilient land management strategies. Ensuring equitable access to land is not just a matter of economic efficiency but also of social justice. By adopting inclusive and sustainable land governance practices, Pakistan can create a more balanced and productive agricultural sector, fostering long-term rural development and economic stability.

### Historical Context: Colonial Legacies and Post-Independence Failures

Pakistan's land governance system is deeply entrenched in its colonial past, shaping the country's rural economy and social structures to this day. Under British rule, the zamindari system granted tax-collection rights to loyal elites, consolidating feudal power while marginalizing peasants. Land revenue laws prioritized taxation over equitable distribution, ensuring that land remained concentrated in the hands of a few. When Pakistan gained independence in 1947, it inherited this exploitative framework, and despite various attempts at reform, the colonial-era land structures have largely persisted, reinforcing inequality and stagnating rural development.

Post-independence, successive governments recognized the need for land reform, but efforts were half-hearted and ultimately failed to bring meaningful change. The land reforms of 1959, 1972, and 1977 sought to impose ceilings on landholdings and redistribute surplus land to landless farmers. However, these reforms were riddled with loopholes that allowed large

landowners to evade restrictions. Many circumvented land ceilings by transferring property to relatives or exploiting legal exemptions, effectively nullifying the intended redistribution. As a result, only about 5% of agricultural land changed hands, leaving the deeply entrenched feudal structure intact.

Political and military elites, many of whom were themselves large landowners, resisted substantive reform. The lack of political will and weak enforcement mechanisms ensured that rural elites continued to dominate, maintaining an economic and social hierarchy that benefited the few at the expense of the many. Tenant farmers remained vulnerable to exploitation, lacking legal protection and access to credit necessary for improving their agricultural productivity. This persistent inequality has contributed to rural poverty, low agricultural output, and limited social mobility, keeping millions of farmers trapped in cycles of economic dependence.

In addition to feudal dominance, modern land governance issues, including outdated land records, lack of transparency, and corruption—continue to exacerbate land-related inequalities. Without addressing these historical and structural challenges, Pakistan's agriculture sector will struggle to achieve sustainable growth and equity. Genuine land reform, backed by strong political commitment, remains essential for breaking the cycle of rural poverty and creating a more just and productive agricultural economy.

### Contemporary Challenges in Land Governance

Feudalism remains deeply entrenched in Pakistan's rural economy, particularly in

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the provinces of Sindh and Punjab. Large landowners, known as waderas, control extensive estates and hold significant political and economic power. This influence allows them to manipulate tenancy laws, often to the detriment of small farmers and sharecroppers. Tenant farmers, or haris, usually receive only 25-50% of their harvest as payment, leaving them in a cycle of economic dependency. Moreover, they lack secure tenure rights, discouraging them from making long-term investments in land improvement, which further diminishes agricultural productivity. This feudal system perpetuates rural inequality, keeping millions of farmers in poverty with little hope of social mobility.

Another significant challenge in land governance is the continuous fragmentation of land holdings. Islamic inheritance laws require land to be divided among heirs, and over generations, this has resulted in increasingly smaller plots of land. Currently, around 65% of Pakistan's farms are under five hectares, making them economically unviable. Small landholdings limit mechanization and efficient agricultural practices, reducing productivity and income for farmers. With shrinking farm sizes, subsistence farming becomes more common, forcing many rural families into debt or pushing them toward urban migration in search of alternative livelihoods.

Urbanization has introduced additional complexities to Pakistan's land governance system. Major cities like Karachi, Lahore, and Islamabad have experienced rapid population growth, increasing the demand for land and housing. In response, land mafias—often supported by political or military elites—have illegally occupied state and private land, selling it to developers or individuals without proper legal oversight. Karachi, the country's largest city, illustrates the scale of this problem, with over 62% of its population living in informal settlements (katchi abadis). These settlements often lack basic services such as clean water, sanitation,

and electricity, exposing residents to poor living conditions and the constant threat of eviction. Weak urban planning and corruption in land administration have allowed these issues to persist, with little accountability for those responsible for illegal land seizures.

Gender inequality is another pressing issue in Pakistan's land governance system. While legal provisions technically grant women inheritance rights, cultural norms and patriarchal traditions often prevent them from claiming or controlling land. A 2023 World Bank report found that only 3% of Pakistan's agricultural land is owned by women. This disparity has far-reaching implications, as land ownership is a crucial factor in economic security. Women who are denied land ownership have limited access to credit and financial resources, making it harder for them to invest in agriculture or other businesses. Additionally, landlessness makes women more vulnerable to economic exploitation and domestic violence. Without addressing gender disparities in land ownership, Pakistan cannot achieve meaningful social or economic progress.

Environmental degradation is another critical challenge affecting land governance. Deforestation, soil erosion, and unsustainable farming practices have severely degraded Pakistan's arable land. According to the Food and Agriculture Organization (FAO), Pakistan loses approximately 27,000 hectares of forest annually, contributing to soil degradation and declining agricultural productivity. Climate change further exacerbates these problems. Pakistan ranks among the most climate-vulnerable countries in the world, regularly experiencing extreme weather events such as floods, droughts, and heatwaves. The devastating 2022 floods submerged 4.4 million acres of land and displaced over 8 million people, underscoring the urgent need for climate-resilient land-use planning. Many of the worst-affected communities were already marginalized, living on insecure land without legal protections

or access to resources. Without significant intervention, environmental and climate-related threats will continue to destabilize Pakistan's land governance system, deepening social and economic inequalities.

### **Institutional and Legal Failures**

Pakistan's land administration system suffers from deep-rooted corruption, inefficiency, and a lack of transparency. Land records are still maintained manually by patwaris (revenue officers), a system inherited from the colonial era. This outdated system is highly vulnerable to manipulation, with land titles often being forged or tampered with. The process of registering land transactions or resolving disputes frequently involves bribery, making it difficult for ordinary citizens—especially the poor—to assert their property rights. This systemic corruption allows influential individuals to illegally acquire land while depriving marginalized communities of their rightful claims.

One of the most damaging consequences of this flawed system is the backlog of land-related legal cases. Currently, over 1.4 million land disputes are pending in Pakistani courts, with some cases unresolved for decades. The slow judicial process, combined with the high cost of litigation, disproportionately affects low-income individuals who lack the resources to fight prolonged legal battles. For many, land disputes result in financial ruin or force them to abandon their claims altogether, reinforcing existing inequalities.

Despite the existence of various laws and policies intended to improve land governance, enforcement remains weak. The 2016 National Land Use Policy, for example, aimed to regulate urban expansion, prevent encroachment on agricultural land, and promote sustainable development. However, due to a lack of political will and institutional capacity, its implementation has been minimal. Similarly, legal protections for tenant farmers and women's inheritance rights are routinely ignored, rendering

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these laws ineffective. Without a stronger commitment to enforcement, land governance in Pakistan will continue to be dominated by powerful elites at the expense of vulnerable populations.

### Pathways to Reform

Addressing land inequality in Pakistan requires bold and comprehensive reforms that focus on redistribution, secure tenancy rights, and improved governance. One of the most pressing issues is the concentration of landownership, which has left millions of rural households landless or struggling with small, unviable plots. To tackle this, progressive land ceilings must be enforced to prevent large-scale land monopolization. Any surplus land should be redistributed to landless farmers, ensuring equitable access to resources. Additionally, tenancy laws need to be strengthened to provide farmers with secure contracts that outline fair profit-sharing arrangements. By guaranteeing tenant rights and incentivizing investment in land improvement, agricultural productivity can be significantly enhanced.

A key reform needed in land governance is the digitization of land records. The current manual system is prone to corruption, manipulation, and inefficiency, leading to countless disputes and legal battles. Punjab's Land Record Management Information System (LRMIS) has proven to be a successful model by providing online access to land records, streamlining transactions, and reducing conflicts. Scaling up this system nationwide, along with investments in technology and capacity-building, would bring much-needed transparency and efficiency to land governance.

Gender inequality in landownership is another challenge that must be addressed through both legal and cultural shifts. While Pakistan's laws grant women inheritance rights, enforcement remains weak due to deep-rooted patriarchal norms. Legal reforms should be coupled with awareness campaigns and mobile courts to ensure that women can claim their rightful share of land. Joint land titling, where both spouses are legally recognized as landowners, can further promote gender equity and economic empowerment.

Sustainable land use is crucial in the face of climate change and environmental degradation. Integrating climate resilience into land-use planning through Geographic Information System (GIS) mapping can help regulate construction in flood-prone areas and prevent disasters. Additionally, promoting agroforestry and sustainable farming practices can restore degraded lands, improve soil fertility, and enhance long-term food security.

Finally, grassroots movements play a crucial role in driving systemic change. Organizations like the Pakistan Kissan Rabita Committee advocate for land rights and challenge elite control over land resources. Strengthening these movements, fostering alliances with civil society, and amplifying the voices of marginalized communities can push for meaningful reforms and greater accountability in land governance.

### Conclusion

Land governance in Pakistan remains a critical issue that shapes the country's economic stability, social justice, and environmental sustainability. The persistence of feudal structures, land fragmentation, urban encroachment, and gender disparities continues to hinder equitable development. Without

addressing these systemic problems, millions of rural and urban households will remain trapped in cycles of poverty and vulnerability. The inefficiencies and corruption within Pakistan's land administration system further exacerbate these challenges, preventing fair access to land and legal protection for marginalized communities.

However, meaningful reforms can pave the way for a more just and productive land governance framework. Implementing land redistribution policies, strengthening tenancy rights, and digitizing land records are essential steps toward reducing inequality and improving agricultural productivity. Ensuring that women have legal and cultural support to claim their inheritance rights can promote economic security and empowerment. Moreover, integrating climate-resilient land-use strategies is crucial for mitigating environmental degradation and preparing for future climate challenges.

Grassroots movements and political mobilization remain vital in driving change. By fostering alliances between civil society, policymakers, and affected communities, Pakistan can push for more inclusive and transparent land governance. Sustainable and equitable land policies will not only enhance agricultural efficiency but also lay the foundation for long-term economic growth and social justice.

*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 Energy in Pakistan: A Sustainable Solution

Discover how the transition to solar energy in Pakistan can address energy shortages, reduce costs, and benefit the environment. Explore the challenges of adoption and the need for financial incentives, supportive policies, and public awareness to harness solar power effectively.

Aqsa Irshad & Muhammad Khalid Bashir

2/25/2025

As the world faces growing challenges related to climate change and energy security, renewable energy sources like solar power have gained significant importance. Many countries are actively transitioning towards cleaner energy solutions to reduce their dependence on fossil fuels and mitigate environmental degradation. In Pakistan, where energy shortages and environmental concerns are pressing issues, solar energy presents a viable and sustainable alternative.

With 60% of the population residing in urban areas and cities such as Faisalabad, Karachi, and Lahore experiencing frequent power outages, there is an urgent need for reliable and affordable energy sources. Pakistan's electricity demand continues to rise, but its reliance on non-renewable energy sources has led to high electricity costs, power shortages, and increased carbon emissions. Solar energy, with its abundant availability and long-term cost benefits, offers a promising solution to address these challenges.

Despite the potential advantages, several factors influence households' willingness to adopt solar energy. Financial constraints, lack of awareness, high initial installation costs, and limited access to financing options are some of the key barriers preventing widespread adoption. Additionally, while many consumers recognize the benefits of solar power, concerns about system reliability, maintenance, and government policies play a crucial role in decision-making.

To accelerate the transition to solar energy, a combination of supportive policies, financial incentives, and awareness campaigns is essential. Governments and financial institutions can facilitate access to low-interest loans and subsidies, making solar systems more

affordable for middle- and lower-income households. Public awareness initiatives can further educate people on the long-term economic and environmental benefits of solar power. By addressing these challenges and creating an enabling environment for solar adoption, Pakistan can move toward a more sustainable, energy-secure future while reducing its carbon footprint.

### Factors Influencing Solar Energy Adoption

Several factors influence households' willingness to adopt solar energy, shaping their decisions on whether to invest in this renewable energy source. Economic status, education, awareness, and energy costs play a crucial role in determining adoption rates. While solar energy presents a promising alternative to traditional electricity sources, financial constraints and a lack of policy support continue to pose challenges for widespread implementation.

Higher-income households are generally more inclined to invest in solar energy due to their financial capacity, as they can afford the high upfront costs of installation. In contrast, lower-income groups often struggle with affordability, making the initial investment a major barrier. While solar energy can lead to long-term savings on electricity bills, many households are unable to bear the initial expenditure without financial assistance. Expanding access to low-interest loans, grants, and subsidies can help bridge this gap and encourage a more diverse range of households to transition to solar energy.

Education and awareness are also key determinants of solar energy adoption. Households with higher levels of education tend to have a better

understanding of the economic and environmental benefits of renewable energy, making them more likely to consider investing in solar power. However, a significant portion of the population lacks adequate knowledge about solar energy and its long-term advantages. Public awareness campaigns, informational programs, and community-driven initiatives can help educate people about the cost-effectiveness and sustainability of solar energy, fostering greater acceptance and adoption.

The increasing frequency of power outages and rising electricity costs further drive interest in solar energy. In many urban areas, persistent load shedding disrupts daily life and affects productivity. Households that have already switched to solar energy report greater energy reliability and reduced dependence on the national grid, leading to lower electricity expenses. As electricity tariffs continue to rise, more families are exploring solar energy as a means of securing a stable and cost-effective power supply.

Despite these benefits, financial and technological barriers remain significant challenges. The high initial costs of solar panel installations deter many potential adopters, especially in middle- and lower-income segments. Additionally, concerns regarding the reliability and maintenance of solar systems contribute to hesitation. Limited access to financing options further restricts adoption, as many households struggle to secure loans or subsidies. Furthermore, the lack of strong government incentives and supportive policies discourages investment in solar energy. Addressing these barriers through financial incentives, improved accessibility, and policy reforms can accelerate the adoption of solar energy

and contribute to a more sustainable energy future.

### **Recommendations for Expanding Solar Energy Adoption**

Expanding solar energy adoption in Pakistan requires a comprehensive strategy that addresses financial, regulatory, and awareness-related barriers. A multi-faceted approach can help create an environment conducive to the widespread use of solar technology, ensuring that more households and businesses transition to renewable energy sources.

One of the most significant barriers to solar adoption is the high installation cost. To mitigate this, partnerships between the government and the private sector should be encouraged to lower the price of solar panels and associated equipment. Subsidies and bulk purchasing initiatives can also make solar technology more affordable for households, especially those in middle- and lower-income brackets. By reducing upfront costs, more families can access solar energy, leading to broader adoption across urban and rural areas.

Supportive policies play a crucial role in driving renewable energy growth. The government should develop policies that incentivize solar energy investments through tax breaks, grants, and regulatory simplifications. An efficient and streamlined regulatory framework will make it easier for households to install and use solar systems without bureaucratic hurdles. Clear guidelines on grid integration and net metering policies can further encourage households to invest in solar technology.

Financial incentives such as direct subsidies and low-interest loans are essential to making solar energy more accessible. Many households hesitate to invest in solar systems due to financial constraints, and expanding access to affordable financing options can significantly increase adoption rates. The

government should collaborate with financial institutions to create dedicated funds and flexible loan programs that cater to diverse income groups, ensuring that even low-income households can afford solar installations.

Encouraging a shift from non-renewable energy sources is another vital step. Increasing taxes on fossil fuel-based energy while using the generated revenue to support renewable energy initiatives can drive more households toward solar adoption. Promoting green energy investments through government and private sector collaboration will further enhance the development of solar infrastructure and technology.

Public awareness campaigns are crucial in educating people about the economic and environmental benefits of solar energy. Launching targeted initiatives, workshops, and informational programs can help dispel misconceptions and encourage households to explore renewable energy options. Showcasing success stories of families that have successfully transitioned to solar power can further inspire others to make the switch.

The government should take the lead by installing solar systems in public institutions such as schools, hospitals, and administrative buildings. Large-scale solar projects can also boost overall renewable energy production and demonstrate the viability of solar power on a national scale.

Lastly, reducing taxes on solar equipment will lower costs and encourage adoption. Eliminating import duties and promoting local production of solar panels and related components can make solar systems more affordable, fostering long-term growth in Pakistan's renewable energy sector.

### **Conclusion**

The transition to solar energy in Pakistan presents a viable solution to the country's

persistent energy shortages, rising electricity costs, and environmental concerns. While the benefits of solar power are evident, widespread adoption remains limited due to financial constraints, lack of awareness, high initial costs, and insufficient policy support. Addressing these challenges requires a comprehensive strategy that integrates financial incentives, supportive policies, and public awareness campaigns.

Reducing the upfront cost of solar installations through subsidies, bulk purchasing initiatives, and affordable financing options can make solar energy more accessible to a broader segment of the population. Government-led initiatives, including tax incentives, grants, and net metering policies, can further encourage households to transition to solar power. Additionally, educating the public on the long-term economic and environmental advantages of solar energy through targeted campaigns can bridge the awareness gap and increase adoption rates.

By fostering collaboration between the government, private sector, and financial institutions, Pakistan can create an enabling environment for renewable energy expansion. Investing in large-scale solar projects and integrating solar systems into public institutions will further demonstrate the feasibility of solar power. Through these efforts, Pakistan can move toward a sustainable, energy-secure future while reducing its reliance on fossil fuels and minimizing its carbon footprint.

*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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**RURAL INNOVATION**



## Empowering Women in Sindh's Agriculture Research

Explore how empowering women in agriculture research in Sindh can drive innovation, sustainability, and climate resilience. Addressing barriers through policy reforms, education, and mentorship is essential for creating an inclusive agricultural sector that fosters growth and development.

Shabnum Soomro

2/5/2025

Agriculture is the backbone of Pakistan's economy, contributing approximately 22.7% to the country's GDP and employing nearly 42.3% of the labor force. Sindh, with its fertile lands and diverse agricultural landscape, plays a crucial role in the country's food security and economic stability. While men have traditionally dominated the agricultural sector, women have been instrumental in both farming and research, making significant yet often overlooked contributions. Their involvement in agricultural research is essential for advancing sustainable practices, improving crop yields, and addressing climate challenges.

Women in Sindh actively participate in crop management, seed selection, livestock care, and post-harvest processing, drawing on indigenous knowledge and innovative techniques. Many female researchers and agronomists are working on climate-resilient farming techniques, water conservation methods, and disease-resistant crop varieties, helping to modernize traditional farming practices. Despite their vital role, women face limited access to education, land ownership, financial resources, and decision-making platforms, restricting their ability to lead in agricultural research. Socio-cultural norms, mobility constraints, and the underrepresentation of women in scientific institutions further limit their contributions to the field.

Several initiatives have been launched to bridge this gender gap, including women-focused agricultural training programs, scholarships for female researchers, and government-backed rural development schemes. Encouraging women's participation in agricultural research requires policy interventions, financial incentives, and awareness campaigns that

challenge deep-rooted gender biases. Strengthening institutional support for female agronomists and researchers will not only empower women but also lead to more inclusive, efficient, and resilient agricultural systems in Sindh.

As Pakistan strives to enhance its agricultural productivity and sustainability, women must be at the forefront of research and innovation. By recognizing their contributions and addressing existing barriers, Sindh can harness the full potential of its female agricultural workforce, paving the way for a more equitable and progressive future in agricultural research.

### Historical Context: Women in Agriculture in Sindh

Women in Sindh have historically played a fundamental role in agriculture, particularly in rural areas, where they contribute significantly to food production and livestock management. For generations, they have been involved in sowing, harvesting, irrigation, fodder collection, and seed preservation, ensuring food security and sustainability in their communities. Their indigenous knowledge of soil fertility, crop rotation, organic pest control, and water conservation has been invaluable in maintaining traditional farming practices. This expertise has been passed down through families, making women an essential pillar of the agricultural workforce.

Despite their extensive contributions, women's participation in formal agricultural research has remained limited due to deep-seated cultural norms, lack of access to education, and institutional barriers. Historically, male-dominated research institutions and agricultural extension services have overlooked

women's insights and expertise, leading to an underrepresentation of their perspectives in scientific advancements. Additionally, restricted mobility, lower literacy rates, and limited financial resources have hindered many women from transitioning from informal farming roles to formal research positions.

However, in recent years, the landscape has started to change. More women are now enrolling in agriculture-focused academic programs, joining research institutions, and working on innovative farming solutions. These female researchers are contributing to advancements in crop science, sustainable agriculture, and climate-resilient farming practices. Their efforts in developing drought-resistant crops, improved irrigation methods, and eco-friendly pest management strategies are helping Sindh's agricultural sector adapt to modern challenges, including climate change and resource scarcity.

To further support this progress, it is essential to remove systemic barriers and promote gender-inclusive policies that encourage women's participation in agricultural research. By integrating women's traditional knowledge with scientific advancements, Sindh can create a more resilient and productive agricultural sector that benefits both farmers and the broader economy.

### Innovations Driven by Women in Agricultural Research in Sindh

Women in Sindh are making significant strides in agricultural research, addressing critical issues such as food security, climate change, and sustainable farming practices. Their contributions are particularly vital in a region where agriculture is the primary livelihood for millions.

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Women researchers in Sindh have been instrumental in developing crop varieties that are resilient to local environmental challenges, such as drought and salinity. For instance, female scientists at Sindh Agriculture University have contributed to the development of high-yield wheat and cotton varieties that are better suited to the region's arid climate. These innovations are crucial for Sindh, where water scarcity and soil salinity are major constraints to agricultural productivity. According to the Pakistan Bureau of Statistics, Sindh produces 25% of the country's wheat and 30% of its cotton, underscoring the importance of such research. Through their research in biotechnology, women have also worked on breeding improved rice and sugarcane varieties that require less water while maintaining high yields. Such advancements have been beneficial to smallholder farmers who struggle with diminishing water availability due to climate change.

Women in Sindh are leading efforts to promote sustainable farming practices, such as organic farming, integrated pest management, and efficient water use. For example, female researchers have introduced drip irrigation systems and crop rotation techniques to smallholder farmers, significantly improving water efficiency and soil health. A study by the International Water Management Institute (IWMI) found that farms adopting these practices in Sindh saw a 15-20% increase in crop yields while reducing water usage by 30%. Additionally, many women researchers are involved in promoting biofertilizers and organic pesticides, which help reduce the dependency on chemical inputs and lower production costs. Organizations such as the Pakistan Agricultural Research Council (PARC) have supported these initiatives, allowing more farmers to adopt eco-friendly agricultural methods.

Sindh is highly vulnerable to climate change, with frequent droughts, floods, and erratic rainfall patterns affecting agricultural productivity. Women researchers are at the forefront of developing climate-smart agricultural

technologies, such as drought-resistant crops and conservation agriculture techniques. Their work is particularly impactful for smallholder farmers, who constitute the majority of Sindh's agricultural workforce. According to the United Nations Development Programme (UNDP), women-led farms in Sindh adopting climate-smart practices have reported a 25% increase in yields. They have also been involved in promoting agroforestry and intercropping methods to mitigate soil degradation and enhance biodiversity. These practices not only improve resilience against extreme weather conditions but also provide alternative income sources for rural households.

Women in Sindh are also leveraging technology to revolutionize agriculture. Mobile-based advisory services, precision farming tools, and data-driven agricultural practices are being introduced by female researchers to help farmers make informed decisions. For example, initiatives like the Sindh Agriculture Growth Project (SAGP) have empowered women farmers through access to digital platforms that provide real-time weather updates, market prices, and pest control advice. Many female scientists are also working on developing AI-driven applications that can diagnose crop diseases through images taken by farmers on their smartphones. This digital transformation is bridging the knowledge gap for rural farmers and allowing them to improve productivity while minimizing losses.

### **Challenges Faced by Women in Agricultural Research in Sindh**

Despite their contributions, women in agricultural research in Sindh face numerous challenges that limit their potential and impact. Gender disparity remains a significant issue, as women continue to be underrepresented in agricultural research institutions. Cultural norms and societal expectations often discourage women from pursuing careers in science and technology. According to a 2022 report by the Higher Education Commission (HEC) of Pakistan, women

constitute only 28% of the agricultural research workforce in Sindh, with even fewer in leadership roles. This underrepresentation means that women's perspectives and contributions are often overlooked in decision-making processes.

Access to quality education and training remains another major barrier for women in Sindh. Many rural women lack the opportunity to pursue higher education in agricultural sciences due to limited infrastructure and societal restrictions. Even when they do enroll in agricultural universities, they often face challenges in accessing advanced training, laboratory facilities, and professional development opportunities. Limited scholarships and financial assistance further restrict their academic progress. Women researchers in smaller institutions also struggle to attend international conferences and workshops, which are crucial for skill enhancement and global collaboration.

Balancing work and family responsibilities is another major challenge. The demanding nature of agricultural research, which often requires fieldwork and long hours in laboratories, makes it difficult for women to manage both professional and domestic responsibilities. Many female researchers experience career stagnation or early exits from the field due to societal expectations around caregiving. This is particularly true in rural areas, where women are expected to prioritize household duties over professional aspirations.

Women researchers in Sindh also face significant hurdles in securing research grants and funding. A study by the Pakistan Agricultural Research Council (PARC) found that women researchers receive 40% less funding than their male counterparts, limiting their ability to conduct field studies, access advanced laboratory equipment, and publish their findings. The lack of financial support restricts the scope and impact of their research, making it harder for them to compete with male colleagues for leadership roles.

Another challenge is the absence of strong mentorship and professional networking

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opportunities. Women in Sindh's agricultural research sector often lack access to influential mentors who can guide their careers. This limits their ability to navigate institutional challenges, secure leadership positions, and gain visibility for their contributions. Without strong networks, women struggle to advocate for their research and connect with policymakers who could support the implementation of their innovations in the field.

### **The Path Forward: Empowering Women in Agricultural Research in Sindh**

To address these challenges and harness the full potential of women in agricultural research, concerted efforts are needed from policymakers, research institutions, and the private sector. The government of Sindh should implement policies that promote gender inclusion in agricultural research by introducing affirmative action policies, gender quotas in leadership positions, and equal pay initiatives. Expanding existing programs like the Benazir Income Support Programme (BISP) to provide financial support for women pursuing careers in agricultural research can encourage more participation. Additionally, establishing specialized research fellowships for women would create greater incentives for female researchers to contribute to agricultural innovation.

Investing in education and training for women in Sindh is crucial to overcoming barriers to entry into agricultural research. Scholarships, mentorship programs, and outreach initiatives should be launched to encourage more girls to enroll in agricultural sciences. Institutions like Sindh Agriculture University and other research centers should develop

specialized training programs tailored to women's needs, including hands-on research experience and exposure to modern agricultural technologies. Encouraging collaborations with international universities and research institutions can also provide women with access to global knowledge, enhancing their research capabilities.

Ensuring that women researchers have equal access to funding is vital. Targeted funding programs and grants should be established to support women-led research projects, ensuring that financial constraints do not hinder their progress. International organizations and funding agencies should prioritize gender-responsive budgeting and create financial opportunities specifically designed for women researchers. Public-private partnerships can also play a role in funding women-led innovations in agricultural research.

Work-life balance remains a significant concern for women in research, and institutions in Sindh must address this by implementing policies such as flexible work schedules, parental leave, and the provision of on-campus childcare facilities. These measures can help retain talented women researchers and ensure their long-term engagement in the field.

Building mentorship and networking platforms is another critical step in empowering women in agricultural research. Establishing structured mentorship programs that connect early-career women researchers with experienced professionals can bridge the knowledge gap and provide guidance for career advancement. Research institutions should organize leadership training workshops and career development seminars tailored to women in agriculture.

Encouraging participation in national and international conferences can further help women build professional networks, increasing their visibility and opportunities for collaboration.

### **Conclusion**

A strong and inclusive agricultural research sector in Sindh requires the active participation of women. Their contributions to innovation, sustainability, and climate resilience are already evident, yet they continue to face structural barriers that limit their full potential. By addressing these challenges through policy reforms, increased educational opportunities, financial support, and institutional commitments to gender equity, Sindh can create an enabling environment for women researchers. Encouraging mentorship, networking, and work-life balance initiatives will further help integrate more women into leadership roles within agricultural research. As Sindh moves towards a more progressive and sustainable agricultural future, empowering women will be a key driver of growth and resilience. Recognizing their expertise and ensuring their inclusion in decision-making processes will not only strengthen agricultural research but also contribute to broader economic and social development in the region.

*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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## Revolutionizing Pakistan's Agriculture with Farm-to-Table

Explore how farm-to-table ventures can transform Pakistan's agricultural landscape by connecting smallholder farmers with consumers. Learn about sustainable agriculture practices, fair pricing, and successful initiatives that enhance food security and boost rural livelihoods.

Laiba Javed

2/6/2025

In a developing country like Pakistan, where food security, economic instability, and inflation threaten rural livelihoods, the need to support local agriculture has never been more urgent. The agricultural sector, which contributes 23% to Pakistan's GDP and employs 37.4% of the workforce, is struggling due to rising input costs, climate change, and limited market access. Smallholder farmers, who own less than 12 acres of land and make up over 92% of the farming population, face challenges such as post-harvest losses, lack of technology, and unfair pricing structures. Additionally, inflation and supply chain disruptions have made it harder for farmers to earn sustainable incomes while ensuring food affordability for consumers.

Farm-to-table ventures present a transformative opportunity to address these issues by connecting farmers directly with consumers, reducing intermediaries, and promoting sustainable practices. This model ensures fair prices for farmers while providing fresh, high-quality produce to consumers. By eliminating middlemen, farm-to-table systems allow farmers to retain a greater share of profits, making their businesses more viable. Moreover, these ventures encourage environmentally friendly farming practices such as organic cultivation, water conservation, and regenerative agriculture, reducing the sector's carbon footprint.

### Challenges Facing Pakistan's Agricultural Sector

Pakistan has 22 million hectares of cultivated land, yet outdated farming practices, inefficient resource use, and lack of investment hinder productivity and profitability. The country's agriculture sector faces multiple structural

challenges, including high input costs, limited mechanization, and water shortages. Climate change has further exacerbated the situation, leading to unpredictable weather patterns, reduced crop yields, and increased vulnerability to pests and diseases.

Post-harvest losses are a major concern, particularly in perishable crops such as fruits and vegetables, where an estimated 30-40% of produce is wasted due to poor storage, inadequate transportation, and lack of processing facilities. These losses translate into an economic burden of approximately PKR 400 billion annually (Pakistan Horticulture Development Board, 2023), reducing farmers' incomes and limiting food availability for consumers.

Additionally, while Pakistan has 1.51 million hectares of naturally organic land, only 0.2% of its agricultural land is globally certified as organic (Willer, 2018). The lack of certification and market access prevents farmers from capitalizing on the growing demand for organic produce both domestically and internationally. Limited awareness and high certification costs further discourage smallholder farmers from transitioning to organic farming.

These challenges highlight the need for farm-to-table initiatives that promote sustainable farming practices, improve supply chain efficiency, and create direct market access for farmers. By investing in better infrastructure, training programs, and digital marketplaces, Pakistan can reduce post-harvest losses, enhance food quality, and make agriculture more profitable and resilient to economic and environmental shocks.

### Successful Farm-to-Table Initiatives in Pakistan

Farm-to-table initiatives in Pakistan are proving to be a game-changer for smallholder farmers by enhancing productivity, increasing profitability, and promoting sustainable agricultural practices. These ventures help bridge the gap between farmers and consumers, ensuring better pricing, reducing post-harvest losses, and fostering a resilient food system.

One such initiative is National Foods Limited's *Seed to Table* project, which was launched to reduce reliance on imported raw materials and strengthen local agricultural supply chains. The project has successfully cultivated 500 acres for tomato production, saving approximately USD 2 million in imports and reducing dependence on foreign markets. With plans to expand into red chili production, the initiative has the potential to localize an additional USD 10 million worth of imports (HortiDaily, 2023). It has also provided 2,500 farmers with training in organic farming techniques and improved market access, enabling them to command better prices for their produce.

The *Slow Food Movement in Pakistan* is another notable effort that promotes organic farming and traditional food practices. By educating farmers on sustainable agricultural techniques and innovative marketing strategies, this movement supports environmentally responsible food production. It also organizes public awareness events to highlight the benefits of consuming locally sourced, eco-friendly food, encouraging a shift toward sustainable diets (Slow Food, 2024).

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The *Pakistan Agriculture Development Project*, supported by Winrock International, focuses on increasing farm productivity and reducing post-harvest losses—one of the biggest challenges faced by smallholder farmers. With post-harvest losses in fruits and vegetables reaching 30-40% annually, causing an economic burden of PKR 400 billion (Pakistan Horticulture Development Board, 2023), this project connects farmers in Sindh and Punjab with domestic and export markets. It also facilitates access to cold storage and food processing facilities, ensuring that produce retains its quality and value, ultimately increasing farmer incomes.

The *Regenerative Production Landscape Collaborative (RPLC) Pakistan*, funded by the Laudes Foundation and implemented by WWF-Pakistan, covers over 100,000 hectares of farmland and benefits more than 50,000 farmers. The initiative introduces regenerative agriculture models that improve soil health, biodiversity, and water conservation while promoting sustainable farming practices that reduce chemical inputs and enhance productivity (WWF, 2019).

Farm-to-table ventures offer multiple advantages to Pakistan's agricultural sector. By eliminating middlemen, farmers receive a fairer share of profits, which encourages reinvestment in sustainable practices such as organic farming, value-added food processing, and improved irrigation techniques. The environmental benefits are significant, as these initiatives reduce food miles and carbon emissions associated with long-distance transportation. Furthermore, they contribute to food security by encouraging the consumption of fresh, seasonal, and locally grown produce, which enhances national nutrition outcomes.

Value addition is a key aspect of these initiatives, helping farmers move beyond raw commodity sales. Processing fruits and vegetables into jams, sauces, dried products, or organic juices increases profitability and creates new income

streams. Additionally, direct relationships between farmers and consumers promote trust, transparency, and food traceability, encouraging healthier and more ethical consumption patterns.

Scaling up these initiatives requires investment in infrastructure, digital marketplaces, and farmer training. With government support, private sector collaboration, and consumer awareness, farm-to-table ventures can transform Pakistan's agricultural landscape, ensuring long-term sustainability, economic resilience, and enhanced livelihoods for farmers.

### **The Transformative Potential of Farm-to-Table Ventures**

Farm-to-table ventures hold immense transformative potential for Pakistan's agricultural sector by addressing key issues such as farmer profitability, environmental sustainability, food security, and consumer trust. These initiatives ensure fair pricing and better market access by eliminating intermediaries, allowing farmers to retain a larger share of their profits. In Pakistan, where smallholder farmers make up over 92% of the farming population and struggle with low earnings due to exploitative pricing structures, direct consumer engagement can significantly improve their financial stability. Studies show that farmers typically receive only 25-30% of the final retail price of their produce when sold through traditional supply chains. By contrast, farm-to-table models can increase their earnings by 40-50%, enabling them to reinvest in improved seed varieties, sustainable irrigation, and modern farming techniques.

Environmental sustainability is another major advantage of farm-to-table initiatives. Pakistan's agriculture sector contributes nearly 39% of the country's greenhouse gas emissions (World Bank, 2023), primarily due to inefficient supply chains, chemical-intensive farming, and long-distance transportation. Reducing food miles through local sourcing lowers carbon footprints while promoting organic and regenerative farming

techniques. Additionally, cutting down on food waste, which currently stands at an estimated 19.6 million tons per year (FAO, 2023), ensures better resource utilization and economic gains for both farmers and consumers.

These initiatives also improve food security and nutrition. With 36.9% of Pakistan's population experiencing food insecurity (World Food Programme, 2023), encouraging the consumption of fresh, seasonal, and locally grown food can enhance dietary diversity and reduce dependence on expensive, imported products. Moreover, direct relationships between farmers and consumers build trust, ensuring transparency in food sourcing, safety, and quality. By fostering mindful eating habits, farm-to-table ventures can reshape Pakistan's food system into one that is equitable, sustainable, and resilient.

### **Practical Recommendations to Strengthen Farm-to-Table Ventures in Pakistan**

Strengthening farm-to-table ventures in Pakistan requires a multi-faceted approach that addresses infrastructure gaps, financial constraints, technological integration, and consumer awareness. Investment in cold storage and logistics is critical, as Pakistan loses 30-40% of its fruit and vegetable production annually due to inadequate post-harvest management, amounting to economic losses of approximately PKR 400 billion (Pakistan Horticulture Development Board, 2023). Developing cold chains, efficient transportation networks, and processing facilities can help farmers extend the shelf life of perishable goods, reduce waste, and increase profitability.

Government support and policy reforms are equally essential. Policymakers should incentivize sustainable farming by offering subsidies for organic inputs such as biofertilizers and compost, as well as providing low-interest loans to smallholder farmers who wish to transition to eco-friendly agricultural methods. Countries that have implemented similar policies have seen a significant increase in organic farming

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adoption and improved farmer incomes. Additionally, simplifying the regulatory framework for farm-to-table businesses can encourage more entrepreneurs to enter this space.

Technology integration can further enhance the farm-to-table movement. Digital platforms and mobile apps can connect farmers with urban consumers, allowing direct sales that bypass middlemen and ensure fair pricing. In neighboring India, platforms like eNAM have helped farmers increase their profit margins by up to 20% through direct market access. Pakistan can adopt similar models to modernize its agricultural supply chain.

Expanding farmers' markets in urban centers is another practical step. Local governments should facilitate spaces where farmers can sell directly to consumers, ensuring better prices and increasing food transparency. In countries like Thailand and Turkey, government-supported farmers' markets have contributed to rural income growth while promoting sustainable food consumption.

Lastly, awareness campaigns and training programs must educate farmers about best practices in sustainable agriculture, value addition, and business management. Teaching farmers how to process and package their produce for premium markets can increase their earnings. By addressing these challenges holistically, Pakistan can create a thriving farm-to-

table ecosystem that benefits both farmers and consumers while promoting food security and sustainability.

### Conclusion

Farm-to-table ventures have the potential to revolutionize Pakistan's agricultural landscape by directly linking farmers with consumers, ensuring fairer pricing, reducing post-harvest losses, and promoting sustainable practices. Given the economic challenges faced by smallholder farmers, the inefficiencies in the supply chain, and the environmental concerns surrounding conventional agriculture, these initiatives offer a viable pathway to improve rural livelihoods, enhance food security, and support national economic growth. Successful projects like National Foods Limited's Seed to Table initiative and the Regenerative Production Landscape Collaborative demonstrate that with the right investment, policy support, and technological integration, farm-to-table models can be scaled to benefit a larger segment of the farming population.

However, realizing the full potential of these ventures requires addressing key obstacles such as inadequate infrastructure, lack of digital connectivity, and limited consumer awareness. Expanding cold storage facilities, enhancing logistics networks, and investing in e-commerce solutions can bridge existing gaps in the farm-to-table supply chain. Additionally, government-

backed policy incentives, including financial support for sustainable farming and organic certification, can encourage more farmers to participate in direct-to-consumer sales. Public awareness campaigns will also play a crucial role in driving consumer demand for locally sourced, eco-friendly produce.

By fostering a collaborative ecosystem involving farmers, policymakers, private enterprises, and consumers, Pakistan can create a more resilient and equitable agricultural sector. Strengthening farm-to-table initiatives will not only boost farmer incomes but also contribute to national food security and environmental conservation. As global trends shift towards sustainability and transparency in food systems, Pakistan has an opportunity to position itself at the forefront of this movement. With strategic investments and a commitment to innovation, farm-to-table ventures can serve as a powerful tool for economic development, ensuring long-term prosperity for both farmers and consumers alike.

*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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## Transforming Pakistan's Rural Economy with Agribusiness

Explore how agribusiness is revolutionizing Pakistan's rural economy by modernizing agricultural practices, enhancing productivity, and creating job opportunities. Discover the impact of advanced technologies and improved infrastructure on economic diversification and rural development.

Haram Noor

2/18/2025

The rural economy of Pakistan, traditionally dominated by small-scale, subsistence farming, has undergone a significant transformation with the rise of agribusiness. Agribusiness, which encompasses the entire value chain of agricultural production—from cultivation and input supply to processing, distribution, and marketing—has emerged as a powerful force reshaping rural landscapes. The integration of advanced technologies, capital investments, and commercial practices into agriculture has redefined the sector, driving increased productivity, efficiency, and economic diversification.

Historically, rural economies in Pakistan operated within a framework of traditional agricultural practices characterized by low productivity and limited market integration. Farmers relied on age-old methods of cultivation, which were often vulnerable to environmental challenges, market fluctuations, and resource limitations. These factors perpetuated cycles of poverty and economic stagnation in many rural regions. However, with the advent of globalization, liberalization, and advancements in agricultural technologies, agribusiness has emerged as a driver of growth. By linking small-scale farmers to national and international markets, agribusiness enables the flow of inputs, credit, and technical expertise, facilitating a transition to modern, commercially oriented agriculture.

The rise of agribusiness in Pakistan is closely tied to industrialization and urbanization trends that have fueled demand for high-value agricultural products such as fruits, vegetables, dairy, meat, and processed food items. This demand has pushed agricultural stakeholders to adopt innovations such as

mechanization, precision farming, irrigation technologies, and supply chain logistics. As a result, traditional agriculture is evolving into a more dynamic, value-added industry where profits are generated not only through production but also through processing, packaging, and distribution.

For rural economies, agribusiness represents both opportunities and challenges. On one hand, it generates employment, enhances farm incomes, and empowers smallholders through contract farming arrangements and cooperative models. By integrating rural producers into organized supply chains, agribusiness minimizes post-harvest losses, promotes value addition, and improves access to markets. On the other hand, the rise of agribusiness raises concerns about equity, environmental sustainability, and the displacement of traditional farming systems.

### Agribusiness and Economic Development in Rural Pakistan

Agribusiness has emerged as a cornerstone of economic development in rural Pakistan, significantly contributing to agricultural productivity, market efficiency, and employment generation. As a sector that encompasses farming, agro-processing, input supply, and distribution networks, agribusiness has played a crucial role in integrating rural producers into national and global markets. According to the Pakistan Bureau of Statistics (2023), agribusiness contributes approximately \$50 billion annually to the national economy, with substantial growth in agro-processing and export-oriented industries.

The adoption of modern machinery has led to notable increases in agricultural productivity. Mechanization, particularly

the use of tractors and combine harvesters, has reduced dependence on manual labor while enhancing efficiency. Over the past decade, tractor use has increased by 15% annually, enabling farmers to cultivate larger areas in shorter timeframes, thereby boosting overall output. Furthermore, improved irrigation techniques, including drip irrigation and laser land leveling, have optimized water use and improved crop yields.

Market access for agricultural producers has also improved through value addition in agro-processing industries. Rice milling, dairy processing, and fruit preservation industries have created new avenues for farmers to increase their earnings. For instance, Pakistan's rice exports, driven by value-added processing and improved packaging, reached \$2.5 billion in 2022, strengthening the country's position in global markets. Similarly, the dairy sector has seen rapid expansion, with increased production of packaged milk, yogurt, and cheese, catering to both domestic and international demand.

The agribusiness sector has been a major source of employment, particularly in rural areas where alternative job opportunities are limited. The Pakistan Economic Survey (2023) highlights that agro-processing industries employ over 10 million people, with a significant proportion being women. Women's participation in agribusiness, particularly in dairy farming, poultry production, and fruit processing, has contributed to rural household incomes and economic empowerment. Additionally, logistical services, including transportation, storage, and marketing, have provided further employment opportunities.



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Despite its numerous advantages, agribusiness in Pakistan faces several challenges. Smallholder farmers, who make up 65% of the agricultural workforce, often struggle to compete with large-scale agribusiness enterprises due to limited access to credit, modern technology, and market linkages. This marginalization hampers their ability to benefit from growing market opportunities. Another pressing issue is post-harvest losses, which cost the economy approximately \$1.3 billion annually due to inadequate storage, inefficient transportation, and lack of processing facilities. Addressing these challenges through policy support, improved infrastructure, and financial inclusion measures can further enhance agribusiness's role in Pakistan's rural economic development.

### **The Impact of Technological Advancements on Agribusiness in Pakistan**

Technological advancements have significantly transformed agribusiness in Pakistan, enhancing productivity and resource management through precision agriculture, digital platforms, and climate-smart technologies. Mobile applications such as Farmdar and Taraqee provide farmers with real-time updates on weather conditions, market prices, and best practices, facilitating informed decision-making. Additionally, innovations like drip irrigation and solar-powered pumps have improved water efficiency, particularly in water-scarce regions like Balochistan.

Despite these advancements, challenges persist. Limited access to technology and digital literacy hinder smallholder farmers from fully benefiting from these innovations. According to the Pakistan Telecommunication Authority (2023), only 25% of rural households in Pakistan have internet access, creating a digital divide that restricts agribusiness growth at the grassroots level.

Beyond technological progress, agribusiness in Pakistan has profound social and environmental implications. It has created employment opportunities

and expanded market access, empowering rural communities. Women in Punjab and Sindh, for instance, have gained economic independence through participation in dairy cooperatives and agro-processing ventures. However, agribusiness also exacerbates rural inequalities, as large enterprises continue to dominate land and resources. According to the World Bank (2023), the top 5% of landowners control 35% of agricultural land, further marginalizing small-scale farmers.

The environmental consequences of agribusiness remain a pressing concern. Large-scale cultivation has contributed to deforestation and soil degradation, with Punjab losing approximately 10,000 hectares of forest cover annually due to sugarcane expansion. Additionally, excessive groundwater extraction for irrigation has led to declining water tables, particularly in Punjab and Sindh, intensifying the challenge of water scarcity.

While agribusiness continues to drive economic growth and technological progress in Pakistan, addressing the digital divide, land inequality, and environmental sustainability is essential for ensuring long-term, inclusive development.

### **Policy Recommendations**

The expansion of agribusiness has reshaped Pakistan's rural economy, fostering productivity, modernizing agricultural practices, and integrating rural producers into competitive supply chains. However, these benefits remain unevenly distributed, with small-scale farmers facing challenges such as land consolidation, income disparities, and environmental degradation.

To ensure inclusive and sustainable rural development, practical policy interventions are necessary. Strengthening smallholder inclusion through accessible credit, technology, and market linkages—such as cooperative models and contract farming—can enhance their participation in agribusiness. Investing in rural

infrastructure, including cold storage facilities, better road networks, and improved digital connectivity, will help reduce post-harvest losses and improve farmers' access to markets. Encouraging climate-smart agriculture and regenerative farming practices can mitigate environmental degradation, ensuring long-term sustainability. Additionally, bridging the digital divide by expanding internet access and offering training in digital tools will empower farmers to leverage modern agricultural innovations effectively.

By aligning economic growth with social equity and environmental sustainability, Pakistan can maximize the potential of agribusiness to drive rural development and strengthen food security.

### **Conclusion**

Agribusiness has emerged as a transformative force in Pakistan's rural economy, driving productivity, market integration, and employment generation. By modernizing traditional agricultural practices and linking farmers to national and international markets, agribusiness has significantly contributed to economic diversification and rural development. The adoption of advanced technologies, improved infrastructure, and agro-processing industries has enhanced efficiency and profitability within the sector.

However, challenges remain in ensuring that the benefits of agribusiness are equitably distributed. Smallholder farmers continue to face barriers to accessing credit, modern technology, and market opportunities, limiting their ability to compete with large enterprises. Additionally, environmental concerns such as deforestation, soil degradation, and water scarcity pose long-term threats to sustainable agricultural growth. Addressing these issues through targeted policy interventions—including investment in rural infrastructure, expansion of digital literacy programs, and promotion of climate-smart agriculture—will be critical to maximizing agribusiness's potential.

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Moving forward, a balanced approach that integrates economic growth with social equity and environmental responsibility is essential. By fostering an inclusive agribusiness model that supports smallholders, encourages sustainable practices, and enhances technological accessibility, Pakistan can

strengthen its rural economy, ensure food security, and promote long-term agricultural resilience in an increasingly competitive global market.

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## Returns on Intercropping in Sugarcane Cultivation

Discover how intercropping in sugarcane farming can enhance productivity and boost income for farmers in Sindh. Learn about the economic benefits, sustainable practices, and employment opportunities created by cultivating short-duration crops alongside sugarcane.

Aslam Memon & Muhammad Ismail Kumbhar

2/19/2025

Sugarcane is a major cash crop in Pakistan. It has aided the sugar industry's growth, improved farmers' socioeconomic situations, and contributed to economic development. Sugarcane is a primary source of monetary revenue for farmers. Monocropping, on the other hand, hinders diversification and causes profitability to fluctuate according to market and environmental challenges. Intercropping, the practice of cultivating two or more crops at the same time, has emerged as a feasible approach for diversifying revenue streams, improving soil health, and mitigating market volatility risks.

Because sugarcane takes a long time to mature, growers must wait 10–14 months before they get returns on their investment. Enough room is also left between the two rows while planting it. Until the plants are fully developed, this space is left free. So Short-duration crops can be cultivated there without compromising cane productivity. Intercropping makes greater use of available land by utilizing the spaces between sugarcane rows, which are frequently underutilized during the early growth stages of sugarcane.

Furthermore, it is labor-intensive, requires a lot of input, and competes fiercely with cotton and other garden crops. Sugarcane's economics are called into doubt when growers profit more from other crops. Farmers use a variety of intercropping strategies to increase their income per acre. Farmers can supplement their income before the sugarcane harvest by growing short-duration crops such as vegetables (e.g., tomato, okra, onions etc.) or legumes (e.g., mung beans, lentils). Legumes fix atmospheric nitrogen in the soil, minimizing the

requirement for chemical fertilizers and increasing soil fertility for future crops.

Data collected from farmers in the major sugarcane growing districts of Sindh show significant economic benefits from intercropping in the sugarcane. According to survey results, farmers are adopting the following major intercrop combinations in sugarcane: sugarcane + sunflower; sugarcane + onion; sugarcane + wheat; sugarcane + coriander; sugarcane + mustard; sugarcane + tomato; and sugarcane + cabbage and spinach. The economics of various intercropping were investigated, and it was shown that sugarcane + onion + wheat produced the highest net profit. Furthermore, the best inter-crop combinations were sugarcane + onion and sugarcane + tomato. Farmers who used intercropping in sugarcane reported a 25 to 30% increase in total earnings compared to monocropping.

intercropping in sugarcane often necessitates more work, resulting in more productive job prospects and greater earnings. Many studies have shown that intercropping increases growers' net income and creates job opportunities for landless and owner-occupied household families.

### Intercropping Adoption Challenges in Sindh

The adoption of intercropping in Sindh, particularly in sugarcane farming, faces multiple challenges despite its potential to enhance productivity and income for farmers. While intercropping allows farmers to utilize land efficiently and gain additional income from short-duration crops, there is limited research available on the cost of production, profitability, and the various agronomic factors affecting yield under different intercropping strategies. This lack of

information makes it difficult for farmers to make informed decisions regarding the selection of suitable crops and best management practices.

Although intercropping has been practiced for generations, its scientific evaluation has only recently gained attention among researchers and policymakers. The increasing interest in intercropping stems from the substantial profits that sugarcane farmers can generate by cultivating additional crops alongside their primary cash crop. Short-duration crops such as pulses, vegetables, and oilseeds can be effectively intercropped with sugarcane, providing both economic and soil health benefits. However, a knowledge gap persists, as many farmers are unaware of optimal intercropping techniques, suitable crop combinations, and the agronomic measures required for successful implementation. Without proper extension services and training programs, farmers struggle to adopt these methods effectively.

One of the major obstacles in intercropping adoption is the inefficient irrigation system in Sindh. Many farmers experience uneven water distribution, making it difficult to allocate water efficiently between sugarcane and intercrops. Since sugarcane is a water-intensive crop, ensuring adequate moisture for both crops become challenging, especially in areas where water shortages are frequent. Poor irrigation infrastructure, outdated water management practices, and climate variability further exacerbate this issue, making intercropping a riskier endeavor for farmers who rely on consistent water supply.

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The initial investment required for intercropping also poses a barrier to widespread adoption. Farmers need additional seeds, fertilizers, and labor, which can be financially burdensome, particularly for small-scale and resource-constrained farmers. Many hesitate to invest in intercropping due to uncertainty about returns and the potential risks involved. Additionally, access to quality inputs and credit facilities remains limited, further discouraging adoption.

Addressing these challenges requires targeted interventions, including increased research on intercropping strategies, improved extension services to educate farmers, better water management solutions, and financial support mechanisms. By overcoming these barriers, intercropping can become a viable and profitable practice, benefiting both farmers and the agricultural sector in Sindh.

### Conclusion

Intercropping in sugarcane farming presents a promising opportunity for farmers in Sindh to enhance productivity, increase income, and improve soil fertility. The practice has been shown to provide significant economic benefits, with certain crop combinations yielding higher profits than monocropping. By making use of underutilized land between sugarcane rows, farmers can cultivate short-duration crops that not only supplement their income before the main harvest but also contribute to sustainable agricultural practices by reducing the need for chemical fertilizers. Additionally, intercropping creates employment opportunities by increasing labor demand in rural areas.

However, despite these benefits, the adoption of intercropping remains limited due to several challenges. A lack of awareness, inadequate research on the best practices, water distribution issues, and financial constraints hinder farmers from fully utilizing this technique.

Addressing these challenges requires a multi-faceted approach, including increased research, better access to extension services, improved irrigation management, and financial support for small-scale farmers. By overcoming these barriers, intercropping can become an integral part of sugarcane farming, ensuring both economic stability and long-term agricultural sustainability in Sindh. With the right policy interventions and farmer support, intercropping has the potential to transform sugarcane farming into a more resilient and profitable system.

*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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The Agricultural Economist, Vol. 2(2)  
**Jujube Farming Challenges in Pakistan**

Explore the paradox of jujube farming in Pakistan, where high profitability clashes with declining market appeal. Discover the factors contributing to price instability, outdated practices, and market challenges threatening this vital agricultural sector.

Muhammad Hanif

2/20/2025

Jujube (*Ziziphus jujuba*), commonly known as Ber in Pakistan, is a fruit-bearing plant from the Rhamnaceae family, native to Asia. Known for its hardy nature, jujube is cultivated in various climates, from tropical to temperate regions. The fruit, also known as the Chinese date, is highly valued for its rich nutritional content and versatile uses. It is a hardy fruit that thrives in arid conditions, requiring minimal water while offering substantial yields. For farmers, jujube is a goldmine, a crop that promises high returns with relatively low input costs. Yet, despite its profitability, something strange is happening: people are gradually losing interest in jujube. What was once a beloved fruit now struggles to maintain its place in the market, raising a puzzling contradiction, why is a financially rewarding crop failing to sustain consumer demand?

This paradox is not just about consumer preferences, it runs deeper, touching on the struggles of jujube farmers who, despite their hard work, continue to face a cycle of instability. One of the biggest concerns is the extreme price fluctuation, some seasons bring in massive profits, while others leave farmers in financial distress. Adding to this challenge is the fact that many farmers rely on outdated techniques, repeating the same mistakes year after year. Poor pruning methods, lack of pest control, and inefficient harvesting practices reduce the overall quality of the fruit, making it even harder to compete in the market.

Another major challenge facing jujube farmers is the lack of awareness and access to modern agricultural knowledge. Many farmers continue to rely on traditional cultivation methods that have been passed down for generations, unaware that new techniques could

significantly improve their yield, fruit quality, and profits. They often lack information on proper pruning, pest and disease control, irrigation management, and post-harvest handling, all of which play a crucial role in maintaining fruit quality and market value. Additionally, many farmers do not have access to proper storage facilities or preservation methods, which leads to excessive spoilage and financial losses.

Furthermore, a weak understanding of market trends and consumer preferences makes it difficult for them to adapt to changing demands. As consumer interest in jujube declines, farmers continue to produce the same varieties without exploring value-added products or alternative uses that could attract new buyers. Without proper guidance, many farmers remain stuck in a cycle of low-quality production and unstable earnings, despite the crop's potential profitability. If this knowledge gap is not addressed, jujube farming may struggle to remain a sustainable and competitive agricultural sector in the long run.

This article explores the hidden struggles of jujube cultivation. We will dive into the reasons behind market instability, the recurring mistakes that limit productivity, and the knowledge gaps that prevent farmers from reaching their full potential. Understanding these factors is crucial for revitalizing the jujube industry and ensuring that it continues to be a profitable and sustainable venture in the years to come.

### **The Impact of Border Closures on Jujube Prices**

Jujube farmers in Pakistan live under constant uncertainty not because of their hard work or yield, but because of forces beyond their control. The instability of

border trade has turned pricing into a gamble. If this issue remains ignored, Pakistan risks crippling one of its most promising agricultural sectors. Urgent action is needed, reliable trade agreements, better market access, and strategic storage solutions to protect farmers from this volatility. Without intervention, the future of jujube farming hangs in balance, and with it, the livelihoods of thousands.

For jujube farmers in Pakistan, price fluctuation isn't just an economic challenge, it's a constant battle for survival. Unlike crops with stable domestic demand, Jujube relies heavily on exports, making its price highly volatile. The root cause? Unpredictable border policies and an unstable trade environment. One day, markets are thriving, and farmers sell their produce at competitive rates. The next, without warning, border closures leave tons of jujube stranded with no access to international buyers. The sudden oversupply in local markets causes prices to plummet, turning potential profits into devastating losses. This instability is crippling an industry that holds immense economic potential. Farmers invest months of labor and financial resources into cultivation, expecting a fair return on their hard work. However, their livelihoods depend not on their productivity but on factors entirely beyond their control. The unpredictability of border openings and closings has created an environment of uncertainty where no farmer can confidently plan for the future.

Pakistan exports a significant portion of its jujube production to neighboring countries. When the borders are open, international demand keeps prices at a profitable level, ensuring steady income

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for farmers. However, border closures, whether due to political tensions, trade restrictions, or bureaucratic inefficiencies, immediately disrupt this flow, flooding the local market with unsold stock. Since domestic demand for jujube is limited, the sudden surge in supply leads to a price collapse, pushing farmers into financial distress.

The situation is even worse for small-scale farmers who lack the financial cushion to absorb these shocks. Unlike large exporters with storage facilities and the ability to hold onto their produce until market conditions improve, small farmers are forced to sell their jujube at unreasonably low prices just to recover a fraction of their costs. In extreme cases, some farmers even dump their produce or let it rot, as transportation costs outweigh the profits, they would make from selling at rock-bottom prices.

This constant uncertainty takes a severe psychological toll on farmers, many of whom rely on jujube cultivation as their primary source of income. Imagine spending an entire season nurturing a crop, only to watch its value disintegrate due to sudden and arbitrary trade restrictions. The frustration and helplessness this causes have pushed many farmers to consider abandoning jujube cultivation altogether, despite its high profitability under stable conditions.

Financial instability also means that farmers struggle to reinvest in their orchards, affecting future production quality and yield. Over time, this could weaken Pakistan's position in the international market, where competitors with more stable trade policies could easily take over.

### **Lack of Awareness: The Hidden Barrier to Jujube Farming Success**

One of the biggest yet most overlooked challenges in Pakistan's jujube industry is the widespread lack of awareness among farmers. While jujube is a highly profitable crop, many farmers are unable to maximize its potential due to outdated practices, poor post-harvest management, and limited knowledge of market trends.

Instead of evolving with modern agricultural advancements, most jujube growers continue to rely on traditional methods that often result in financial losses rather than gains. Farmers work hard, but due to their limited knowledge of efficient farming and market strategies, they often fail to reap the full benefits of their labor. The result? High production, low returns. Many farmers don't even know how to access market information. Instead of strategically selling their produce when prices are high, they rush to sell during harvest season when prices are at their lowest due to oversupply. Similarly, most jujube growers have no knowledge of value-added processing, which could help them earn more by selling dried or processed jujube instead of relying solely on fresh sales.

### **The Struggles of Jujube Harvesting**

Jujube farming is not as simple as growing fruit and selling it. Harvesting requires a great deal of effort, skill, and proper planning. The fruit is delicate, and improper handling can cause significant damage, reducing its market value. Farmers often lack awareness of the best harvesting techniques, leading to high post-harvest losses. Many still shake trees roughly to make the fruit fall, causing bruises and making the jujube less appealing to buyers.

### **Traditional Mistakes That Continue to Hurt Farmers**

Many jujube farmers repeat the same mistakes year after year, unaware of better alternatives that could improve their yield and profitability. One of the most common issues is improper pruning, where farmers either neglect it entirely or do it incorrectly, leading to lower yields and smaller fruit sizes. Similarly, a lack of knowledge about soil and water management results in inefficient irrigation practices and incorrect fertilizer application, which not only affects fruit quality but also depletes soil fertility over time. Another major problem is the misuse of pesticides and fertilizers, some farmers overuse them, thinking it will enhance production, while others apply too little, failing to provide the necessary

nutrients. In many cases, low-quality fertilizers further worsen the problem, as they do not supply essential nutrients effectively. Additionally, poor harvesting practices remain a widespread issue; some farmers pick the fruit too early, which compromises its taste and nutritional value, while others delay harvesting, causing overripening and shorter shelf life. Storage and packaging are also often overlooked, with many simply piling up jujubes in open crates instead of using proper storage methods to maintain freshness and extend market viability. These repeated mistakes not only reduce the profitability of jujube farming but also threaten the long-term sustainability of the industry. Addressing these issues through awareness campaigns and farmer training programs is crucial to improving production efficiency and ensuring that jujube remains a viable cash crop in Pakistan.

### **Policy Recommendations**

If Pakistan wants to safeguard its jujube industry, immediate policy intervention is essential. The government must establish stable and transparent trade policies to protect farmers from sudden price crashes. One crucial step is developing emergency response mechanisms that provide alternative export routes or government-backed purchase programs during border closures, ensuring that farmers are not left at the mercy of unpredictable trade disruptions. Additionally, strengthening storage and processing infrastructure can enable farmers to hold onto their produce until market conditions improve, preventing them from being forced to sell at unreasonably low prices. Implementing well-structured trade agreements is another vital measure, as it would create a more predictable export environment and minimize unnecessary disruptions. Furthermore, encouraging value-added processing, such as drying or producing processed jujube products, can open new revenue streams, making the industry less dependent on fresh fruit exports. Without these interventions, Pakistan's jujube farmers will continue to struggle with

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instability, despite the crop's high profitability potential.

Furthermore, educating farmers must be a priority. The government, agricultural institutions, and private sector need to step in and provide comprehensive training programs on modern jujube farming techniques to help farmers maximize their yields and improve fruit quality. Workshops on proper harvesting, storage, and transportation methods are essential to minimize post-harvest losses and maintain the freshness of the produce. Additionally, giving farmers access to market insights and price trends can enable them to make more informed selling

Jujube farming is difficult, but it doesn't have to be a constant struggle. With the right awareness, farmers can reduce post-harvest losses, improve fruit quality, and secure higher profits. The potential for jujube in Pakistan is massive, but without proper knowledge and education, that

potential will remain unrealized. It is time to empower farmers with the tools and information they need to transform jujube cultivation from a challenging endeavor into a truly rewarding business.

### Conclusion

The paradox of jujube farming in Pakistan highlights a troubling disconnect between the crop's high profitability and its declining market appeal. While jujube remains a financially rewarding fruit, farmers are trapped in cycles of price instability, outdated practices, and a lack of market awareness. Border closures, limited access to storage facilities, and insufficient knowledge of modern farming techniques continue to threaten the industry's sustainability. If these challenges remain unaddressed, Pakistan risks losing a valuable agricultural sector that has long supported rural livelihoods.

However, solutions exist. Implementing stable trade policies, improving storage

infrastructure, and promoting value-added processing can shield farmers from volatile market conditions. At the same time, investing in farmer education and modern agricultural practices will enhance productivity, fruit quality, and profitability. The future of jujube farming in Pakistan depends on a collective effort—from policymakers, agricultural experts, and farmers themselves—to bridge knowledge gaps, strengthen market resilience, and ensure that this once-beloved fruit regains its place in both local and international markets.

*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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## Wetlands in Sustainable Farming for Climate Resilience

Discover the vital role of wetlands in sustainable farming across Asia. Learn how innovative practices like rice-fish farming and sustainable aquaculture enhance climate resilience, food security, and biodiversity while preserving essential wetland ecosystems.

Shahan Aziz

2/24/2025

Wetlands are among the most productive ecosystems on Earth, offering a diverse range of ecological, economic, and social benefits. These vital ecosystems regulate water cycles, filter pollutants, store carbon, and provide habitat for a wide variety of species. In the context of sustainable agriculture, wetlands play a crucial role by serving as natural reservoirs, reducing the impacts of floods and droughts, and acting as carbon sinks that help mitigate climate change. They also support biodiversity, which is essential for maintaining soil fertility and pest control in farming systems.

Across Asia, where agriculture remains a cornerstone of economic growth and food security, wetlands are being increasingly integrated into farming practices to address climate challenges and enhance productivity. Countries such as China, India, and Bangladesh have adopted wetland-based farming techniques, including rice-fish farming and floating agriculture, which optimize water resources while maintaining ecological balance. These approaches not only improve yields but also provide livelihoods to rural communities, reducing pressure on conventional land-based agriculture.

Pakistan, despite having extensive wetland resources, has yet to fully harness their potential in sustainable farming. Many wetlands in the country remain underutilized due to a lack of awareness, policy support, and scientific research. However, with increasing climate vulnerabilities and water scarcity concerns, integrating wetlands into agricultural systems could provide a sustainable solution to enhance food security, restore ecosystems, and support rural livelihoods.

As the global demand for sustainable agriculture rises, innovative wetland-based farming strategies offer promising opportunities. This article explores the role of wetlands in sustainable farming, examines emerging trends in Asia, and highlights the relevance of these strategies for Pakistan, where wetlands could play a transformative role in ensuring climate-resilient and environmentally friendly agricultural practices.

### Wetlands and Their Role in Sustainable Agriculture

Wetlands contribute significantly to agricultural sustainability by enhancing water retention, improving soil fertility, and mitigating climate change impacts. These natural ecosystems regulate water cycles, filter pollutants, and provide habitat for diverse flora and fauna. Traditional rice farming in Asia, particularly in countries like China, India, and Vietnam, has long relied on wetlands. However, with climate change accelerating extreme weather conditions, their role has expanded beyond conventional agriculture.

A report from the Food and Agriculture Organization (FAO) highlights that wetlands contribute to 20% of global agricultural production, particularly rice, which feeds over half of the world's population. In addition to food production, wetlands store carbon, reducing greenhouse gas emissions, and serve as buffer zones against floods and droughts. For instance, wetlands can absorb excess rainfall during monsoon seasons, reducing the risk of flooding, and release stored water during dry periods, ensuring a steady supply for irrigation.

In Pakistan, wetlands cover approximately 10% of the country's total land area, with significant concentrations in the Indus Delta, Himalayan lakes, and coastal regions. Despite their ecological importance, many of these wetlands are under threat due to urbanization, agricultural expansion, and climate change. According to the World Wildlife Fund (WWF), Pakistan has lost over 60% of its wetlands in the last 50 years, primarily due to unsustainable farming practices and water mismanagement. This loss has had severe consequences for biodiversity, water security, and rural livelihoods.

### Emerging Trends and Strategies in Asia

Asian countries have increasingly recognized the importance of wetlands in sustainable farming, implementing innovative strategies to address environmental challenges while enhancing agricultural productivity. These emerging trends reflect a shift towards integrating ecological preservation with farming practices to ensure long-term sustainability and resilience against climate change. By exploring these approaches, Pakistan can learn valuable lessons and leverage its wetland resources more effectively.

One of the key trends is agroecological farming, which merges traditional agricultural knowledge with modern sustainability techniques to promote biodiversity and maintain ecological balance. Thailand and Indonesia have successfully implemented integrated rice-fish farming, where rice paddies serve as aquatic ecosystems supporting fish populations. This approach minimizes the need for chemical

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fertilizers and pesticides while increasing food security and diversifying farmers' income sources. Fish waste acts as a natural fertilizer, improving soil fertility and reducing input costs. In Pakistan, despite having vast wetland resources, agroecological farming remains underutilized. However, the Indus River Basin, which supports one of the world's largest irrigation networks, presents an opportunity to implement integrated rice-fish farming. By adopting this approach, farmers could enhance food production, lower expenses, and improve their resilience to climate change.

Another emerging strategy is floating agriculture, a practice pioneered in Bangladesh that has gained global recognition as a climate-adaptive farming technique. Farmers construct bamboo rafts covered with organic matter as a planting base, allowing them to grow crops even in waterlogged conditions. This method is particularly beneficial for flood-prone areas, enabling year-round crop production despite extreme weather events. In Pakistan, floating agriculture could provide a viable alternative for farmers in regions like Sindh and Punjab, where seasonal floods frequently disrupt traditional farming practices. By implementing floating farms, communities could ensure food security and economic stability while adapting to climate-induced disasters.

Wetland conservation has also gained importance as a means of carbon sequestration, particularly in China, where the government has integrated wetland restoration into its national climate policy. Over 800,000 hectares of degraded wetlands have been rehabilitated, contributing to reduced carbon emissions and improved agricultural sustainability. Since wetlands act as natural carbon sinks, they play a vital role in mitigating climate change. Pakistan, with its extensive wetland ecosystems, including the Himalayan wetlands and the Indus Delta, has significant potential for carbon sequestration. By restoring and

conserving these wetlands, Pakistan could enhance its climate resilience, reduce its carbon footprint, and improve water retention in agricultural areas, ultimately benefiting farming communities.

Sustainable aquaculture, integrated with wetland management, has also emerged as a crucial strategy in Asian countries such as Vietnam and the Philippines. These nations have developed mangrove-friendly aquaculture systems that preserve coastal wetlands while supporting fisheries. Mangroves provide natural water filtration, reduce soil erosion, and enhance fishery productivity. Pakistan's coastal wetlands, particularly in Balochistan and Sindh, offer immense potential for sustainable aquaculture. Initiatives such as mangrove restoration projects led by organizations like the International Union for Conservation of Nature (IUCN) have already demonstrated positive outcomes in improving fish stocks and protecting coastal communities from climate-induced disasters. Expanding these efforts could further strengthen Pakistan's aquaculture industry while preserving vital wetland ecosystems.

Policy support is crucial for the success of wetland-based agricultural practices. Governments across Asia, such as India and Indonesia, have introduced financial incentives and climate adaptation funds to encourage wetland conservation in agriculture. However, Pakistan's National Wetlands Policy, drafted in 2012, remains largely unimplemented. Revitalizing this policy and providing incentives for farmers to adopt wetland-based farming techniques could significantly enhance food security and environmental sustainability. By learning from successful models in Asia, Pakistan can harness its wetland resources to promote sustainable agriculture and build resilience against environmental challenges.

## Contribution to Climate Change Mitigation and Resource Conservation

Wetlands play a crucial role in climate change mitigation and resource conservation by regulating water availability, acting as carbon sinks, and supporting biodiversity. Their ability to absorb excess water during floods and release it during droughts makes them essential for climate resilience. Additionally, wetlands store significant amounts of carbon, reducing greenhouse gas emissions and contributing to global climate goals.

A compelling example comes from Vietnam's Mekong Delta, where wetland restoration has effectively reduced saltwater intrusion, preserving fertile land for rice cultivation. In China, the Poyang Lake wetlands have been instrumental in maintaining water levels for irrigation, especially during extended dry periods. These cases highlight the importance of wetland conservation in ensuring agricultural sustainability and water security.

In Pakistan, wetlands have the potential to offer similar benefits in mitigating climate change impacts. Haleji Lake and Keenjhar Lake in Sindh, for instance, serve as important water reservoirs for irrigation and drinking water supply. However, these wetlands are increasingly threatened by pollution, industrial waste, and excessive water extraction. Restoring and protecting these ecosystems could significantly enhance Pakistan's resilience to climate change while ensuring the long-term productivity of its agricultural sector.

Beyond climate mitigation, wetlands also support biodiversity by providing habitats for numerous species. According to the FAO, nearly 35% of wetland species in Asia face extinction due to habitat degradation caused by urban expansion and intensive farming. Sustainable wetland management not only restores these ecosystems but also helps safeguard rural livelihoods.

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Pakistan's wetlands, such as the Indus Dolphin Reserve and Chotiari Reservoir, are home to unique species vital for maintaining ecological balance. Protecting these wetlands is essential not only for biodiversity conservation but also for sustaining the fishing and farming communities that rely on them for their economic well-being.

### **Relevance to Pakistan: Challenges and Opportunities**

Pakistan's wetlands remain largely underutilized and are facing significant threats, despite their immense potential for contributing to sustainable farming. Several key challenges hinder their effective use in agriculture. One major issue is water mismanagement, as excessive extraction for irrigation and urban use has led to the degradation of wetlands, reducing their ability to store and regulate water. Additionally, pollution from industrial discharge and agricultural runoff has contaminated many wetland ecosystems, compromising their ecological functions and reducing their capacity to support biodiversity.

A critical challenge is the lack of awareness among farmers and policymakers regarding the potential of wetlands for sustainable agriculture. Many stakeholders underestimate the role of wetlands in improving soil fertility, water retention, and climate resilience. Furthermore, climate change has intensified wetland degradation, with rising temperatures and erratic rainfall patterns threatening their long-term viability.

Despite these challenges, several opportunities exist for integrating wetlands into sustainable farming

practices in Pakistan. Restoration projects, such as the Recharge Pakistan initiative, focus on wetland rehabilitation for water storage and climate resilience. Expanding such efforts could significantly enhance the country's ability to manage floods and droughts while supporting agricultural productivity.

Educating farmers on wetland-based farming techniques presents another opportunity. Training programs could encourage the adoption of sustainable practices, such as integrated rice-fish farming and floating agriculture, which have proven successful in other Asian countries.

Policy implementation also plays a crucial role. The National Wetlands Policy, drafted in 2012, remains largely unimplemented. Enforcing this policy and introducing financial incentives for wetland conservation could drive substantial progress.

International collaboration could further accelerate wetland conservation efforts. Partnering with organizations like the FAO and IUCN would provide Pakistan with technical expertise and financial support, helping to restore and manage wetlands for long-term agricultural and environmental benefits.

### **Conclusion**

The role of wetlands in sustainable farming is increasingly gaining recognition across Asia, offering promising solutions to climate resilience, food security, and biodiversity conservation. As seen in countries like China, India, and Bangladesh, integrating wetlands into agricultural systems through innovative practices such as rice-fish farming,

floating agriculture, and sustainable aquaculture has yielded significant economic and environmental benefits. These strategies enhance agricultural productivity while preserving vital wetland ecosystems, ensuring long-term sustainability.

Pakistan, with its extensive but underutilized wetland resources, stands at a critical juncture where adopting wetland-based farming techniques could address pressing challenges such as water scarcity, soil degradation, and climate change. While issues like water mismanagement, pollution, and lack of awareness hinder progress, opportunities exist in the form of wetland restoration initiatives, farmer education programs, and policy interventions. Strengthening collaborations with international organizations like the FAO and IUCN can further support conservation efforts and provide technical expertise for sustainable wetland management.

As climate change continues to threaten traditional farming systems, leveraging wetlands for agriculture presents a viable and ecologically responsible path forward. By implementing well-designed policies, investing in research, and encouraging farmer participation, Pakistan can harness the full potential of its wetlands to create a more resilient and sustainable agricultural sector.

*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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**RURAL COMMUNITY**

The Agricultural Economist, Vol. 2(2)  
**Bridging Rural Gender Gap in Pakistan**

Bridging the rural gender gap in Pakistan is essential for sustainable economic growth and poverty reduction. Empowering rural women can unlock their potential, improve household well-being, and social progress.

Syeda Hira Batool

2/11/2025

Gender inequality remains one of the most pervasive and persistent barriers to sustainable development worldwide. In Pakistan, this issue is particularly pronounced in rural areas, where women face significant challenges that hinder their full participation in economic, social, and political life. These challenges include limited access to education, healthcare, land, and financial services, compounded by deeply rooted social and cultural norms that restrict their opportunities for personal and economic growth. Rural women play a crucial role in agriculture, livestock management, and household responsibilities, yet their contributions are often undervalued, and they receive little to no financial compensation for their labor. Bridging the rural gender gap is not only essential for achieving gender equality but also for accelerating broader economic development, social inclusion, and environmental sustainability in Pakistan.

One of the key barriers rural women face is restricted access to education. High dropout rates, early marriages, and a lack of educational infrastructure prevent many girls from completing even primary schooling. This lack of education limits their employment prospects, economic independence, and decision-making power within their households and communities. Additionally, poor healthcare services disproportionately affect rural women, with high maternal mortality rates, malnutrition, and limited access to reproductive healthcare contributing to overall gender disparities.

Economic constraints further widen the gender gap. Women in rural Pakistan have limited access to land ownership, agricultural inputs, and credit facilities. Traditional inheritance practices often

exclude women from property rights, leaving them economically dependent on male family members. Moreover, a lack of gender-sensitive governance and policies means that rural women's voices remain largely unheard in decision-making processes.

Addressing these challenges requires a multifaceted approach, including expanding education opportunities, ensuring access to healthcare and financial resources, promoting gender-inclusive policies, and challenging societal norms that reinforce discrimination. Empowering rural women is not just a matter of equity—it is essential for Pakistan's sustainable development and economic growth.

### **The Rural Gender Gap in Pakistan: An Overview**

In Pakistan, the rural gender gap refers to the disparities between men and women in access to resources, opportunities, and decision-making power. These disparities manifest in areas such as income generation, healthcare, education, land ownership, and political participation. Rural women in Pakistan are often more disadvantaged than their urban counterparts, and their contributions to agriculture and the economy are frequently undervalued.

Globally, women in rural areas account for nearly 43% of the agricultural labor force, and in Pakistan, this figure is even higher. According to the Pakistan Bureau of Statistics, women constitute approximately 70% of the agricultural workforce in rural areas, playing a critical role in food production and rural economies. However, despite their significant contributions, rural women in Pakistan face systemic barriers, including limited access to land, credit, and extension services, which restrict

their ability to enhance agricultural productivity and improve their livelihoods.

Bridging the rural gender gap is crucial for achieving the United Nations' Sustainable Development Goals (SDGs), particularly Goal 5: Gender Equality. Empowering rural women in Pakistan is not only a matter of justice but also a key to unlocking the potential of rural communities and fostering broader societal and economic development.

### **Challenges Faced by Rural Women in Pakistan**

One of the primary barriers to gender equality in rural Pakistan is limited access to education. According to UNESCO, Pakistan has one of the highest gender gaps in education globally, with only 13% of rural women having completed secondary education compared to 47% of rural men. Despite government efforts to improve female literacy, socio-cultural barriers such as early marriages, conservative gender norms, and the expectation that girls will prioritize household chores prevent many from attending school. The Economic Survey of Pakistan (2022) indicates that nearly 53% of girls in rural areas drop out before reaching secondary school, significantly reducing their chances of economic independence. Lack of education leads to limited employment opportunities, reinforcing poverty cycles and restricting women's contributions to the economy.

Rural women also face significant healthcare challenges, particularly concerning maternal and reproductive health. According to the Pakistan Demographic and Health Survey (PDHS), the maternal mortality ratio in rural areas is 319 deaths per 100,000 live births, compared to 140 in urban areas.

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A shortage of female healthcare professionals, inadequate medical infrastructure, and restricted mobility due to cultural constraints leave many women without access to essential healthcare. Additionally, only 34% of rural women use modern contraceptive methods, limiting their ability to make informed reproductive choices. Malnutrition remains another critical issue, with 45% of rural women suffering from anemia, affecting their overall health and productivity.

Economic disparities further widen gender inequality in rural Pakistan. Despite comprising nearly 65% of the agricultural workforce, rural women rarely receive financial compensation for their labor, as their contributions are often seen as an extension of household duties. Only 3% of rural women own land, despite their critical role in farming. Legal and social barriers, including male-dominated inheritance practices, restrict women from securing land rights, making it difficult for them to access agricultural subsidies or credit. According to the State Bank of Pakistan, only 7% of rural women have access to formal financial services. Without financial independence, rural women struggle to invest in businesses, expand agricultural activities, or improve their living conditions.

Gender-based violence (GBV) remains a widespread issue in rural Pakistan, with over 90% of women experiencing some form of domestic abuse, according to the Human Rights Commission of Pakistan. Practices such as honor killings, forced marriages, and restrictions on women's mobility further undermine their rights. Due to a lack of awareness and limited access to legal support, many women do not report violence, allowing perpetrators to act with impunity. Social stigmas surrounding GBV also discourage victims from seeking help.

### **The Importance of Bridging the Rural Gender Gap in Pakistan**

Bridging the rural gender gap in Pakistan is not just a matter of equity but a crucial step toward economic growth, poverty

reduction, and sustainable development. According to the World Bank, increasing women's labor force participation could add nearly \$60 billion to Pakistan's GDP by 2025. Rural women contribute significantly to agriculture, comprising nearly 65% of the sector's workforce. However, due to a lack of education, land ownership, and access to financial services, their productivity remains constrained. Providing them with training, resources, and fair wages could enhance agricultural output and household income, reducing poverty across rural communities.

Research shows that when women have control over household resources, they prioritize spending on children's education, nutrition, and healthcare. In Pakistan, households where women manage finances see a 20% increase in child school enrollment rates. Improved female financial empowerment could significantly reduce child malnutrition, which currently affects 40% of rural children under five. Access to better healthcare services for rural women, including maternal health facilities, could lower the maternal mortality ratio of 319 deaths per 100,000 live births and improve overall family well-being.

Environmental sustainability is another key reason for bridging the gender gap. Rural women in Pakistan play a crucial role in managing natural resources and practicing sustainable farming. Studies indicate that providing women with access to modern agricultural techniques could increase farm yields by up to 30%. By incorporating women into climate adaptation strategies, Pakistan can improve food security and resilience against climate change.

Strengthening women's participation in political and social decision-making is equally important. Despite women comprising nearly 49% of Pakistan's population, their representation in rural governance remains minimal.

### **Strategies for Bridging the Rural Gender Gap in Pakistan**

Bridging the rural gender gap in Pakistan requires practical, well-structured strategies to empower women and integrate them into economic and social progress.

Investing in education and vocational training is essential. The government should remove barriers such as school fees, lack of transportation, and safety concerns that prevent girls from attending school. Establishing more girls' schools in rural areas and providing scholarships for higher education can boost female literacy rates. Additionally, vocational training centers focusing on agriculture, handicrafts, digital skills, and entrepreneurship should be expanded, equipping rural women with practical skills to enter the workforce and start businesses.

Strengthening women's land and property rights is another crucial step. Despite legal provisions, social norms often prevent women from inheriting land. The government should launch awareness campaigns about women's inheritance rights and ensure strict enforcement of property laws. Women should also be given access to land ownership programs, agricultural subsidies, and farming technology to enhance productivity. Local authorities can play a role in ensuring that land inheritance disputes are resolved fairly in favor of rightful female heirs.

Expanding access to financial resources can significantly boost women's economic participation. Microfinance institutions should introduce women-friendly loan schemes with lower interest rates and flexible repayment options. Rural banks and financial literacy programs should actively engage women in understanding savings, investments, and credit management. Digital banking and mobile payment solutions should be promoted to give rural women greater financial independence.

Addressing gender-based violence is critical for empowering rural women. The government must increase investment in women's protection

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centers, legal aid services, and helplines for survivors. Community programs should raise awareness about domestic violence laws, and local law enforcement agencies must ensure stricter punishment for perpetrators. Additionally, engaging men and community leaders in gender equality initiatives can help shift cultural attitudes and create safer environments for women.

### Conclusion

Bridging the rural gender gap in Pakistan is not just a moral imperative but a strategic necessity for sustainable economic growth, poverty reduction, and social progress. Rural women form the backbone of the agricultural sector and play a crucial role in household well-being, yet systemic barriers prevent them from reaching their full potential. By

addressing challenges related to education, healthcare, financial inclusion, and land ownership, Pakistan can unlock a vast, untapped economic and social resource.

Investing in education and vocational training for rural women will equip them with skills needed for economic independence, while improved healthcare access will enhance overall community well-being. Strengthening women's land and property rights, coupled with financial empowerment through microfinance and digital banking, can create pathways for sustainable economic development. Moreover, eliminating gender-based violence and ensuring women's participation in governance will lead to more inclusive policies that reflect their needs and aspirations.

Empowering rural women is not just about ensuring fairness; it is a catalyst for national progress. When women thrive, families prosper, communities flourish, and economies grow. Pakistan must take bold steps to bridge the gender gap, ensuring a future where rural women contribute as equal partners in building a stronger, more resilient nation.

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## Rural Infrastructure for Pakistan's Economic Resilience

Explore how well-developed rural infrastructure is vital for Pakistan's economic resilience. Strategic investments in roads, electricity, and digital connectivity can help rural communities thrive despite challenges like climate change and resource constraints.

Arooj Fatima

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Rural infrastructure serves as the backbone of rural economies and plays a crucial role in fostering economic growth, improving livelihoods, and ensuring long-term sustainability. In Pakistan, where nearly 63% of the population resides in rural areas, investing in infrastructure is essential for reducing poverty, enhancing agricultural productivity, and creating new economic opportunities. The development of roads, electricity, water supply, irrigation systems, telecommunications, and social infrastructure like schools and healthcare facilities directly contributes to rural economic resilience and social well-being.

Given that Pakistan's rural economy is heavily reliant on agriculture—contributing 22.7% to GDP and employing 37.4% of the labor force—improving infrastructure can significantly enhance productivity and efficiency. Well-maintained rural roads, for instance, facilitate the transportation of goods to markets, reducing post-harvest losses and increasing farmers' incomes. Reliable electricity supplies support agro-based industries, enabling value-added processing and storage. Investments in water supply and irrigation systems help ensure stable agricultural output, mitigating the risks of droughts and climate variability.

Beyond agriculture, rural infrastructure opens avenues for economic diversification into manufacturing, services, and trade. Expanding digital infrastructure, including mobile networks and broadband internet, can empower rural entrepreneurs by providing access to financial services, e-commerce platforms, and remote

learning opportunities. Improved healthcare and education services contribute to a healthier and more skilled workforce, enhancing labor productivity and long-term economic stability.

Despite its importance, rural infrastructure development in Pakistan faces significant challenges, including funding constraints, inefficient planning, governance issues, and vulnerability to climate change. Addressing these challenges requires a multi-faceted approach, including public-private partnerships, innovative financing mechanisms, and climate-resilient infrastructure planning.

This article explores the significance of rural infrastructure in enhancing economic resilience, identifies critical infrastructure needs, and discusses the challenges and strategies required for sustainable development in Pakistan's rural areas.

### Understanding Economic Resilience and Its Connection to Rural Infrastructure

Economic resilience is the capacity of an economy to withstand, recover from, and adapt to external shocks while maintaining long-term growth and stability. In Pakistan, rural communities are particularly susceptible to natural disasters, climate change, economic downturns, and fluctuations in commodity prices, all of which threaten their livelihoods. The devastating 2022 floods, which impacted 33 million people, destroyed 4.4 million acres of crops, and resulted in economic losses exceeding \$30 billion, underscored the urgent need for resilient rural infrastructure to mitigate such risks.

Rural infrastructure plays a fundamental role in strengthening economic resilience by facilitating recovery, enabling adaptation, and supporting sustainable economic growth. A well-maintained transportation network allows farmers to access markets efficiently, reduce post-harvest losses (which currently account for 15-20% of agricultural output), and lower transaction costs. Improved road connectivity also supports the expansion of rural businesses, encourages tourism, and enhances trade activities.

Similarly, reliable energy and water supply systems are essential for economic diversification. Stable electricity provision fosters the growth of agro-processing industries, small enterprises, and digital services, generating employment beyond agriculture. Meanwhile, efficient irrigation systems ensure water security and climate resilience in farming, reducing dependence on erratic rainfall and mitigating drought risks.

Investing in rural healthcare and education also strengthens resilience by enhancing human capital and productivity. When rural populations have access to quality healthcare, vocational training, and digital skills, they can better adapt to economic transformations and emerging opportunities. Strengthening these infrastructure elements is key to ensuring long-term economic resilience and stability in Pakistan's rural economy.

### Key Components of Rural Infrastructure

The development of rural infrastructure in Pakistan demands a comprehensive

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strategy that integrates multiple interconnected sectors, each playing a vital role in economic resilience and sustainable growth. Improving rural infrastructure can bridge the gap between rural and urban areas, ensuring that rural communities have access to markets, services, and economic opportunities.

Transportation infrastructure is fundamental to rural development, yet nearly 60% of rural roads in Pakistan remain unpaved, making mobility difficult for millions. Poor roads isolate rural populations, limiting their access to markets, education, healthcare, and employment opportunities. Weak transportation networks also raise logistics costs, reducing the competitiveness of rural businesses, particularly in agriculture, which provides 90% of the country's food supply. Investing in all-weather roads and bridges can significantly enhance rural connectivity, improving farmers' market access and reducing post-harvest losses. Large-scale projects under the China-Pakistan Economic Corridor (CPEC) have contributed to improving road networks, but localized infrastructure development is still needed to ensure better regional connectivity. Better transportation not only boosts trade but also attracts investment, creates jobs, and strengthens service delivery.

Water and irrigation infrastructure is another critical pillar of rural development. Agriculture consumes 90% of Pakistan's water resources, yet 60% of farmland relies on rain-fed irrigation, making it highly vulnerable to droughts and erratic rainfall patterns. Enhancing irrigation systems through modern techniques such as drip and sprinkler irrigation can increase water efficiency and boost agricultural productivity. Initiatives like the National Program for Improvement of Watercourses have successfully rehabilitated over 60,000 watercourses, benefiting millions of farmers by reducing water losses and improving irrigation efficiency. Additionally,

access to clean drinking water remains a challenge, with 70% of rural households lacking safe water sources. This leads to severe health consequences and reduces workforce productivity. Expanding water supply systems, including the installation of filtration plants and water storage facilities, can enhance public health, reduce waterborne diseases, and support rural industries.

Energy access is a fundamental driver of economic activity, but 30% of Pakistan's rural population remains without electricity, limiting agricultural efficiency, small business growth, and access to essential services. Electricity is essential for irrigation, food processing, cold storage, and manufacturing, yet unreliable power supply forces many rural businesses and farmers to rely on expensive alternatives like diesel-powered generators. Renewable energy solutions offer a promising alternative. Solar energy projects, such as the Solar Tube Well Program, have installed over 10,000 solar-powered tube wells, reducing operational costs for farmers and improving water access. Expanding off-grid solar solutions and mini-hydropower projects can further promote energy security, supporting small enterprises and enhancing rural livelihoods.

Telecommunications and internet connectivity are becoming increasingly essential for rural economic integration. However, only 34% of Pakistan's rural population has access to the internet, compared to 64% in urban areas. Expanding broadband infrastructure in rural areas can unlock new opportunities in e-commerce, digital banking, online education, and telemedicine. Platforms like Tajir and Bykea are already providing rural entrepreneurs with access to broader markets, while digital payment systems are easing business transactions. Strengthening telecommunications can also improve agricultural extension services, enabling farmers to receive real-time information on weather

conditions, market prices, and pest control measures.

Lastly, investments in healthcare and education are crucial for long-term economic resilience. 70% of rural healthcare facilities are inadequate, leaving communities vulnerable to disease outbreaks and limiting workforce productivity. Additionally, 44% of rural children are out of school, restricting their ability to pursue non-agricultural careers. Strengthening healthcare infrastructure by expanding rural hospitals, mobile health units, and telemedicine services can improve well-being and economic participation. Similarly, investing in rural schools, vocational training centers, and digital literacy programs can equip young people with marketable skills, reducing dependency on agriculture and creating a more diverse rural economy.

A well-developed rural infrastructure is fundamental to boosting economic growth, enhancing resilience, and ensuring long-term prosperity for Pakistan's rural communities.

### **The Impact of Improved Rural Infrastructure on Economic Resilience**

Climate change has significantly altered agricultural practices in Türkiye, disrupting traditional farming cycles and threatening food security. The country has witnessed increasing irregular rainfall, prolonged droughts, and extreme temperature fluctuations, all of which have negatively impacted agricultural productivity. According to the Turkish Statistical Institute (TÜİK), agricultural production declined by 7.6% in 2021, primarily due to erratic weather patterns. Key agricultural regions such as the Mediterranean and Aegean, known for their fruit and vegetable production, have suffered from severe droughts, while the Black Sea region has experienced excessive rainfall and flooding, damaging crops and reducing yields.

Prolonged droughts and rising temperatures have accelerated soil

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degradation and water scarcity, putting further pressure on farmers. A report by the Turkish Ministry of Environment and Urbanization predicts that Türkiye will face a 2-3°C temperature increase by the end of the century, leading to more frequent and intense climate shocks. These changes have already caused a two-week shift in seasonal patterns, affecting planting and harvesting schedules. For example, unseasonably warm winters have led to early blooming in fruit trees, making them vulnerable to late frosts, which significantly reduces yields and causes economic losses for farmers.

To combat these challenges, climate-resilient agricultural strategies—such as drought-resistant crops, efficient irrigation techniques, and precision farming—must be widely adopted. Without urgent action, climate change will continue to disrupt Türkiye's agricultural sector, threatening food security, rural livelihoods, and economic stability.

### **Challenges in Improving Rural Infrastructure**

Improved rural infrastructure plays a crucial role in enhancing economic resilience in Pakistan by enabling rural communities to withstand economic and environmental shocks, adapt to changing circumstances, and take advantage of new economic opportunities. Investments in transportation, irrigation, energy, telecommunications, and social infrastructure have far-reaching impacts that strengthen the rural economy and improve livelihoods.

One of the most significant benefits of improved rural infrastructure is the increase in agricultural productivity. Reliable irrigation systems ensure efficient water use, helping farmers combat droughts and climate variability. Enhanced road networks allow for faster transportation of perishable goods, reducing post-harvest losses, which currently range from 15-20% of total agricultural output. Access to affordable and sustainable energy

sources, such as solar-powered tube wells and cold storage facilities, helps reduce costs and improve yields, increasing farmers' incomes and economic stability.

Infrastructure development also encourages economic diversification, reducing rural communities' reliance on agriculture. Better road connectivity and electricity supply attract investment in small businesses, agro-processing units, and rural manufacturing, creating non-farm employment opportunities. This shift strengthens economic resilience by expanding income sources beyond traditional farming.

Another key impact is greater social and economic inclusion. Access to quality healthcare and education is directly linked to improved infrastructure, reducing inequalities between urban and rural populations. When rural communities have better schools, healthcare centers, and reliable communication networks, they experience higher literacy rates, improved public health, and enhanced workforce productivity, ultimately reducing poverty and improving living standards.

Furthermore, well-connected communities are better prepared to respond to crises such as natural disasters, economic shocks, or pandemics. Strong infrastructure facilitates faster relief efforts, economic recovery, and resource mobilization, making rural economies more resilient and sustainable in the long term.

### **Strategies for Improving Rural Infrastructure**

Improving rural infrastructure in Pakistan requires a multi-faceted approach that integrates government initiatives, private sector investment, community engagement, and sustainable technologies. Several practical strategies can help address existing infrastructure gaps and enhance economic resilience.

Public-Private Partnerships (PPPs) can play a crucial role in mobilizing private

investment and expertise for infrastructure development. The government can offer incentives such as tax breaks and subsidies to attract private firms to build roads, bridges, and renewable energy projects in rural areas. Successful PPP models, such as Sindh's road improvement programs, demonstrate how private investment can enhance rural connectivity.

Community-Led Development ensures that infrastructure projects are tailored to local needs. The government should establish village-based committees to identify priorities, oversee implementation, and ensure transparency in development projects. This approach has proven effective in regions where locally managed water supply systems have improved access to clean water.

International Assistance from organizations like the World Bank and Asian Development Bank (ADB) can provide crucial funding and technical support for large-scale rural infrastructure projects. Pakistan can secure low-interest development loans for transportation networks, irrigation systems, and digital connectivity, ensuring long-term sustainability.

Sustainable Technologies, such as solar-powered water pumps, microgrids for electricity, and digital platforms for market access, can reduce costs, increase efficiency, and minimize environmental impacts. Expanding drip irrigation systems and smart agriculture tools will improve water efficiency and enhance productivity in rural farming communities.

### **Conclusion**

A well-developed rural infrastructure is indispensable for Pakistan's economic resilience, ensuring that rural communities can thrive despite challenges like climate change, economic shocks, and resource constraints. Strategic investments in roads, electricity, irrigation, digital connectivity, and social services are crucial for unlocking the full potential

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of rural economies, enhancing productivity, and diversifying income sources beyond agriculture.

By improving transportation networks, farmers can reduce post-harvest losses, access better markets, and improve trade efficiency. Reliable electricity and water infrastructure foster the growth of agro-processing industries, while digital connectivity enables e-commerce, financial inclusion, and remote education. Additionally, strengthening healthcare and education ensures a skilled and healthier workforce, leading to sustained economic progress.

To overcome funding and governance challenges, Pakistan must adopt a multi-stakeholder approach, incorporating public-private partnerships, community-led initiatives, and international support. Sustainable technologies such as solar energy, drip irrigation, and digital platforms offer cost-effective solutions for enhancing rural infrastructure while minimizing environmental impacts.

A long-term commitment to rural infrastructure development will not only reduce poverty and economic disparity but also strengthen national economic resilience. By prioritizing

inclusive, climate-resilient, and technologically driven solutions, Pakistan can transform its rural economy, ensuring sustainable development and prosperity for future generations.

*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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## Banana Yield Discrepancies in Sindh, Pakistan

Explore the critical challenges in Pakistan's agriculture sector due to discrepancies in banana yield data. Learn about the need for accurate data collection methods and how variations in farming techniques, climate, and market influences affect yield reporting.

Kaldeep Kumar

2/25/2025

Sindh plays a dominant role in Pakistan's banana production, contributing approximately 154,000 tons annually, which accounts for 70% of the country's total output, according to the Pakistan Bureau of Statistics (2023). Within Sindh, Tando Allahyar stands out as a key production hub, responsible for nearly 40% of the province's banana yield. This region has long been a cornerstone of the banana industry, supplying both local and national markets. However, despite its significant contribution, the sector faces multiple challenges that hinder its full potential. Water scarcity remains a pressing issue, with farmers struggling to maintain consistent irrigation due to declining water availability. Soil degradation further complicates matters, as continuous cultivation without proper soil management leads to declining fertility and lower yields. Additionally, limited access to modern agricultural technology prevents many farmers from adopting advanced cultivation methods, restricting productivity growth and making it difficult to compete with global banana-producing regions.

A significant discrepancy exists between reported and officially documented banana yields, leading to concerns about data accuracy and transparency in the agricultural sector. Many farmers in Tando Allahyar claim that their banana fields produce 1,500 Monds per acre per year, a figure that suggests high productivity and efficient farming practices. However, official records from government agencies, NGOs, and research institutions paint a very different picture. According to these sources, the average banana yield in Sindh falls within the range of 200 to 400 Monds per acre per year, far lower than

the figures provided by local farmers. This inconsistency raises several critical questions: Are farmers overestimating their production, or is there a flaw in official data collection methods? Could differences in farming techniques, input usage, or climatic factors explain these variations? Additionally, factors such as post-harvest losses, transportation inefficiencies, and market fluctuations may contribute to the lower official estimates.

Understanding the root cause of these discrepancies is essential for policymakers, researchers, and agricultural extension services. Accurate data is necessary for devising effective policies, ensuring fair pricing, and improving productivity in the banana sector. Addressing this issue requires comprehensive investigation, including independent yield assessments, farmer surveys, and improvements in data collection methods to bridge the gap between reported and recorded agricultural output.

### Why Yield Discrepancies?

A significant discrepancy exists in the reported yield data, with farmers claiming much higher production levels than those documented by government agencies, NGOs, and researchers. Several factors contribute to these variations, including differences in farming techniques, data collection methods, soil fertility, climate conditions, and the role of market intermediaries. Understanding these factors is essential to developing a more accurate picture of banana production in Sindh and addressing the challenges faced by farmers.

One of the primary reasons for yield variation is the difference in farming

techniques. In recent years, some progressive farmers in Tando Allahyar have adopted modern agricultural practices, significantly improving their production. These include the use of tissue culture banana plants, which ensure more uniform growth and higher-quality produce, and efficient irrigation systems like drip irrigation, which optimize water use and reduce wastage. Additionally, improved fertilization methods, including the use of organic compost and balanced nutrient applications, contribute to better plant health. Regular pruning and pest management practices also play a role in maximizing yield. However, many farmers still rely on traditional methods, leading to lower productivity. The yield data reported by official sources may reflect an average that includes both modern and traditional farms, thus underrepresenting the success of high-yield farms.

Another major issue is the lack of updated or comprehensive data collection. Government institutions and research organizations often rely on outdated surveys and estimates rather than direct farm-level observations. Many reports are based on generalized district-wide or province-wide figures that fail to capture real-time changes in agricultural practices. For instance, the Pakistan Bureau of Statistics and provincial agricultural departments collect data periodically, which may not reflect the rapid adoption of improved techniques by some farmers. In contrast, farmers' self-reported data often reflect peak yields under optimal conditions rather than average production over a season. This discrepancy between actual farm-level productivity and broad

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official estimates further fuels the debate over the accuracy of reported figures.

Soil fertility and climate conditions also play a crucial role in banana production. Even within Tando Allahyar, land conditions vary significantly. Some farms are in areas with nutrient-rich soil, sufficient water supply, and favorable climatic conditions, allowing them to achieve higher productivity. Others struggle with soil salinity, water shortages, and temperature fluctuations, which limit their yield potential. According to a 2022 report by Sindh Agriculture University, nearly 30% of the agricultural land in Sindh is affected by salinity, negatively impacting overall agricultural output. Farmers cultivating bananas in less fertile areas are likely to report lower yields, further contributing to the discrepancy in production statistics.

There is also a concern that official reports may underreport production figures due to multiple factors. Some farmers may downplay their actual yields to avoid taxation or government scrutiny, leading to artificially low production statistics. Additionally, government agencies often generalize data, averaging figures across entire districts without distinguishing between high-yield and low-yield farms. In many cases, field surveys are either not conducted frequently or rely on secondary data, making the figures less reliable. On the other hand, some farmers might overstate their production due to personal pride, market competition, or selective reporting of their best harvests rather than an annual average.

The role of middlemen and market influences further complicates the situation. The banana supply chain in Sindh is heavily influenced by intermediaries, known as arthis, who purchase produce at wholesale prices and resell it in urban markets. Some traders and middlemen manipulate production data to control market prices. For example, if lower yields are reported, banana prices may rise,

benefiting traders. Conversely, reports of abundant production may be used to justify lower farmgate prices, negatively affecting farmers. This power dynamic between farmers, middlemen, and market forces plays a crucial role in shaping how production data is reported and perceived.

In conclusion, the variation in banana production statistics in Sindh can be attributed to differences in farming techniques, outdated data collection methods, soil and climate conditions, potential misreporting, and market influences. Addressing these issues requires more accurate data collection through direct farm-level surveys, promoting modern farming techniques among all farmers, and ensuring transparency in market practices. By doing so, stakeholders can work towards a more realistic assessment of Sindh's banana industry, ultimately benefiting farmers, researchers, and policymakers.

### The Way Forward

Bridging the gap between reported and actual banana production figures in Sindh requires a multi-faceted approach involving technological advancements, farmer engagement, policy reforms, and research-based interventions. One of the most effective solutions is the implementation of independent field surveys combined with modern technology-based data collection methods. The use of satellite imaging, GIS mapping, and AI-driven agricultural monitoring can provide real-time insights into production levels, reducing reliance on outdated or estimated figures. By incorporating drones and sensor-based technologies, researchers can obtain precise yield data across different farming regions. Similar methodologies have been successfully implemented by the Food and Agriculture Organization (FAO) in several countries, leading to improved agricultural data accuracy.

Farmer participation in official data collection is another crucial step in improving transparency and reliability. Government agencies, NGOs, and

research institutions should collaborate with progressive farmers to ensure their high-yield practices are accurately reflected in official statistics. Many farmers employing modern techniques are often left out of surveys, resulting in skewed averages that do not represent the true production potential of banana farming in Sindh. Programs such as the Sindh Agriculture Policy 2023 emphasize farmer involvement in policy discussions, but more structured mechanisms are needed to integrate their input into the official data framework. Establishing farmer-led data collection networks, where trained individuals within farming communities help record and verify yields, could be an effective strategy.

Standardizing farming practices across Sindh can also contribute to minimizing production discrepancies. While some farmers have embraced advanced techniques such as tissue culture banana farming, efficient irrigation systems, and organic fertilization, many others continue to rely on traditional methods that yield lower productivity. Expanding agricultural training programs and providing subsidies for adopting modern practices could help bridge this gap. The Sindh Irrigated Agriculture Productivity Enhancement Project (SIAPEP), which has already introduced modern farming techniques to over 50,000 farmers, serves as a model initiative. However, scaling up such efforts and ensuring knowledge transfer across all banana-producing regions will be essential.

Finally, strengthening research and policy interventions is necessary for long-term improvements. Agricultural research institutions like the Sindh Agriculture University and the Pakistan Agricultural Research Council (PARC) require increased funding and support to conduct detailed farm-level studies. These institutions can play a critical role in not only improving data collection methodologies but also in formulating policies that benefit farmers. According to a 2023 PARC report, investments in agricultural research can lead to yield increases of up to 25% in Pakistan. With

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better data-driven decision-making, policymakers can ensure fair pricing, resource allocation, and long-term sustainability for Sindh's banana industry.

### Conclusion

The discrepancies in banana yield data in Sindh highlight a critical challenge in Pakistan's agricultural sector: the need for accurate, transparent, and modernized data collection methods. While farmers in Tando Allahyar report significantly higher yields than official records suggest, the variations can be attributed to differences in farming techniques, data collection limitations, soil and climate conditions, and market influences. Addressing these inconsistencies is essential for making

informed policy decisions, ensuring fair pricing, and supporting the long-term growth of the banana industry.

A comprehensive solution requires the integration of technology-driven data collection methods, independent field surveys, and greater farmer participation in official statistics. Encouraging standardized farming practices and expanding agricultural training programs will help bridge the productivity gap, ensuring that all farmers benefit from modern advancements.

Additionally, strengthening research institutions and increasing investment in agricultural studies will provide the necessary insights to support sustainable growth.

By implementing these measures, Sindh's banana sector can move towards greater accuracy in production data, improved farming efficiency, and enhanced market stability. Reliable statistics will not only benefit farmers but also policymakers, researchers, and consumers, ensuring a more resilient and prosperous agricultural future for the region.

*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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## Public Health Campaigns in Rural Pakistan

Explore how public health campaigns in rural Pakistan tackle healthcare challenges, improve access to medical facilities, and enhance health outcomes through initiatives like telemedicine, vaccination drives, and community health programs.

Tanzila Yasmin

2/28/2025

Public health campaigns play a pivotal role in improving the well-being of rural communities, particularly in countries like Pakistan, where rural areas face significant healthcare challenges. With 63% of Pakistan's population living in rural areas, access to healthcare services remains a critical issue. Rural populations often lack adequate healthcare facilities, with hospitals and clinics located far from their homes. This geographical isolation exacerbates health disparities, making public health interventions not just necessary but lifesaving.

One of the primary objectives of public health campaigns in rural areas is to raise awareness about preventable diseases and promote healthy behaviors. Many rural residents have limited knowledge about sanitation, hygiene, nutrition, and vaccination, increasing their vulnerability to infectious diseases. Public health initiatives, including immunization drives, maternal and child health programs, and sanitation awareness campaigns, help bridge this gap by educating communities about disease prevention and healthcare access.

Furthermore, mobile health clinics and telemedicine services have become essential components of public health outreach in rural Pakistan. These initiatives bring medical expertise directly to remote communities, reducing the burden of travel for patients and ensuring timely diagnoses and treatments. Government programs, along with efforts from non-governmental organizations (NGOs), play a crucial role in delivering healthcare services to underserved populations.

Public health campaigns also address pressing issues such as malnutrition, maternal mortality, and waterborne

diseases, which are prevalent in rural Pakistan. By promoting vaccinations, family planning, and access to clean drinking water, these initiatives significantly improve health outcomes and reduce mortality rates.

Sustained investment in public health infrastructure, along with strong community engagement, is essential for long-term improvements. By prioritizing preventive care and health education, public health campaigns can transform rural healthcare and ensure healthier communities for future generations.

### The Rural Health Landscape in Pakistan

Pakistan's rural areas face a complex set of health challenges that significantly impact the well-being of their populations. One of the most pressing concerns is the high disease burden, with rural communities disproportionately affected by infectious diseases such as tuberculosis (TB), malaria, and diarrheal illnesses. Poor sanitation, lack of clean drinking water, and limited health education contribute to the spread of these diseases. Pakistan accounts for 61% of TB cases in the Eastern Mediterranean Region, and rural populations bear the brunt of this burden due to inadequate healthcare access and delayed diagnoses. Malaria and diarrhea further exacerbate health disparities, particularly among children and the elderly, leading to preventable illnesses and fatalities.

Maternal and child health remains a significant concern in rural Pakistan. Maternal mortality rates are considerably higher in rural areas, standing at 186 deaths per 100,000 live births, compared to lower rates in urban centers. A lack of skilled birth attendants, limited prenatal care, and poor healthcare infrastructure

contribute to these preventable deaths. Additionally, malnutrition is a widespread issue, with 40% of children under five suffering from stunted growth due to inadequate nutrition and food insecurity. These conditions hinder physical and cognitive development, reducing future economic and social prospects for affected children.

Access to healthcare services in rural Pakistan remains severely limited. Only 30% of rural households have access to basic healthcare facilities, in contrast to 50% in urban areas. This disparity is further compounded by a severe shortage of healthcare professionals, with only one doctor available for every 1,300 people in rural regions. Many individuals must travel long distances to receive medical attention, often delaying crucial treatments. Strengthening healthcare infrastructure, increasing the rural medical workforce, and implementing targeted health interventions are essential to addressing these challenges and improving rural health outcomes.

### The Role of Public Health Campaigns

Public health campaigns play a crucial role in addressing healthcare disparities in rural Pakistan by implementing targeted interventions that improve access to medical services, prevent disease, and promote overall well-being. Mobile health units and telemedicine have emerged as effective solutions to overcome geographical barriers that prevent rural populations from receiving timely medical care. These mobile clinics bring essential healthcare services directly to remote communities, reducing the burden of travel for patients. Additionally, initiatives like Sehat Kahani have revolutionized healthcare delivery by using telemedicine to connect rural

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patients with urban doctors, ensuring they receive affordable and timely medical consultations without having to travel long distances.

Vaccination programs remain one of the most cost-effective ways to improve public health, protecting vulnerable populations from preventable diseases. Pakistan's Expanded Program on Immunization (EPI) has made significant progress, particularly in combating polio, reducing cases by 99% since 1994. Routine immunization efforts targeting diseases like measles, hepatitis, and tetanus are essential in rural areas where outbreaks can have devastating consequences. The cost of vaccinating a child is significantly lower than the expenses incurred in treating complications arising from preventable diseases, making immunization a vital strategy for improving public health.

Sanitation and access to clean water are equally critical in preventing disease and improving quality of life. In rural Pakistan, 21% of the population lacks access to clean drinking water, leading to a high prevalence of diarrheal diseases. Simple yet effective interventions, such as distributing water purification tablets and constructing low-cost latrines, can drastically reduce waterborne illnesses and alleviate the strain on healthcare facilities.

Public health campaigns that focus on education and community engagement also contribute to long-term health improvements. Programs promoting hygiene, nutrition, and disease prevention empower communities to adopt healthier behaviors. Community-led sanitation initiatives, for example, have successfully reduced open defecation, leading to better health outcomes and lower disease transmission.

### **Cost-Effectiveness of Public Health Interventions**

Cost-effectiveness in public health is crucial for ensuring that limited resources are utilized efficiently to achieve maximum health benefits. Evaluating interventions based on key metrics, such

as the cost per Disability-Adjusted Life Year (DALY) averted and the cost per life saved, helps determine their impact. For instance, providing insecticide-treated bed nets to prevent malaria costs approximately \$20–40 per DALY averted, making it a highly cost-effective intervention. Similarly, vaccination programs for diseases like measles and polio offer significant health benefits at a relatively low cost, preventing severe illness and reducing mortality rates in vulnerable populations.

In Pakistan, public health initiatives have demonstrated remarkable cost-effectiveness. The Lady Health Worker (LHW) Program is a prime example of an intervention that delivers high returns on investment. By training over 110,000 women to provide essential healthcare services in rural areas, the program has significantly improved maternal and child health outcomes. LHWs help with prenatal care, immunization, and family planning, contributing to lower maternal and infant mortality rates in underserved regions.

Similarly, Pakistan's National TB Control Program has made substantial progress in combating tuberculosis, a major public health concern. Since 2001, the program has successfully treated over 1.6 million TB patients, with treatment costs as low as \$100 per patient. The affordability of TB treatment, coupled with early detection and effective management, has helped curb the disease's spread, saving lives and reducing long-term healthcare costs. These examples highlight the importance of investing in cost-effective public health interventions to improve overall health outcomes in Pakistan's rural communities.

### **Challenges in Rural Healthcare Delivery**

Despite significant progress, rural Pakistan continues to face numerous challenges in delivering effective healthcare. One major obstacle is the geographical barrier. Many rural communities are located far from healthcare facilities, and inadequate transportation infrastructure makes it

difficult for residents to access timely medical care. The long distances and lack of reliable roads often force people to rely on unqualified local healers, delaying essential treatments.

Economic constraints further compound these issues. With nearly 39% of rural Pakistanis living below the poverty line, many families cannot afford healthcare expenses, including doctor visits, medicines, and diagnostic tests. The high cost of private healthcare services pushes rural populations to depend on underfunded public health facilities, which are often overcrowded and ill-equipped.

A critical challenge is the lack of healthcare infrastructure. Many rural areas do not have adequate hospitals, clinics, or diagnostic laboratories, leading to delays in diagnosis and treatment. Patients frequently must travel to urban centers for specialized care, which adds financial and logistical burdens.

Additionally, there is a severe shortage of healthcare workers in rural regions. Many doctors, nurses, and specialists prefer to work in urban areas due to better salaries, career growth opportunities, and living conditions. As a result, rural healthcare facilities are often understaffed, affecting the quality and availability of medical care. Addressing these challenges requires targeted policies, investment in rural healthcare infrastructure, and incentives to encourage medical professionals to serve in underserved areas.

### **Recommendations**

To improve the cost-effectiveness of public health campaigns in rural Pakistan, several strategic interventions should be implemented. First, increasing investment in preventive care is crucial. Strengthening vaccination programs, promoting sanitation initiatives, and expanding health education efforts can significantly reduce the disease burden. Preventive measures, such as immunizations and hygiene awareness, cost far less than treating advanced

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illnesses, making them economically viable solutions.

Leveraging technology is another effective strategy. Expanding telemedicine services and mobile health units can bridge the gap between rural populations and healthcare providers. Telemedicine initiatives, like Sehat Kahani, have already demonstrated success in connecting remote patients with qualified doctors, reducing travel costs and improving timely diagnosis.

Strengthening community health worker programs is essential. Training and deploying more Lady Health Workers (LHWs) can enhance healthcare accessibility by providing maternal and child health services, promoting nutrition awareness, and assisting in disease prevention. These workers serve as a vital link between rural populations and the broader healthcare system.

Improving data collection and analysis can enhance the effectiveness of public health interventions. Using a data-driven approach allows policymakers to identify high-risk areas and allocate resources efficiently, ensuring that interventions are targeted where they are needed most.

Finally, fostering public-private partnerships can maximize resources and expertise. Collaborating with NGOs and private healthcare providers can supplement government efforts, expanding outreach programs and funding innovative solutions. By implementing these strategies, Pakistan can make rural healthcare more accessible, efficient, and cost-effective.

### Conclusion

Public health campaigns are essential in addressing the healthcare challenges faced by rural Pakistan, where limited access to medical facilities, high disease burdens, and economic constraints continue to impact health outcomes. By prioritizing preventive care, leveraging technology, and strengthening community health initiatives, these campaigns have played a critical role in reducing mortality rates, preventing disease outbreaks, and improving overall well-being. Programs such as the Lady Health Worker initiative, vaccination drives, and telemedicine services have demonstrated significant cost-effectiveness, proving that targeted interventions can yield substantial health benefits at minimal costs.

Despite these successes, rural healthcare delivery still faces numerous obstacles, including inadequate infrastructure, a shortage of healthcare professionals, and persistent financial barriers. To overcome these challenges, increased investment in healthcare infrastructure, expansion of telemedicine services, and further integration of community health workers are necessary. Additionally, fostering partnerships between the government, private sector, and NGOs can help mobilize resources and expertise to enhance healthcare accessibility.

Sustained commitment to public health initiatives will be crucial for long-term progress. By focusing on cost-effective strategies, strengthening healthcare systems, and engaging local communities, Pakistan can bridge the healthcare gap between rural and urban areas, ensuring a healthier future for all its citizens.

*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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## Geographical Indications: Boosting Rural Development in Türkiye

Discover how geographical indications (GIs) are transforming rural development in Türkiye by providing economic benefits, enhancing market competitiveness, and preserving cultural heritage. Explore how Türkiye's extensive agricultural & artisanal heritage provides a strong foundation for expansion.

Mithat Direk

2/28/2025

Geographical Indications (GIs) play a transformative role in rural development by providing economic, social, and cultural benefits to local producers and communities. By legally recognizing products with unique qualities linked to their geographical origin, GIs help protect traditional knowledge, strengthen market competitiveness, and create sustainable economic opportunities. In Türkiye, a country known for its rich cultural and agricultural diversity, GIs have emerged as a powerful tool for rural revitalization, benefiting small-scale producers and preserving centuries-old traditions.

Türkiye's rural economy relies heavily on agriculture, artisanal production, and handicrafts, many of which are deeply tied to local landscapes and cultural heritage. With 75% of the country's land classified as rural and about 25% of its population residing in these areas, GIs offer a structured approach to fostering economic development while maintaining regional identity. Certified products such as Antep pistachios, Aydın figs, and Ezine cheese have gained international recognition due to their GI status, ensuring premium pricing, better market access, and protection against imitation.

Beyond economic advantages, GIs contribute to environmental sustainability by encouraging traditional farming methods and biodiversity conservation. They also promote agrotourism, attracting visitors eager to experience authentic local flavors and crafts. Moreover, GI certification empowers rural communities by increasing bargaining power for small-scale producers and creating employment opportunities, particularly for women and youth.

By leveraging the potential of GIs, Türkiye can bridge rural-urban economic gaps, strengthen its agricultural sector, and preserve its cultural heritage. Through strategic policies and market-driven approaches, GIs serve as a sustainable mechanism for fostering inclusive growth and enhancing rural livelihoods, ensuring long-term prosperity for local producers and their communities.

### The Role of Geographical Indications in Rural Development

Geographical Indications (GIs) play a crucial role in strengthening rural economies by protecting products that have a distinct geographical origin and unique attributes. These designations ensure that traditional knowledge, local expertise, and regional resources are preserved while offering rural producers economic opportunities. By linking products to their place of origin, GIs provide a legal framework that safeguards authenticity, prevents imitation, and enhances the reputation of rural goods in both domestic and international markets.

One of the most significant benefits of GIs is their role in preserving cultural heritage. Many rural products have deep historical and cultural roots, reflecting the customs and identity of local communities. These products, whether agricultural goods like Aydın figs and Antep pistachios or handcrafted items like Çini ceramics, represent centuries-old traditions that define regional identities. By protecting such products, GIs ensure that traditional skills and knowledge are passed down through generations, maintaining the authenticity and uniqueness of rural craftsmanship.

Economically, GIs provide rural producers with a competitive advantage by differentiating their products in the market. This recognition allows them to command higher prices, access niche markets, and attract consumers willing to pay a premium for authenticity and quality. In Türkiye, where agriculture remains a vital part of rural livelihoods, GIs have enabled small-scale farmers and artisans to compete in national and global markets, reducing economic disparities between urban and rural areas.

Additionally, GIs contribute to sustainable development by promoting environmentally friendly production methods that prioritize local resources over mass industrial production. By encouraging sustainable farming and artisanal practices, GIs help maintain biodiversity, reduce carbon footprints, and promote responsible consumption. As Türkiye continues to expand its GI portfolio, these protections will play an even more integral role in rural development, supporting economic growth while preserving cultural and environmental integrity.

### Geographical Indications in Türkiye: A Growing Movement

Türkiye's rich cultural and natural heritage provides a strong foundation for the growing movement of Geographical Indications (GIs). With over 2,500 traditional products that could qualify for GI status, the country has recognized the immense value of these designations in preserving authenticity, boosting rural economies, and enhancing global recognition. As of 2023, more than 1,000 products have either been registered or are in the process of gaining GI protection, according to the Turkish

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Patent and Trademark Office (TPE). This rapid expansion highlights Türkiye's commitment to leveraging GIs as a tool for economic development and cultural preservation.

One of the most prominent GI success stories is Antep Baklava from Gaziantep, which received GI protection in 2013. Known for its delicate layers, high-quality pistachios, and unique preparation methods, Antep Baklava has become a global icon of Turkish cuisine. The industry contributes over \$1 billion annually to the local economy, supporting thousands of jobs and reinforcing Gaziantep's reputation as a center of culinary excellence.

Another well-known GI product is Aydın İnciri (Aydın Fig), protected since 2006. Aydın's ideal climate and soil conditions make it the perfect environment for cultivating figs of exceptional taste and texture. The region produces 60% of Türkiye's dried figs, generating export revenues of approximately \$300 million per year.

Trabzon Hurması (Trabzon Persimmon) is another valuable GI-protected product. Grown in the Black Sea region, this fruit is integral to local agriculture, providing farmers with economic stability and contributing to regional tourism. As more Turkish products gain GI status, they not only support rural livelihoods but also strengthen Türkiye's global market presence, ensuring that its traditional goods are recognized and valued worldwide.

### **Economic Impact of GIs in Türkiye**

Geographical Indications (GIs) have a substantial economic impact in Türkiye, particularly in rural areas where they support employment, boost exports, and promote tourism. By protecting and promoting traditional products, GIs create economic opportunities for small-scale producers and artisans, fostering sustainable rural development.

One of the key economic benefits of GIs is job creation, particularly for women and smallholder farmers. The production of Isparta Roses, for example, provides

employment for over 10,000 people, many of whom are women involved in the delicate process of rose harvesting. This employment not only preserves traditional agricultural practices but also empowers rural communities by offering stable incomes and reducing rural-to-urban migration.

GIs also contribute significantly to Türkiye's export potential. The country's agricultural exports reached \$25 billion in 2022, with GI-certified products playing a major role in this success. GI labels enhance the reputation and marketability of Turkish goods, enabling them to compete in international markets and command premium prices. Products such as Aydın Figs, Antep Baklava, and Malatya Apricots have gained strong international recognition, driving demand and increasing export revenues.

Furthermore, GIs encourage rural tourism, which generates additional income for local economies. The Cappadocia Wine Region, known for its unique volcanic soil and ancient winemaking traditions, has experienced a surge in wine tourism. Visitors flock to the region to experience vineyard tours, wine tasting, and local culinary traditions, benefiting local businesses and hospitality services.

Overall, GIs play a crucial role in Türkiye's rural economic landscape by creating employment, boosting exports, and fostering tourism-driven growth.

### **Challenges in Türkiye's GI Journey**

Türkiye's journey in leveraging Geographical Indications (GIs) for rural development is filled with opportunities but also significant challenges. While GIs have the potential to boost local economies, protect cultural heritage, and promote sustainable development, several obstacles hinder their full realization.

One of the primary challenges is awareness and education. Many rural producers are unfamiliar with the benefits of GI registration or the process involved in obtaining protection.

Without proper knowledge, they may miss out on opportunities to enhance the market value of their products. Training programs and outreach initiatives are essential to help small-scale farmers and artisans understand how GI certification can improve their livelihoods.

Another major hurdle is infrastructure and resource limitations. Many rural communities lack modern production facilities, efficient supply chains, and access to wider markets. Without proper storage, transportation, and marketing channels, even GI-certified products struggle to reach their full potential. Investments in rural infrastructure, including processing centers and distribution networks, are crucial to scaling up production and improving competitiveness.

The issue of imitation and fraud also threatens the success of Türkiye's GI products. Counterfeit or misleadingly labeled products dilute the value of genuine GIs, leading to loss of consumer trust and financial losses for legitimate producers. Strengthening enforcement mechanisms, including stricter regulations and monitoring, can help combat the spread of fake GI-labeled goods.

Additionally, the successful implementation of GI policies requires stronger coordination among government agencies, producers, and private sector stakeholders. A unified approach that includes policy support, financial incentives, and collaborative marketing strategies can enhance the effectiveness of GIs as a tool for rural development.

By addressing these challenges, Türkiye can fully harness the potential of GIs, ensuring that rural producers benefit from their cultural and economic heritage while strengthening the country's position in global markets.

### **The Socio-Economic Benefits of GIs**

Geographical Indications (GIs) play a crucial role in enhancing the socio-economic well-being of rural communities by preserving cultural

heritage, boosting consumer confidence, and promoting sustainable agricultural practices. These designations not only protect traditional products but also create economic opportunities that improve the livelihoods of local producers.

One of the most significant benefits of GIs is the preservation of cultural identity. Many traditional crafts, culinary techniques, and agricultural methods have been passed down through generations, forming an integral part of regional heritage. GIs provide formal recognition to these practices, ensuring that they remain valued and continue to be practiced. For example, Türkiye's rich artistic traditions, such as Ebru (marbling) and Çini (ceramic tiles), have been safeguarded through GI protection. This not only supports artisans but also fosters cultural pride and attracts interest from tourists and collectors.

GIs also enhance consumer trust by guaranteeing product authenticity and quality. Consumers increasingly seek products with distinct origins and verified production methods, making GIs a valuable tool in differentiating traditional goods from mass-produced alternatives. The assurance of authenticity encourages customer loyalty, increases market demand, and allows producers to command higher prices. This is particularly important in sectors such as food, beverages, and handicrafts, where quality perception significantly influences purchasing decisions.

Additionally, GIs promote sustainable agriculture by prioritizing local resources and environmentally responsible farming techniques. Many GI-certified agricultural products follow traditional methods that conserve biodiversity and minimize environmental impact. By reducing reliance on industrial farming and chemical inputs, GIs contribute to ecological balance and the long-term viability of rural economies.

Through these socio-economic benefits, GIs serve as a powerful mechanism for

rural development, supporting local producers, strengthening cultural traditions, and fostering sustainable growth in Türkiye's diverse regions.

### **Recommendations for Strengthening GIs in Türkiye**

Strengthening Geographical Indications (GIs) in Türkiye requires a multi-faceted approach that enhances producer awareness, reinforces legal protections, provides financial and technical assistance, promotes rural tourism, and fosters collaboration among key stakeholders. By implementing these strategies, Türkiye can maximize the economic and cultural benefits of its GI-registered products, ultimately supporting rural development and increasing global recognition of its traditional goods.

One of the most important steps is increasing awareness campaigns to educate rural producers about the advantages of GI registration. Many small-scale farmers and artisans remain unaware of the potential economic benefits, including higher market value and better export opportunities. Organizing workshops, seminars, and media outreach initiatives can help producers understand how to navigate the GI registration process and leverage these designations to boost their income.

Strengthening legal frameworks is also essential to prevent imitation and fraud, which undermine the value of GI-protected products. Türkiye should enhance enforcement mechanisms by increasing inspections, imposing stricter penalties on counterfeiters, and improving traceability systems to ensure that only authentic products reach consumers.

Providing financial and technical support can help small-scale producers meet quality standards and expand their market reach. Government grants, low-interest loans, and training programs in modern production techniques and marketing strategies would improve competitiveness and sustainability.

Rural tourism presents another opportunity to capitalize on GIs by creating immersive experiences for visitors. Food festivals, craft workshops, and guided farm tours showcasing traditional production methods can generate additional income for rural communities while preserving cultural heritage.

Finally, fostering public-private partnerships is key to ensuring long-term success. Collaboration between government agencies, NGOs, and private enterprises can facilitate investment, promote GI-certified products in international markets, and support innovation. By strengthening these areas, Türkiye can fully harness the potential of GIs to drive rural economic growth and cultural preservation.

### **Conclusion**

Geographical Indications (GIs) have emerged as a vital instrument for rural development in Türkiye, offering economic, cultural, and environmental benefits to local communities. By protecting region-specific products and linking them to their historical and geographical origins, GIs enhance market competitiveness, support small-scale producers, and preserve centuries-old traditions. Türkiye's extensive agricultural and artisanal heritage provides a strong foundation for expanding GI registrations, with products like Antep Baklava, Aydın Figs, and Isparta Roses already demonstrating significant economic impact.

Despite their potential, challenges such as low awareness among producers, inadequate infrastructure, and the threat of imitation continue to hinder the full realization of GIs. Addressing these issues requires coordinated efforts, including public awareness campaigns, stronger legal enforcement, and financial support for rural producers. Moreover, leveraging GI-certified products for rural tourism can create additional economic opportunities, attracting visitors and boosting local businesses.

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Türkiye stands at a critical juncture in its GI journey. By implementing strategic policies and fostering collaboration among stakeholders, the country can maximize the benefits of its unique products. Strengthening GI protections will not only empower rural communities but also enhance Türkiye's

presence in global markets, ensuring sustainable development and the preservation of its rich cultural heritage for future generations.

*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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**RURAL FINANCE**



## Government Subsidies for Rural Development in Pakistan

Explore how government subsidies in rural Pakistan address economic challenges, enhance agricultural productivity, and improve access to essential services. Learn about their role in poverty alleviation and the importance of proper management for sustainable rural development.

Ayesha Ijaz

2/13/2025

Government subsidies are financial aids or incentives provided by the state to support specific sectors, businesses, or groups within an economy. These subsidies are designed to achieve social and economic objectives such as poverty alleviation, economic growth, employment generation, and addressing market failures. They can take various forms, including direct cash transfers, tax exemptions, subsidized interest rates, and price reductions for essential goods and services. By reducing costs for producers and consumers, subsidies can encourage investment, enhance productivity, and ensure affordability of crucial commodities like food, fuel, and fertilizers.

However, while subsidies play a crucial role in economic and social development, their implementation must be carefully managed. Poorly designed subsidy programs can lead to unintended negative consequences, such as fiscal strain on government resources, inefficiencies in resource allocation, and market distortions that discourage competition and innovation. Moreover, in some cases, subsidies can contribute to environmental degradation, particularly when they promote excessive use of natural resources like water and fossil fuels. Ensuring transparency, proper targeting, and periodic evaluation is essential for maximizing their benefits and minimizing negative impacts.

This article examines the rationale, impact, and effectiveness of government subsidies in Pakistan, with a particular focus on rural areas. Rural regions in Pakistan face significant challenges, including inadequate infrastructure, low household incomes, and a heavy dependence on agriculture. In this

context, subsidies can help improve agricultural productivity, stabilize food prices, and support small-scale farmers in overcoming financial constraints. Targeted interventions, such as fertilizer and seed subsidies, rural electrification programs, and fuel price support, play a crucial role in promoting sustainable and equitable development. However, the long-term sustainability of these subsidies depends on sound fiscal policies and effective governance to ensure that benefits reach the intended recipients without excessive budgetary burdens.

### Why Do Governments Provide Subsidies?

Governments provide subsidies to achieve multiple economic, social, and environmental objectives. These financial incentives play a crucial role in promoting economic development by supporting key sectors such as agriculture, infrastructure, and industry. In Pakistan, where agriculture contributes approximately 22.7% to GDP and employs nearly 37.4% of the labor force, subsidies on fertilizers, high-yield seeds, and irrigation systems help increase productivity and ensure food security. Additionally, government support for infrastructure, such as rural roads, electrification, and water supply systems, enhances market connectivity and boosts economic activity. Industrial growth also benefits from subsidies, particularly in the form of tax incentives and grants for small and medium enterprises (SMEs), which drive job creation and overall industrial expansion.

Another significant reason for providing subsidies is to improve social welfare by making essential goods and services

more affordable for lower-income populations. Programs like Pakistan's Benazir Income Support Program (BISP) provide direct cash transfers to underprivileged households, improving access to education and healthcare. Similarly, subsidized housing initiatives and food assistance programs help reduce poverty and enhance living conditions, especially for marginalized communities. By reducing the financial burden on low-income groups, these subsidies contribute to social stability and human capital development.

Subsidies also help address market failures caused by externalities or information asymmetry. For instance, without government support, investment in renewable energy sources such as solar panels and biogas systems may remain limited due to high initial costs. By offering subsidies, the government encourages clean energy adoption, reducing reliance on fossil fuels and mitigating environmental harm. Likewise, subsidizing public transportation helps make commuting more affordable while reducing congestion and pollution, ultimately benefiting society as a whole.

Enhancing competitiveness in local industries is another important objective of government subsidies. Export subsidies allow domestic industries to sell their products internationally at competitive prices, boosting trade and foreign exchange earnings. Additionally, financial assistance for SMEs strengthens their market presence, improves productivity, and fosters innovation, helping smaller businesses compete with larger firms.

Environmental sustainability is also a key motivation behind subsidies. By

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supporting green initiatives such as afforestation programs, renewable energy projects, and sustainable farming techniques, governments promote environmentally friendly practices. These incentives encourage businesses and individuals to adopt eco-friendly solutions, helping mitigate climate change and ensuring long-term ecological balance.

While subsidies serve as powerful tools for economic and social development, their effectiveness depends on proper implementation, transparency, and regular evaluation to ensure they achieve their intended goals without creating financial burdens or market distortions.

### **Impact of Subsidies on the Economy**

Subsidies play a crucial role in shaping economic outcomes, offering both advantages and disadvantages. On the positive side, subsidies drive economic growth by reducing production costs, enabling businesses to expand and generate employment. For instance, Pakistan's Kissan Package has provided interest-free loans and fertilizer subsidies, significantly boosting agricultural productivity. Additionally, subsidies contribute to poverty reduction by lowering the prices of essential goods and services, making them more accessible to low-income households. Programs like the Ehsaas Program have played a key role in uplifting rural communities by providing financial support and social protection.

Subsidies also foster innovation by encouraging investment in research and development (R&D), particularly in high-tech industries like clean energy and pharmaceuticals. Government funding in these areas enables businesses to develop sustainable solutions that might otherwise be too costly. Moreover, targeted subsidies for rural infrastructure, including electrification and road networks, promote balanced regional development by integrating underdeveloped areas into the broader economy.

Despite their benefits, subsidies can have several negative consequences. A major drawback is the fiscal burden they place on government budgets, leading to deficits and diverting resources from other critical sectors such as healthcare and education. Furthermore, subsidies can distort markets by reducing competition and discouraging efficiency, making industries reliant on government support rather than innovation. Poorly targeted subsidies often fail to reach intended beneficiaries, instead benefiting wealthier groups or inefficient enterprises. Additionally, environmental degradation can result from subsidies supporting fossil fuels or unsustainable farming practices, leading to long-term ecological damage. Therefore, effective policy design and implementation are essential to maximize the benefits of subsidies while minimizing their drawbacks.

### **Effectiveness of Subsidies in Rural Areas of Pakistan**

Subsidies play a critical role in addressing socio-economic challenges in rural Pakistan, where nearly 64% of the population resides. These regions face persistent issues such as poverty, limited infrastructure, and a heavy dependence on agriculture. While subsidies have contributed significantly to rural development, their effectiveness depends on proper targeting, implementation, and long-term sustainability.

Agricultural productivity has improved due to subsidies for essential inputs like seeds, fertilizers, and irrigation. Initiatives such as the Kissan Package have provided much-needed relief to farmers, helping increase crop yields and ensure food security. However, many small-scale farmers still face difficulties in accessing these benefits due to bureaucratic hurdles and limited awareness. Additionally, challenges such as water scarcity and soil degradation continue to hinder agricultural growth, emphasizing the need for integrated policy solutions.

Infrastructure development in rural areas has been supported through subsidies for electrification and road construction. Programs like the Rural Electrification Program by WAPDA have extended electricity access to off-grid communities, improving productivity and living conditions. Enhanced road networks have facilitated market access for farmers and small businesses. However, infrastructure gaps remain, particularly in remote areas where investment is often insufficient.

Access to essential services has improved through programs like BISP and Ehsaas, which provide cash transfers to low-income families. These initiatives have enhanced access to healthcare, education, and nutrition, contributing to poverty reduction. Additionally, subsidized housing and healthcare programs have helped improve living standards, although coverage remains uneven, and many deserving households are still left out.

Energy access in rural areas has expanded due to subsidies for renewable energy projects, particularly solar energy systems supported by the Alternative Energy Development Board (AEDB). These initiatives have reduced reliance on traditional fuels like wood and kerosene, promoting environmental sustainability and improving household well-being.

Support for small enterprises has been facilitated through subsidized loans and training programs, such as the Kamyab Jawan Program, which helps rural entrepreneurs establish and expand their businesses. However, many small businesses still struggle with limited access to credit and markets, reducing the overall impact of these initiatives.

Targeted subsidies, particularly cash transfers and vocational training programs, have contributed to poverty alleviation in rural areas. The Ehsaas Program has played a significant role in providing financial support and skills development opportunities to marginalized communities. While subsidies have improved rural

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livelihoods, ensuring their long-term effectiveness requires better targeting, reduced leakages, and complementary structural reforms.

### Challenges and Recommendations

Subsidies in Pakistan play a vital role in supporting economic development, but several challenges hinder their effectiveness. One of the main issues is inefficient targeting, where subsidies often benefit wealthier individuals or larger landowners rather than the most vulnerable populations. For example, agricultural subsidies frequently favor large-scale farmers, while small-scale farmers struggle to access financial support. This misallocation reduces the intended impact of subsidies on poverty alleviation and rural development.

Environmental concerns also pose significant challenges. Excessive reliance on fertilizer and water subsidies has led to soil degradation and water scarcity, threatening long-term agricultural sustainability. Overuse of subsidized inputs depletes natural resources and reduces soil fertility, ultimately harming small farmers who depend on these resources for their livelihoods.

Many subsidy programs lack sustainability, acting as short-term fixes rather than addressing the root causes of poverty and underdevelopment.

Temporary financial support without broader structural reforms fails to create lasting economic improvements.

To improve the effectiveness of subsidies, a data-driven approach should be adopted to ensure resources reach those who need them most. Digital databases and biometric verification can help eliminate inefficiencies. Additionally, promoting eco-friendly farming practices and renewable energy solutions can make subsidies more sustainable. Investing in long-term solutions such as education, healthcare, and infrastructure will help reduce dependence on subsidies and create a self-sufficient rural economy.

### Conclusion

Government subsidies in rural Pakistan have played a crucial role in addressing economic challenges, enhancing agricultural productivity, and improving access to essential services. By supporting farmers, small businesses, and low-income households, these financial incentives have contributed to poverty alleviation and rural development. However, their effectiveness depends on proper targeting, efficient allocation, and sustainable implementation. Poorly managed subsidies can lead to market distortions, fiscal burdens, and environmental degradation, reducing their long-term impact.

To maximize the benefits of subsidies, the government must adopt a more data-driven approach to ensure that financial assistance reaches the most deserving beneficiaries. Investing in digital tracking systems and biometric verification can help eliminate inefficiencies and prevent leakages. Additionally, integrating environmental sustainability into subsidy programs—such as promoting renewable energy and sustainable agricultural practices—can mitigate negative ecological impacts.

Structural reforms, including improvements in education, healthcare, and infrastructure, are essential to reducing long-term reliance on subsidies. A well-balanced approach that combines targeted financial support with broader economic development policies can create a more self-sufficient rural economy. Ultimately, subsidies should serve as a tool for empowerment rather than dependence, fostering economic resilience and sustainable growth in Pakistan's rural areas.

*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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## Transforming Pakistan's Rural Economy Through Cooperation

Discover how cooperation in agriculture can revolutionize Pakistan's rural economy by tackling low productivity, financial exclusion, and market inefficiencies. Learn from successful cooperative models worldwide and their impact on farmers and rural entrepreneurs.

Lariab

2/18/2025

Cooperation is a fundamental driver of rural economic development, allowing individuals, groups, and communities to collaborate toward shared goals. In rural economies, where access to resources, markets, and financial support is often limited, cooperative models provide a structured approach to overcoming economic hardships and fostering inclusive growth. In Pakistan, agriculture plays a crucial role, contributing 22.7% of the GDP and employing 37.4% of the labor force. However, challenges such as poverty, resource scarcity, fluctuating market prices, and limited access to credit hinder rural progress. By promoting cooperative models, Pakistan can address these systemic issues and empower small-scale farmers, laborers, and rural entrepreneurs.

Cooperatives offer numerous benefits, including improved bargaining power, shared resources, risk mitigation, and better access to financial services. Agricultural cooperatives can enhance productivity by enabling farmers to pool resources, collectively purchase inputs, and access markets more efficiently. Successful global examples, such as India's Amul Dairy Cooperative, demonstrate the transformative power of collective action. Amul has revolutionized India's dairy industry by providing small-scale farmers with fair pricing, technological support, and a stable market, significantly improving rural incomes and food security. Similar cooperative models in Pakistan can help small farmers access better prices, adopt modern agricultural techniques, and reduce their reliance on intermediaries.

Despite the advantages, cooperative models in Pakistan face challenges, including weak institutional support, lack of financial literacy, and governance

issues. Many rural cooperatives struggle with mismanagement and lack of trust among members. Strengthening policy frameworks, providing financial incentives, and promoting awareness about cooperative benefits are essential for their success. By fostering a culture of collaboration and ensuring regulatory support, Pakistan can harness the power of cooperation to create resilient rural economies, reduce poverty, and promote sustainable development.

### Types of Cooperation in Rural Contexts

Cooperation in rural areas takes various forms, each contributing to economic stability, social development, and technological progress. Voluntary cooperation emerges when individuals unite to address shared challenges without external compulsion. Farmers, for example, often establish cooperatives to pool resources, share risks, and improve productivity. In Pakistan, smallholder farmers in Punjab have formed water user associations to manage irrigation systems more efficiently. These associations help distribute water equitably, maintain irrigation channels, and reduce individual costs, ensuring better water management in agriculture.

Economic cooperation plays a crucial role in enhancing financial security and market access for rural communities. By working together, farmers can negotiate better prices, secure loans, and lower production costs. In Sindh, the Anjuman-e-Falah-e-Aama (AFA) cooperatives allow members to collectively purchase agricultural inputs such as seeds and fertilizers while also providing a platform for marketing their produce at competitive rates. Such initiatives reduce

dependency on middlemen, ensuring fair earnings for farmers.

Beyond economic aspects, social cooperation fosters community well-being by addressing fundamental social needs such as education, healthcare, and financial inclusion. In Khyber Pakhtunkhwa, rural women have formed self-help groups to access microloans and start small businesses. These groups provide a support network that enhances financial independence, promotes entrepreneurship, and empowers women to contribute actively to household and community development.

Technological cooperation is another vital aspect of rural progress. When farmers collaborate to adopt modern agricultural technologies, they improve efficiency and competitiveness. In Pakistan's dairy sector, cooperatives have introduced artificial insemination and milk chilling plants, significantly enhancing milk production and quality. By collectively investing in technology, rural communities can increase productivity, reduce waste, and enhance their long-term economic prospects. Cooperation in these various forms strengthens rural resilience and fosters sustainable development across Pakistan.

### Factors Enhancing Cooperative Productivity

Enhancing the productivity of cooperatives requires addressing key factors that influence their efficiency, sustainability, and economic impact. One of the most critical aspects is access to resources, including land, water, and modern agricultural equipment. In Pakistan, only 40% of agricultural land is irrigated, underscoring the importance of cooperative water management. By collectively managing irrigation systems,

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farmers can optimize water use, reduce waste, and increase crop yields. Access to farm machinery and storage facilities further enhances productivity by reducing post-harvest losses and improving efficiency.

Skill development is another crucial factor in strengthening cooperative productivity. Many farmers lack technical knowledge about modern farming techniques, making training programs essential. Organizations such as the Pakistan Agricultural Research Council (PARC) provide cooperative members with training on sustainable farming practices, pest control, and advanced irrigation methods. Educating farmers on these techniques not only boosts productivity but also ensures long-term sustainability.

Financial support is vital for cooperatives to invest in infrastructure, modern equipment, and expansion. However, small farmers in Pakistan face an annual credit gap of \$5 billion, limiting their ability to scale operations. Access to affordable loans and government-backed financial schemes can help cooperatives overcome this barrier and invest in necessary resources.

Market access is another factor that significantly enhances cooperative productivity. By connecting directly with larger markets, cooperatives help farmers reduce their dependence on intermediaries, ensuring better profits. The Hunza Fruit Cooperative Society in Gilgit-Baltistan provides an excellent example by linking fruit growers with national and international buyers, expanding their reach and increasing incomes.

Finally, effective leadership plays a pivotal role in ensuring the success of cooperatives. The experienced management team of the Lal Suhanra Dairy Cooperative in Punjab has successfully optimized resource allocation and decision-making, leading to increased efficiency and profitability. Strengthening these key areas can significantly enhance cooperative productivity in Pakistan's rural economy.

### **Cooperation and Rural Economic Development: The Case of Pakistan**

Cooperation plays a transformative role in Pakistan's rural economy by addressing fundamental challenges such as low agricultural productivity, poverty, gender disparities, and environmental sustainability. One of the most significant benefits of cooperative efforts is their impact on agricultural productivity. By facilitating knowledge sharing, resource pooling, and access to modern farming techniques, cooperatives help farmers enhance crop yields. Pakistan's average wheat yield stands at 2.9 tons per hectare, well below the global average of 3.5 tons. This gap highlights the potential for cooperatives to introduce better irrigation methods, improved seed varieties, and efficient farm management practices to boost productivity.

Poverty alleviation is another critical area where cooperatives make a difference. By ensuring fair pricing mechanisms and stable incomes, cooperative initiatives empower rural households. The Thardeep Rural Development Program (TRDP) in Sindh has demonstrated how collective action can lift thousands of families out of poverty by promoting community-led economic activities.

Women's empowerment is also a key outcome of cooperative models, as they provide rural women with access to financial resources, land ownership, and income-generating opportunities. Despite making up 70% of Pakistan's agricultural workforce, women own less than 5% of agricultural land. Cooperatives can help bridge this gap by supporting women-led farming initiatives and financial inclusion programs.

Additionally, cooperation fosters environmental sustainability by promoting collective water management and climate-smart agriculture. In Balochistan, farmers have formed cooperatives to adopt drip irrigation systems, conserving water while improving agricultural efficiency. Strengthening cooperative frameworks can significantly contribute to sustainable rural economic development in Pakistan.

### **Challenges to Cooperative Development in Pakistan**

The cooperative movement in Pakistan holds immense potential for transforming rural economies, yet it faces numerous challenges that hinder its effectiveness and expansion. A major obstacle is the lack of awareness among farmers regarding the benefits of cooperatives. Many rural households are unfamiliar with cooperative models and how they can improve their economic well-being. Currently, only 15% of rural households in Pakistan participate in cooperative activities, limiting the overall impact of such initiatives.

Poor infrastructure further weakens the effectiveness of cooperatives. Many rural areas suffer from inadequate road networks, insufficient storage facilities, and unreliable electricity, making it difficult for cooperatives to function efficiently. These infrastructural shortcomings contribute to significant post-harvest losses, estimated at \$1.3 billion annually. Without proper transportation and storage solutions, cooperative members struggle to access larger markets and maximize profits.

Limited access to credit is another major hurdle. Small-scale farmers often lack collateral and face high-interest rates, preventing them from obtaining loans necessary for investment in cooperative projects. The agricultural credit disbursement gap in Pakistan is estimated at 40%, leaving many potential cooperative members without financial support to expand their businesses.

Cultural barriers also pose a significant challenge, particularly for women who wish to participate in cooperative activities. In many regions, traditional social hierarchies and gender discrimination limit women's involvement in economic initiatives. For instance, in rural Sindh, women who attempt to join cooperatives often face societal resistance, restricting their ability to benefit from collective economic efforts.

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Additionally, inconsistent government policies and bureaucratic hurdles have slowed the progress of cooperative development. The Cooperative Societies Act of 1925 remains largely outdated and does not address the modern needs of cooperatives in Pakistan. The absence of policy reforms and institutional support has made it difficult for cooperatives to scale up and sustain their operations. Addressing these challenges through targeted awareness campaigns, improved infrastructure, financial inclusion, and policy reforms can significantly enhance the impact of cooperative initiatives in Pakistan's rural economy.

### Global Lessons: The Amul Model

The success of India's Amul Dairy Cooperative offers valuable lessons for Pakistan's cooperative movement, demonstrating how a well-structured model can transform rural economies. Amul operates on a three-tier structure that ensures farmer participation at every level. At the grassroots, village-level dairy cooperatives collect milk from farmers, which is then processed and marketed by district-level unions and a state-level federation. This decentralized approach allows farmers to retain control over decision-making while benefiting from economies of scale. A similar model in Pakistan's dairy sector could help smallholder farmers increase productivity and profitability.

Another key factor behind Amul's success is its strong brand identity and marketing strategies. Through consistent quality assurance and innovative advertising campaigns, Amul has become a household name, not just in India but internationally. By adopting similar branding strategies, Pakistani cooperatives could enhance market access for rural producers, ensuring better prices and higher incomes. Developing a strong brand presence for locally produced dairy, grains, and fruits could enable Pakistani farmers to compete in both domestic and export markets.

Amul has also played a significant role in empowering millions of dairy farmers, particularly women. By providing fair

prices, training, and access to financial services, Amul has improved rural livelihoods and promoted gender inclusivity. Pakistan can take inspiration from this model to increase women's participation in cooperatives, enabling them to contribute more effectively to the rural economy.

Beyond Amul, other international examples highlight the benefits of cooperative models. The Kibbutz system in Israel has successfully integrated agricultural production with industrial enterprises, creating self-sustaining rural communities. This model emphasizes shared ownership and collective decision-making, ensuring that profits are reinvested into community development. Similarly, Pakistan could explore cooperative structures that integrate agriculture with agro-processing industries, adding value to raw produce and generating employment.

Kenya's dairy sector also provides a noteworthy example. The Kenya Dairy Board has supported cooperative societies, allowing smallholder farmers to access cold storage facilities, improve milk quality, and negotiate better prices. Through such interventions, Kenya has increased milk production and strengthened rural incomes. Pakistan's dairy cooperatives could benefit from similar initiatives, particularly in improving storage and processing capabilities to reduce post-harvest losses.

By learning from these global success stories, Pakistan can develop a more resilient cooperative sector, fostering sustainable rural development, increasing agricultural productivity, and improving livelihoods across the country.

### Policy Recommendations

To fully harness the potential of cooperatives for rural economic development, practical steps must be taken to address existing challenges. Increasing education and awareness about the benefits of cooperatives is crucial. Government agencies, NGOs, and agricultural extension services should conduct training programs and awareness

campaigns, particularly targeting small farmers and rural entrepreneurs. Radio broadcasts, community meetings, and mobile-based learning platforms can effectively disseminate this information to remote areas.

Improving infrastructure is essential to support cooperative activities. Investments should be made in building better roads to facilitate the transportation of goods, establishing storage facilities to reduce post-harvest losses, and developing cold chain networks for perishable products like dairy and fruits. Public-private partnerships can play a key role in financing these initiatives.

Financial inclusion is another priority. The government should collaborate with banks and microfinance institutions to offer low-interest loans and flexible repayment options to cooperative members. Subsidies on essential inputs such as seeds, fertilizers, and livestock feed can further enhance cooperative productivity. Establishing a cooperative development fund would provide long-term financial support for struggling cooperatives.

Reforming outdated policies and simplifying bureaucratic procedures can make it easier for cooperatives to register and operate. The Cooperative Societies Act should be updated to align with modern economic needs, and a digital platform should be introduced for cooperative registration and compliance to minimize red tape.

Ensuring inclusive participation is vital for equitable growth. Women, small-scale farmers, and marginalized groups should receive targeted support through training, leadership development programs, and access to cooperative memberships. Special incentives can be provided to cooperatives that actively involve women and disadvantaged communities.

By implementing these practical measures, Pakistan can strengthen its cooperative sector, improve rural livelihoods, and pave the way for sustainable economic development.

**Conclusion**

Cooperation has the potential to transform Pakistan's rural economy by addressing key challenges such as low agricultural productivity, financial exclusion, and market inefficiencies. By working together, farmers and rural entrepreneurs can gain better access to resources, technology, and financial services, ultimately improving their livelihoods. The success of cooperative models in other countries, such as India's Amul, Kenya's dairy cooperatives, and Israel's Kibbutz system, highlights the significant economic and social benefits of collective action.

Despite its advantages, the cooperative movement in Pakistan faces challenges such as weak institutional support, lack of awareness, inadequate infrastructure, and financial constraints. Addressing these issues requires targeted policy interventions, including education and training programs, investments in infrastructure, access to affordable credit, and legal reforms to facilitate cooperative development. Additionally, ensuring inclusive participation by women and marginalized groups can enhance the impact of cooperative initiatives and create a more equitable rural economy.

By strengthening cooperative frameworks and fostering a culture of collaboration,

Pakistan can improve agricultural productivity, reduce poverty, and promote sustainable development. With the right policies and support systems in place, cooperatives can serve as a powerful tool for rural economic transformation, ensuring long-term prosperity and resilience for farming communities.

*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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## Transforming Financial Inclusion for Farmers in Sindh

Rural cooperatives in Sindh can revolutionize financial inclusion for smallholder farmers by providing essential credit, savings, and insurance services. Strengthening these cooperatives help farmers break free from reliance on informal lenders, invest in better farming techniques, and enhance.

Abdul Baseer

2/19/2025

Financial inclusion plays a vital role in fostering economic development, especially in rural areas where access to formal banking remains scarce. In Sindh, Pakistan, smallholder farmers make up a significant portion of the agricultural workforce, yet they often struggle to secure financial resources essential for purchasing quality seeds, fertilizers, and modern farming equipment. Limited access to credit also hinders their ability to scale up operations, invest in value-added processes, and build resilience against economic shocks such as climate variability and fluctuating market prices. Without adequate financial support, these farmers remain trapped in subsistence farming, unable to transition toward commercial agriculture.

Rural cooperatives have emerged as a key mechanism for addressing this financial gap by offering tailored credit, savings, and insurance products. Unlike traditional banks, cooperatives operate within communities, ensuring that financial services are more accessible and customized to the needs of smallholder farmers. They also promote collective bargaining power, enabling farmers to secure better prices for inputs and higher returns for their produce. In Sindh, expanding the cooperative model could empower farmers with the resources necessary to adopt improved agricultural practices, enhance productivity, and achieve long-term financial stability.

Successful cooperative models from other countries offer valuable insights for Sindh's rural economy. In China, agricultural cooperatives have significantly improved access to credit and technology for small farmers, leading to higher productivity and rural development. Similarly, in the United

States, farm credit cooperatives provide affordable financial services, ensuring that farmers can sustain and expand their businesses. By adopting best practices from these models—such as transparent governance, digital financial services, and government-backed funding—Sindh can develop a more robust and inclusive financial system that benefits smallholder farmers, enhances agricultural output, and contributes to broader rural economic growth.

### The Need for Financial Inclusion in Rural Sindh

Agriculture remains the backbone of Sindh's economy, contributing around 23% to the province's GDP and employing nearly 42% of its workforce. Despite its significance, the rural population, particularly smallholder farmers, continues to struggle with financial exclusion, limiting their ability to invest in better inputs, modernize farming techniques, or protect themselves from economic shocks.

A major challenge is the limited access to formal banking institutions. Over 70% of Sindh's rural population lacks banking services due to the absence of infrastructure in remote areas. Most banks operate in urban centers, making it difficult for rural farmers to access financial resources without traveling long distances. As a result, they remain reliant on informal financial sources.

High interest rates and stringent loan requirements further exacerbate the problem. Commercial banks typically demand collateral and impose interest rates that smallholder farmers cannot afford. Since most of them own small landholdings or work on leased land, they fail to meet the eligibility criteria for formal credit. This forces many to turn to

informal moneylenders, who charge exorbitant interest rates—often ranging between 50% and 100% annually—trapping farmers in cycles of debt.

Another pressing issue is low financial literacy. Many farmers are unaware of available financial products, digital payment solutions, or government-backed credit schemes. Without proper knowledge, they hesitate to engage with formal financial institutions, missing out on opportunities to improve their livelihoods.

Additionally, climate change poses significant financial risks. Sindh experiences frequent droughts, floods, and unpredictable weather patterns that disrupt agricultural productivity. These climate shocks reduce farm income, making it even more critical for farmers to have access to financial tools like crop insurance and emergency credit.

### Role of Rural Cooperatives in Financial Inclusion

Rural cooperatives play a crucial role in improving financial inclusion for smallholder farmers in Sindh by providing tailored financial services that address their unique challenges. These cooperatives help farmers access affordable credit, encourage savings, facilitate group lending, and enhance financial literacy, ultimately strengthening the rural economy.

One of the most significant contributions of cooperatives is providing credit facilities at lower interest rates than informal lenders. For instance, the Sindh Cooperative Bank has extended loans to over 10,000 smallholder farmers at interest rates as low as 12%, which is significantly more affordable than the exorbitant rates charged by informal



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moneylenders. Unlike commercial banks that demand collateral and impose rigid repayment conditions, cooperatives offer flexible repayment options based on seasonal earnings, making it easier for farmers to repay their loans. A successful example of such a model is China's Rural Credit Cooperatives (RCCs), which have effectively provided affordable loans to small farmers, reducing their reliance on informal lenders and increasing agricultural productivity. Sindh could replicate this model with adequate government support.

In addition to credit, cooperatives encourage savings and investment by promoting savings schemes that allow farmers to build financial security. The Thar Cooperative Society in Sindh has introduced savings programs where farmers contribute small amounts regularly, which can later be used for emergencies or reinvestment in farming operations. A similar approach is seen in the United States' Farm Credit System (FCS), where agricultural cooperatives enable farmers to pool their savings and reinvest in essential infrastructure, ensuring long-term financial resilience. Adopting such mechanisms in Sindh could significantly improve farmers' financial stability.

Group lending and risk-sharing mechanisms further enhance financial inclusion by reducing default risks. Many cooperatives operate on the principle of mutual assistance, where members guarantee each other's loans, eliminating the need for individual collateral. In Sindh, the Hala Cooperative Society has successfully implemented a group lending model that has benefited over 500 farmers by providing collateral-free loans. This model has proven effective in other regions as well, ensuring that small farmers can access credit without the burden of traditional banking requirements.

Beyond financial services, cooperatives play a key role in capacity building and financial literacy. Many organizations,

such as the Sindh Agriculture and Forestry Workers Coordinating Organization (SAFWCO), conduct training sessions on financial management, budgeting, and modern agricultural techniques. These initiatives have improved financial literacy among more than 15,000 farmers in the province, empowering them to make informed financial decisions and better manage their resources. Increased financial awareness leads to more efficient farming practices, higher yields, and improved livelihoods.

To protect farmers from climate-related risks, cooperatives have also introduced agricultural insurance services. The Sindh Community Foundation, for instance, has launched insurance products that safeguard farmers against losses from droughts, floods, and other natural disasters. These initiatives have already benefited over 2,000 farmers in flood-prone areas of Sindh. A successful model to consider is China's cooperative-backed agricultural insurance programs, which are supported by government subsidies and provide farmers with financial protection against unpredictable climate events.

Furthermore, cooperatives promote market access and fair pricing by helping farmers bypass exploitative middlemen. The Sindh Abadgar Board has facilitated market linkages for over 1,000 farmers, ensuring they receive fair prices for their produce. A global example is Friesland Campina in the Netherlands, a cooperative that connects farmers to international markets, ensuring competitive prices and sustainable trade practices.

### **Challenges Faced by Rural Cooperatives in Sindh**

Rural cooperatives in Sindh have the potential to significantly enhance financial inclusion and economic development. However, they face several challenges that hinder their effectiveness and expansion.

One of the primary challenges is limited financial resources. Many cooperatives

struggle with inadequate funding, restricting their ability to provide sufficient loans, invest in better infrastructure, or expand their operations. Without financial backing, these cooperatives cannot offer competitive services, making it difficult for farmers to rely on them as a sustainable alternative to informal lenders.

Governance issues also pose a significant challenge. Poor management practices, lack of transparency, and instances of corruption reduce trust among cooperative members. Many cooperatives lack trained personnel who can efficiently manage funds and implement effective financial policies. As a result, mismanagement often leads to inefficiencies and financial losses.

Low membership participation further weakens cooperatives. Many farmers are unaware of the benefits of cooperative membership or hesitate to join due to previous negative experiences with poorly managed cooperatives. The lack of trust in these organizations prevents them from reaching a larger segment of the farming community.

Regulatory hurdles create additional barriers. The bureaucratic process involved in registering and operating a cooperative is often complex, time-consuming, and costly. Moreover, insufficient government support limits their ability to grow and function effectively.

Technological barriers also restrict the efficiency of rural cooperatives. Many still rely on traditional record-keeping methods, which are prone to errors and inefficiencies. The adoption of digital tools and financial technologies remains slow due to a lack of training and resources.

Lastly, lack of infrastructure such as poor roads, inadequate storage facilities, and weak market linkages reduces the overall effectiveness of cooperatives. Without proper transportation and storage solutions, farmers face difficulties in accessing markets, leading

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to post-harvest losses and lower profits. Addressing these challenges through targeted policy support, financial investment, and capacity building can help cooperatives realize their full potential.

### Policy Recommendations

To strengthen rural cooperatives in Sindh and enhance their role in financial inclusion, a multi-pronged policy approach is necessary. The government should introduce targeted financial aid, low-interest credit lines, and tax incentives for cooperatives. Establishing a Cooperative Development Fund could provide initial capital for struggling cooperatives, enabling them to expand services and support smallholder farmers more effectively. Regular training programs should be introduced for cooperative leaders and members to improve governance, financial management, and operational efficiency. Institutions like the Sindh Institute of Rural Development could conduct workshops on cooperative management, digital finance, and market strategies to enhance the skill set of cooperative members.

Leveraging mobile banking, digital wallets, and blockchain technology can improve transparency and accessibility. Cooperatives should collaborate with telecom companies and fintech firms to enable mobile-based savings and loan applications, reducing dependence on paper-based systems. Public-private partnerships are also essential, as banks, fintech companies, and development organizations can work with cooperatives to expand financial services. The State Bank of Pakistan can encourage commercial banks to develop

cooperative-focused lending programs, making credit more accessible to small farmers.

Simplifying cooperative registration, reducing bureaucratic red tape, and implementing strict governance regulations will build trust among farmers and encourage participation. Reviewing and updating the Sindh Cooperative Act can align it with modern economic needs. Investment in rural infrastructure, including better roads, cold storage facilities, and internet access, will improve market access and operational efficiency. Allocating funds for cooperative-managed storage centers can help reduce post-harvest losses, ensuring better profitability for farmers. Raising awareness through radio, community meetings, and social media can educate rural communities about the benefits of cooperatives. Showcasing successful cooperative models from countries like China and the United States can encourage participation and long-term sustainability. By implementing these measures, rural cooperatives in Sindh can become more effective in driving financial inclusion and fostering rural economic development.

### Conclusion

Rural cooperatives in Sindh have the potential to transform the financial landscape for smallholder farmers by providing accessible credit, savings, and insurance services. Their ability to operate within local communities and offer tailored financial products makes them a crucial tool for improving financial inclusion. By strengthening these cooperatives, farmers can break free from reliance on informal lenders,

invest in better farming techniques, and enhance their productivity. However, realizing this potential requires overcoming significant challenges, including financial constraints, governance issues, low membership participation, regulatory barriers, and inadequate infrastructure. Addressing these hurdles through targeted policy interventions, financial support, and technological advancements can significantly enhance the effectiveness of cooperatives.

The role of government and private sector collaboration is essential in making these cooperatives more resilient and sustainable. Public-private partnerships, digital financial solutions, and investment in rural infrastructure will be key to expanding their reach and ensuring long-term viability. Additionally, learning from global best practices and implementing transparent governance structures can build trust among farmers, encouraging greater participation. With well-structured policies and adequate support, rural cooperatives can drive economic empowerment, improve agricultural productivity, and contribute to broader rural development in Sindh. Strengthening these institutions is not just a financial necessity but a crucial step toward achieving inclusive and sustainable economic growth.

*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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## Boost Rural Economy with Digital Payments

Discover how digital payments are transforming rural economic inclusion by providing access to financial services. Learn about mobile banking and fintech innovations that empower communities and foster growth.

Muhammad Hamza Khan

2/26/2025

Economic inclusion, particularly in rural regions, plays a fundamental role in achieving sustainable development by ensuring that individuals and communities have access to financial resources and opportunities. Historically, rural populations have faced significant challenges in accessing formal financial services due to geographical constraints, lack of infrastructure, and limited banking facilities. However, the rise of digital payments has emerged as a transformative force, helping bridge the financial divide between rural and urban areas. By enabling seamless and secure transactions, digital payment systems provide rural communities with greater access to financial services, fostering economic growth and stability.

The rapid advancement of technology, along with increasing internet penetration and widespread smartphone adoption, has revolutionized the way rural economies function. Digital payment solutions such as mobile banking, fintech applications, and digital wallets have empowered individuals by providing them with convenient, low-cost, and efficient financial transactions. These innovations not only enhance economic participation but also promote financial literacy and independence among rural populations.

In countries like Pakistan, where rural communities often struggle with financial exclusion, digital payments offer a promising solution to drive economic empowerment. By reducing dependence on cash-based transactions and informal lending systems, digital financial services contribute to poverty alleviation, enhance savings opportunities, and improve access to credit. Expanding digital payment infrastructure in rural areas will be essential in fostering long-term economic resilience and sustainable development.

### The Need for Economic Inclusion in Rural Areas

Rural communities in many developing nations, including Pakistan, face systemic challenges such as widespread poverty, inadequate infrastructure, and limited access to financial services. According to the World Bank, approximately 1.4 billion adults globally remain unbanked, with the majority residing in rural areas of developing countries. In Pakistan, the situation is particularly concerning, with only 21% of adults having access to formal financial services, as reported by the State Bank of Pakistan in 2021. This lack of access to formal financial systems restricts individuals' ability to save, borrow, and invest, perpetuating cycles of poverty and economic disparity. Without access to banking services, rural communities remain reliant on informal and often exploitative financial practices, further deepening financial instability.

Economic inclusion ensures that individuals and communities have access to affordable financial services and products that facilitate savings, investments, and entrepreneurship—critical components for sustainable economic empowerment. Bridging the financial gap for rural populations can lead to improved livelihoods, increased business opportunities, and overall economic stability. In this context, digital payment systems have emerged as a game-changer, offering rural communities the tools they need to participate in the broader economy. These systems eliminate the need for physical banking infrastructure, allowing users to perform transactions from their mobile phones or digital platforms, thereby increasing financial accessibility and security.

Digital payment systems encompass a diverse range of platforms and technologies, including mobile wallets, online banking, QR codes, and peer-to-peer payment apps. Across the globe, successful examples such as Kenya's M-Pesa, India's Aadhaar-enabled payment systems, and China's Alipay have demonstrated the transformative potential of digital payments in driving financial inclusion. These digital financial solutions have significantly increased the number of people who can access banking services, making it easier for individuals and businesses to send, receive, and save money without traditional banking barriers.

In Pakistan, the adoption of digital payments has been steadily increasing, driven by government initiatives, private sector innovations, and growing internet penetration. Mobile banking platforms such as JazzCash and Easypaisa have expanded financial services to millions of unbanked individuals, particularly in rural areas. Government efforts like the "Raast" payment system introduced by the State Bank of Pakistan further promote digital financial inclusion by facilitating instant and low-cost transactions. These advancements not only enhance economic participation but also contribute to reducing income inequality and improving overall financial security for rural communities. By continuing to expand digital financial infrastructure, Pakistan can move closer to a more inclusive and equitable economy.

### Key Drivers of Digital Payment Adoption in Rural Areas:

One of the primary drivers of digital payment adoption in rural areas is the increasing penetration of smartphones and internet connectivity. As the cost of smartphones continues to decline and

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mobile broadband coverage expands, more rural communities can access digital financial services. In Pakistan, mobile broadband subscriptions reached 101 million in 2022, with a penetration rate of 46%, according to the Pakistan Telecommunication Authority (PTA). This growth has made digital payment solutions more accessible to rural populations, allowing them to engage in cashless transactions conveniently. The availability of affordable smartphones has further accelerated this trend, bridging the digital divide between urban and rural communities.

Government initiatives have also played a crucial role in promoting digital payments and financial inclusion. Pakistan's National Financial Inclusion Strategy (NFIS) aims to expand access to financial services, particularly in underserved areas. The introduction of Raast, an instant payment system developed by the State Bank of Pakistan, has facilitated secure, low-cost digital transactions, making it easier for rural communities to participate in the formal financial system. These efforts demonstrate the government's commitment to reducing reliance on cash transactions and encouraging digital financial solutions.

Private sector innovations have further contributed to the adoption of digital payments in rural areas. Banks and fintech companies have developed user-friendly digital payment solutions tailored to meet the specific needs of rural populations. Easypaisa and JazzCash, the two leading mobile wallet providers in Pakistan, have extended their services to remote regions, enabling millions of rural users to conduct transactions, pay bills, and access savings and credit facilities through mobile platforms. The convenience and security offered by these digital wallets have significantly increased financial participation among rural communities.

Financial literacy programs have also been instrumental in driving digital payment adoption. Many rural populations are unfamiliar with digital transactions and often hesitate to switch from traditional cash-based systems.

Organizations like Karandaaz Pakistan have implemented educational initiatives to raise awareness about the benefits of digital payments, teaching rural users how to use mobile wallets and other financial technologies effectively. These programs have helped build trust in digital payment systems, ensuring that more rural households can take advantage of the financial opportunities provided by digital inclusion.

### **Benefits of Digital Payments in Rural Economic Inclusion**

Digital payments play a crucial role in promoting financial inclusion and economic empowerment in rural areas. One of the primary advantages is providing access to formal financial services. Many rural residents lack physical bank branches in their communities, making it difficult to store, transfer, or receive money securely. Mobile wallets and digital payment apps offer a practical solution by allowing users to conduct financial transactions conveniently from their mobile devices. This digital access is particularly beneficial for unbanked populations, as it opens pathways to savings, credit, and insurance opportunities, helping them build financial resilience.

Another significant benefit is the reduction in transaction costs. Traditional banking services often require rural individuals to travel long distances to access financial institutions, incurring transportation costs and lost income due to time spent away from work. Digital payment systems eliminate these barriers by enabling remote transactions, reducing both time and expenses. Mobile money services allow users to send and receive payments instantly, eliminating the need for costly and time-consuming cash handling.

Digital payments also promote entrepreneurship by providing small and micro-business owners in rural areas with fast and secure payment options. Farmers, artisans, and vendors can now accept digital transactions, broadening their customer base and reducing dependency on cash. This shift encourages business

growth and enhances economic opportunities in rural communities. By integrating digital payment systems, small enterprises can access financial records, making it easier to qualify for loans and expand their businesses.

Furthermore, digital transactions contribute to increased transparency and accountability. Every electronic payment creates a record, reducing the chances of financial fraud, corruption, and fund mismanagement. Governments can use digital payment systems to distribute subsidies and welfare payments directly to recipients, ensuring funds reach the intended beneficiaries without intermediaries. In Pakistan, government programs such as the Ehsaas and Benazir Income Support Programme (BISP) leverage digital payments to provide financial assistance to millions of low-income individuals, improving the efficiency and impact of social welfare initiatives.

Financial empowerment of women is another critical advantage of digital payments. Women in rural areas are often more financially excluded than men, lacking direct control over household finances. Digital payment systems offer women greater financial independence by allowing them to manage their own accounts, receive direct transfers, and participate more actively in economic activities. Initiatives like BISP have been instrumental in empowering women by providing financial aid through digital means, helping bridge the gender gap in financial inclusion.

Additionally, digital payments enhance economic resilience during crises. The COVID-19 pandemic underscored the importance of contactless transactions in maintaining economic continuity. With lockdowns restricting movement and physical banking, digital platforms enabled people to continue financial transactions, ensuring businesses could operate and families could access essential funds.

Lastly, digital payments improve efficiency in agricultural supply chains. Farmers can receive payments directly

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from buyers and suppliers without delays, ensuring smoother transactions and faster access to working capital. This efficiency reduces the risk of payment defaults and strengthens rural economies by improving cash flow within the agricultural sector. By adopting digital financial solutions, rural communities can experience sustained economic growth, financial security, and greater participation in the formal economy.

### **Challenges in Implementing Digital Payments in Rural Areas**

Despite the potential of digital payments to drive financial inclusion and economic growth, several challenges hinder their widespread adoption in rural areas. One of the most significant barriers is digital literacy. Many rural residents, particularly those with limited education, struggle to use smartphones and digital payment applications. A lack of familiarity with mobile banking, security protocols, and transaction procedures discourages them from adopting digital financial services. Bridging this knowledge gap through targeted financial literacy programs and hands-on training is crucial to increasing adoption.

Infrastructure limitations also pose a significant obstacle. Many rural areas suffer from poor internet connectivity and unreliable electricity supply, both of which are essential for the smooth functioning of digital payment systems. Inconsistent network coverage and frequent power outages can make digital transactions inconvenient or inaccessible. Expanding mobile broadband services and improving energy infrastructure are critical steps toward ensuring seamless digital payment experiences in rural regions.

Another major challenge is the lack of trust in digital financial systems. Many rural populations are unfamiliar with digital payments and harbor concerns about fraud, cyber threats, and financial losses. Stories of scams and failed transactions further fuel their apprehensions. Establishing strong consumer protection mechanisms, enhancing cybersecurity, and conducting

awareness campaigns to educate users about secure digital transactions can help build trust and encourage usage.

High transaction fees present another barrier to adoption. While digital payments can reduce overall costs associated with cash transactions, some mobile payment platforms charge fees for money transfers and withdrawals. For low-income users in rural areas, these additional costs can be discouraging. Lowering or subsidizing transaction fees, particularly for small-value transactions, would make digital payments more accessible to economically disadvantaged groups.

Language and user interface barriers further complicate adoption. Most digital payment platforms are designed in major languages such as English or Urdu, which may not be easily understood by rural populations who speak regional dialects. Complex user interfaces can also be intimidating for first-time users. Simplifying mobile applications, incorporating visual guides, and offering multilingual support can make digital payments more inclusive and user-friendly.

Policy and regulatory constraints also create hurdles in the adoption of digital payment solutions. Inconsistent regulations, unclear policies on digital transactions, and bureaucratic delays in licensing for service providers can slow progress. Establishing clear, supportive policies that encourage innovation while ensuring consumer protection is essential for fostering a thriving digital payments ecosystem.

Lastly, limited merchant acceptance remains a key issue. Many small businesses and informal vendors in rural areas are hesitant to accept digital payments due to a lack of knowledge, infrastructure, or concerns about taxation and transaction fees. Expanding merchant awareness programs, providing financial incentives, and integrating easy-to-use digital payment solutions can encourage greater participation, creating a more comprehensive and efficient digital financial ecosystem in rural communities.

Addressing these challenges will be crucial in ensuring the successful implementation of digital payment systems and unlocking their full potential for rural economic inclusion.

### **Case Studies of Successful Digital Payment Adoption**

Several countries have successfully leveraged digital payment systems to drive financial inclusion, particularly in rural areas. These case studies highlight how innovative solutions can empower underserved populations and stimulate economic growth.

Kenya's M-Pesa has been a game-changer in mobile financial services. Launched by Safaricom in 2007, M-Pesa allows users to deposit, withdraw, transfer money, and make purchases using their mobile phones, without needing a bank account. This system has transformed Kenya's economy by providing millions of rural residents with access to financial services. M-Pesa has facilitated business transactions, improved savings, and enabled seamless money transfers, reducing reliance on cash. Its success has made Kenya a global leader in mobile money adoption.

India's Aadhaar-Enabled Payment System (AEPS) has significantly improved financial accessibility for rural populations. By using biometric authentication linked to Aadhaar (India's national identification system), individuals can conduct transactions without a smartphone or physical bank card. This system has been particularly beneficial in delivering government subsidies, pensions, and wages directly to beneficiaries, reducing corruption and ensuring timely disbursements. AEPS has played a crucial role in promoting financial inclusion in India's vast rural landscape.

China's digital transformation, driven by platforms like Alipay and WeChat Pay, has deeply integrated digital payments into everyday life. These platforms have extended financial services to rural areas by enabling farmers and small businesses to participate in e-commerce. Rural

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entrepreneurs can now sell their products online, receive payments instantly, and access credit facilities, enhancing their financial security and economic opportunities.

Ghana's mobile money revolution, led by MTN Mobile Money, has significantly boosted financial inclusion. Mobile money services allow rural residents to perform transactions securely, reducing dependence on cash. The widespread adoption of mobile payments in Ghana has improved access to banking services, promoted small business growth, and contributed to poverty reduction.

These case studies demonstrate that well-designed digital payment systems can drive rural financial inclusion, support economic development, and improve livelihoods worldwide.

### Strategies for Enhancing Digital Payment Adoption in Rural Areas

Enhancing digital payment adoption in rural areas requires a multifaceted approach that addresses infrastructure gaps, financial literacy, security concerns, and regulatory support. A combination of public and private sector efforts can accelerate the transition to a cashless economy, empowering rural communities with greater financial inclusion.

Investing in infrastructure is a critical first step. Governments and private entities must work together to expand internet connectivity and improve electricity supply in remote areas. Public-private partnerships can help bridge this infrastructure gap, making digital payment systems more accessible.

Promoting digital and financial literacy is equally important. Many rural residents are unfamiliar with digital payment platforms, making education campaigns essential. Interactive workshops, mobile tutorials, and community engagement initiatives can equip individuals with the necessary skills and confidence to use digital financial services effectively.

Developing inclusive payment systems that cater to diverse user needs is another key strategy. Digital platforms should

feature intuitive interfaces, multilingual support, and minimal transaction costs to encourage widespread adoption. Innovations such as voice-assisted payment systems can further enhance accessibility for non-literate users.

Strengthening security measures is essential to building trust in digital transactions. Implementing robust security protocols, such as encryption and two-factor authentication, can protect users from fraud. Awareness campaigns should educate users about safe digital payment practices, further enhancing security.

Policy and regulatory support from governments is necessary to create a conducive environment for digital payments. Clear regulations, tax incentives for service providers, and subsidies for rural digital infrastructure can encourage financial technology innovations and ensure consumer protection.

Leveraging local networks can also drive adoption. Community leaders, cooperatives, and self-help groups can act as trusted intermediaries, helping rural populations transition to digital financial systems.

Encouraging private sector collaboration between fintech companies, banks, and mobile operators can lead to tailored solutions for rural communities. These partnerships can lower costs, improve service quality, and expand digital payment outreach.

Developing offline payment solutions, such as NFC-based and SMS-based transactions, can address connectivity challenges. These technologies ensure seamless transactions, even in areas with unreliable internet access, further promoting financial inclusion.

By implementing these strategies, digital payment adoption in rural areas can be significantly enhanced, leading to greater economic participation, improved financial security, and long-term economic growth.

### Conclusion

Digital payments have emerged as a powerful tool for promoting rural economic inclusion, providing individuals with access to financial services that were previously out of reach. By reducing dependence on cash transactions, digital payment systems enable rural communities to participate more actively in the formal economy, fostering economic growth, entrepreneurship, and financial security. The expansion of mobile banking, fintech innovations, and government-backed digital payment initiatives has demonstrated the potential to bridge the financial divide between rural and urban areas.

Despite the evident benefits, challenges such as inadequate infrastructure, digital illiteracy, security concerns, and limited merchant acceptance must be addressed to ensure widespread adoption. Investments in internet connectivity, electricity supply, and financial education will be crucial in overcoming these barriers. Additionally, developing user-friendly payment solutions, strengthening cybersecurity measures, and implementing inclusive policies can enhance trust and encourage greater participation in digital financial systems.

Collaboration between governments, the private sector, and local community leaders is essential in driving digital payment adoption. With continued efforts to expand digital financial services, rural populations can achieve greater financial independence, improve their livelihoods, and contribute to national economic development. By embracing digital payments, rural communities can pave the way for a more inclusive and resilient financial future.

*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 AND NUTRITION**

## Food Security in Pakistan: A Holistic Approach

Addressing food security in Pakistan requires a holistic approach that integrates technology, policy reforms, and community participation. Climate change and economic instability pose significant challenges, demanding immediate strategic planning to enhance food availability and stability.

Kaldeep Kumar

2/17/2025

Food security means ensuring consistent availability, accessibility, and stability of safe and nutritious food for maintaining a healthy and active life. In Pakistan, food security remains a pressing concern, affecting millions due to factors such as population growth, climate change, economic instability, and inefficient agricultural practices. According to the National Nutrition Survey 2018, 36.9% of Pakistanis face food insecurity, while 18% of children under five suffer from acute malnutrition. Moreover, the Global Hunger Index 2022 ranked Pakistan 99th out of 121 countries, underscoring the gravity of the situation. The crisis is further exacerbated by inflation, natural disasters, and supply chain disruptions, making essential food items unaffordable for many.

To combat these challenges, a comprehensive and multi-sectoral approach is essential. Improving agricultural productivity through better irrigation systems, high-yield crop varieties, and efficient land use can help enhance food availability. Strengthening food distribution networks and ensuring affordability through subsidies or social safety nets can improve accessibility, particularly for vulnerable communities. Additionally, modern food preservation techniques, including dehydration, freezing, and vacuum packaging, can minimize food waste and improve year-round availability. Innovative solutions like the utilization of dehydrated fruits and vegetables offer a practical approach to addressing seasonal shortages, reducing spoilage, and enhancing nutritional intake.

Government interventions, coupled with public-private partnerships, can play a crucial role in tackling food insecurity. Investing in sustainable agricultural

policies, climate-resilient crops, and farmer education programs can significantly improve food production. At the same time, raising awareness about nutrition, balanced diets, and food storage practices can promote healthier consumption habits. By integrating these strategies, Pakistan can move toward a more secure and sustainable food system, ensuring that all citizens have access to safe and nutritious food.

### Challenges to Food Security in Pakistan

Pakistan faces numerous challenges to food security, with climate change, economic constraints, post-harvest losses, and agricultural inefficiencies severely affecting the country's ability to provide adequate food for its population. Ranked among the top ten most vulnerable countries to climate change, Pakistan experiences rising temperatures, erratic rainfall, and prolonged droughts, all of which reduce agricultural productivity. The devastating 2022 floods destroyed over 4.4 million acres of farmland, drastically lowering crop yields and worsening food shortages. Additionally, water scarcity is a growing crisis, as Pakistan's per capita water availability has plummeted from 5,260 cubic meters in 1951 to just 1,000 cubic meters in 2023, according to the Pakistan Council of Research in Water Resources (PCRWR).

Post-harvest losses further exacerbate food insecurity, with 30-40% of fruits and vegetables wasted annually due to inadequate storage and inefficient supply chains. The Pakistan Agricultural Research Council (PARC) estimates that these losses cost the country around \$1.3 billion each year, a significant burden on an already strained food system. Economic challenges also play a crucial

role, as soaring inflation and widespread poverty limit access to nutritious food. The World Bank reports that nearly 39.3% of Pakistan's population lives below the poverty line, while food inflation surged to 47.1% in May 2023, making basic food items unaffordable for many.

Agricultural inefficiencies add to the crisis, with outdated farming techniques, reliance on seasonal crops, and inefficient irrigation systems leading to low productivity. Pakistan's wheat yield per hectare stands at 2.9 tons, significantly below the global average of 3.5 tons, according to the Food and Agriculture Organization (FAO). These challenges highlight the urgent need for sustainable agricultural policies, technological advancements, and improved infrastructure to enhance food security in Pakistan.

### Dehydrated Fruits and Vegetables: A Sustainable Solution

Dehydrated fruits and vegetables offer a sustainable solution to food security challenges while simultaneously addressing environmental concerns. This method extends the shelf life of perishable produce, preventing large-scale spoilage and significantly reducing post-harvest losses. In Pakistan, where nearly 40% of fruit production is wasted due to inadequate storage and transportation, dehydration can ensure year-round availability of essential food items. For instance, mangoes, one of Pakistan's major fruit exports, often suffer from high wastage rates. By dehydrating surplus mangoes, both domestic consumption and exports can be enhanced, reducing food loss and increasing farmers' earnings.

Beyond economic benefits, dehydration contributes to environmental



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sustainability. Unlike conventional food storage methods that rely on refrigeration, dehydration requires minimal energy, reducing carbon emissions and overall environmental impact. This is particularly beneficial in Pakistan, where frequent power shortages and high fuel costs make cold storage an impractical option for many small-scale farmers. By adopting dehydration techniques, farmers can preserve their harvest with minimal energy use, ensuring food availability without adding pressure to the already strained energy sector.

Additionally, dehydrated fruits and vegetables provide an affordable and nutrient-rich alternative to fresh produce. They retain most of their nutritional value, offering essential vitamins and minerals in a compact and easily transportable form. This is especially critical for remote and underserved communities, where access to fresh produce is often limited. For example, dehydrated potatoes and tomatoes can be stored for extended periods and rehydrated when needed, ensuring a steady supply of vital nutrients. Moreover, during food crises caused by climate-induced disasters, dehydrated foods can serve as an emergency food reserve, reducing dependency on costly imports. Investing in dehydration technology can strengthen Pakistan's food security, enhance agricultural resilience, and support sustainable food systems.

### Policy Recommendations

To enhance food security in Pakistan, a multi-faceted approach involving both the government and the private sector is essential. One of the most effective strategies is investment in food preservation technologies, particularly dehydration units, which can significantly reduce post-harvest losses. Establishing regional dehydration plants in agricultural hubs such as Multan and Faisalabad has already shown promising results, enabling farmers to extend the shelf life of

perishable produce and minimize waste. Expanding this initiative nationwide could further enhance food availability and stability.

Public awareness campaigns are equally crucial in promoting the benefits of dehydrated food among farmers and consumers. Incorporating dehydration training modules into existing programs like the Prime Minister's Agriculture Emergency Program can help farmers adopt best practices, ensuring that surplus produce is effectively preserved rather than wasted. Additionally, the government can incentivize food processors and farmers by providing subsidies and financial assistance for setting up dehydration units. Offering tax exemptions and low-interest loans can further attract private sector investment, making the technology more accessible to small-scale farmers.

Beyond domestic food security, Pakistan can also benefit from expanding its presence in the global processed food market, valued at \$2.1 trillion in 2022. By promoting the export of dehydrated food products, the country can generate foreign exchange and improve farmers' socio-economic conditions. Finally, implementing sustainable agricultural practices, such as precision farming and modern irrigation techniques, can increase crop yields and resilience to climate change. Drip irrigation systems, for example, have been shown to reduce water usage by up to 60% while boosting crop yields by 20-30%, as evidenced by successful pilot projects in Sindh and Balochistan. These combined efforts can ensure a more resilient and food-secure Pakistan.

### Conclusion

Addressing food security in Pakistan requires a holistic and sustained approach, integrating technological advancements, policy reforms, and community participation. The challenges posed by

climate change, economic instability, and inefficient agricultural practices demand immediate attention and long-term strategic planning. Without intervention, rising food insecurity will continue to threaten millions, exacerbating malnutrition and economic hardship. However, by implementing innovative solutions such as food dehydration, precision agriculture, and improved irrigation systems, Pakistan can enhance food availability and stability.

Investing in dehydration technology presents a particularly promising solution, mitigating post-harvest losses while ensuring year-round food accessibility. Encouraging farmers to adopt modern preservation methods, supported by government incentives and private sector involvement, can strengthen the country's food supply chain. Additionally, integrating sustainable agricultural practices and promoting high-yield crop varieties can boost production while reducing resource wastage. Strengthening food distribution networks and social safety programs will further ensure that vulnerable communities can access nutritious food at affordable prices.

Ultimately, tackling food insecurity in Pakistan requires a collaborative effort among policymakers, agricultural experts, and local communities. Through a combination of targeted investments, policy support, and public awareness, Pakistan can build a resilient and sustainable food system, securing a healthier and more prosperous future for its people.

*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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## Functional Foods: A Solution for Health & Sustainability

Discover how the integration of functional foods into modern diets can combat chronic diseases while promoting a sustainable food system. Learn about the health benefits and environmental impact of these innovative foods.

Areej, Mian Kamran Sharif, Tabana Naz & Maira Abdul Razzak

2/19/2025

The prevalence of chronic diseases is rising globally, accounting for about one-third of the adults suffering with various chronic illnesses. The main etiology behind these chronic illnesses are bad irregular dietary regimes and health system should implement a holistic dietary interventional strategy to fight against chronic diseases. The food a person chooses to eat has a strong impact on his health and affects the environment. Foods that contain components other than their basic nutritional profile are termed as functional foods. These foods are essential to include in diet because they bridge the gap between individual's well-being and healthy planet. A sustainable food system must ensure the consumption of functional foods in daily diet as it contributes to developing a better lifestyle and brings sustainability in the environment. Adding functional foods in daily diet reduces the prevalence of chronic diseases and helps improve public health, ensuring healthy future generations.

The modern world has witnessed the upsurging of metabolic disturbance, gastrointestinal and cardiovascular diseases. The reason behind this high prevalence is poor lifestyle behaviors and bad dietary choices. Greenhouse gas emissions, deforestation, soil erosion, and water wastage are the main environmental challenges that are facing by the planet today. A holistic interventional strategy that will ensure environmental sustainability and improve health and well-being, must be implemented to resolve these environmental challenges. Accessibility and affordability in the food system will provide promising results in combating acute and chronic diseases because when every person is accessible to healthy

food, the risk of getting acute and chronic diseases will be reduced. Functional foods are one of the types of sustainable diets containing bioactive substances and provide benefits beyond basic nutrition. The addition of functional foods into daily meals will help the meal to become balanced and it can actively support public health and create a sustainable ecosystem.

Dietary supplements are products containing nutrients and are meant to supplement a person's diet, and they are not developed to treat or prevent chronic diseases. They are essential because it reduces nutritional deficiencies and supports overall health and quality of life, but consuming functional foods are more beneficial because they are more than just dietary supplements. Functional foods, commonly referred to as nutraceuticals, are gaining popularity owing to their many functionalities. They improve health quality and diminish illness risk. The notion of designer foods originated in the 1980s and was controlled by the Ministry of Health and Welfare in Japan, subsequently expanding to North America and other international markets. The worldwide market for these meals is consistently developing and is anticipated to attain 91 billion USD. Clinical investigations, both in vivo and in vitro, have shown that the intake of functional meals aids in the prevention or mitigation of several chronic conditions, including cancer, cardiovascular conditions, neurological disorders, and gastrointestinal tract ailments. The health benefits arise from the presence of bioactive chemicals in many dietary products, although in minimal quantities. Though in little amounts, it reduces inflammation and

sickness and promotes health and well-being.

The demand for functional foods is increasing and in response, the food industry has increased the variety of functional products that are more accessible and appealing to a wide range of consumers. Although the sustainability of functional foods is increasing, it is also equally important that consumers have the knowledge necessary to make informed choices. Awareness and education are equally important in achieving environmental sustainability. When people are aware of the physiological benefits of functional foods, they can effectively incorporate them into their daily meals that ultimately ensure a balanced diet, promoting both environmental sustainability and individual's health.

### Sustainability Through Functional Food Innovation

Sustainability in the food system fulfils the needs of the present without risking the capacity to meet the needs of future generations and it comprises of economic sustainability, social sustainability, and environmental sustainability. Human health and ecological balance are the priority of sustainable food systems. The objectives of functional foods are to promote the consumption of nutrient-dense, minimally processed foods that help in achieving environmental sustainability. Sustainable dietary practices encourage the consumption of whole grains, cereals, legumes, nuts, and seeds while minimizing the dependency on livestock farming. Plant-based functional foods such as nuts and seeds are locally grown and cultivated using various methods that are eco-friendly, and it can drastically lower our carbon footprints

and reduce the strains on natural ecosystem.

Development of food technology has a big impact on the future of functional foods. Researchers develop nutrient-dense food sources that use fewer natural resources by using various cutting-edge techniques such as precision fermentation, cellular agriculture, and biofortification. Plant-based dairy alternatives provide a sustainable and gut-friendly choice, while functional snacks made from seeds offer both nutrition and a reduced carbon footprint when compared to typical packaged meals. Moreover, innovation needs the right ecosystem and innovative food production technologies like 3D food printing and vertical farming are paving the way for a more sustainable food industry by diminishing waste and improving resource efficiency.

### **Empowering Consumers for a Healthier Future**

The provision of education and awareness to the consumers is very important because it will help in achieving ultimate goals to create sustainable environment and better lifestyle. The food we choose to eat matters, and it will greatly impact on our health and the environment. The collaboration between health organizations, NGOs, food industries, and government will help achieve sustainability in a shorter time because it will provide power and strength to the food system. Public health campaigns should focus on the benefits of functional foods and their role in sustainability, while the food manufacturers should focus on their work and provide ethical food handling and transparent labelling. Sensory evaluation of the food must be address before its availability to all the socioeconomic groups. Taste preferences, cost of the product and regulatory constraints must also be addressed to ensure safety and security. Establishing a food system having affordable and accessible nutritious alternatives will help in achieving better

nutrition and environmental sustainability.

### **A Vision for the Future: Functional Foods as a Catalyst for Change**

With ongoing advancements in nutrition research, food processing technology, and sustainable agriculture, functional foods are set to revolutionize dietary habits and public health. Researchers are constantly exploring the intricate relationship between diet and well-being, uncovering new ways in which food can act as both nourishment and medicine. Soon, we can expect the development of personalized functional foods, tailored to meet individual nutritional and health needs based on genetic profiles, lifestyle, and medical history.

A sustainable food system that prioritizes functional foods presents an opportunity to move away from high-calorie, nutrient-depleted processed foods that contribute to obesity and chronic diseases. Instead, functional foods rich in bioactive compounds, vitamins, and essential nutrients can help mitigate health risks, boost immunity, and enhance overall well-being. By incorporating these nutrient-dense foods into our daily diets, we are taking proactive measures toward a healthier and more resilient future.

Beyond individual health benefits, the widespread adoption of functional foods supports sustainable agriculture by encouraging biodiversity, reducing environmental degradation, and promoting eco-friendly food production methods. Every food choice we make impacts both our bodies and the planet, making it essential to shift towards a balanced, functional diet that prioritizes long-term health over short-term convenience.

Now is the time to correct poor dietary habits and make informed decisions about what we consume. By embracing functional foods, we can build a future where nutrition and sustainability go hand in hand. Every meal is an opportunity to nourish us and contribute

to a healthier world. The integration of functional foods into mainstream diets will not only improve public health but also drive positive changes in food systems globally, ensuring a better quality of life for future generations.

### **Conclusion**

The integration of functional foods into modern diets presents a powerful solution to the rising prevalence of chronic diseases and environmental degradation. By embracing functional foods, we are not only improving individual health but also contributing to a more sustainable food system that reduces environmental strain. The growing awareness of the physiological benefits of these foods, combined with advancements in food technology and sustainable agriculture, reinforces their role as a catalyst for positive change in both nutrition and environmental conservation.

A holistic approach that includes education, accessibility, and affordability will empower individuals to make informed dietary choices, ensuring a shift from nutrient-poor processed foods to nutrient-dense, bioactive-rich functional foods. Sustainable dietary practices, such as reducing reliance on livestock farming, promoting plant-based nutrition, and adopting innovative food production technologies, will help create a resilient and resource-efficient food system.

The future of functional foods is promising, offering personalized nutrition and a pathway to a healthier population. As consumers, industries, and policymakers work together, we can drive a meaningful transformation toward a healthier, more sustainable world. Every meal is an opportunity to nourish both we and the planet, ensuring better health and well-being for 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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**PUBLIC HEALTH ECONOMICS**

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**Boosting Sanitation in Rural Pakistan**

Improving sanitation in rural Pakistan is essential for public health and offers significant economic benefits. Enhanced sanitation leads to reduced healthcare costs, increased productivity, better labor efficiency, and increased infrastructure investments.

Aimen Younas

2/6/2025

Improving sanitation in rural communities is not merely a public health priority but also an economic imperative for Pakistan. With nearly 35% of rural households lacking access to improved sanitation facilities, the consequences of poor sanitation are far-reaching and multifaceted. Rural areas, which contribute significantly to Pakistan's economy—with agriculture accounting for 24% of GDP and employing 37.4% of the workforce bear the dual burdens of health hazards and reduced economic productivity.

Poor sanitation leads to increased prevalence of waterborne diseases such as diarrhea, cholera, and dysentery, placing immense pressure on already limited healthcare resources in rural regions. This, in turn, results in lost labor productivity and higher medical expenses, diverting funds that could otherwise be invested in local development. Studies indicate that every dollar invested in sanitation improvements can yield up to \$4.3 in economic benefits, largely due to decreased healthcare costs and enhanced productivity.

Moreover, inadequate sanitation adversely affects educational outcomes. Children in rural areas often miss school due to illness, which exacerbates the literacy gap between urban and rural populations. UNESCO reports that rural literacy in Pakistan stands at only 49%, compared to 74% in urban centers, and improved sanitation can play a crucial role in bridging this divide by reducing disease incidence and promoting consistent school attendance.

Long-term economic development is also closely tied to environmental sustainability. Proper sanitation reduces

environmental degradation, preserving water resources and soil fertility essential for agriculture. Cleaner environments support higher crop yields and more stable agricultural production, further contributing to food security and rural economic resilience. By investing in sustainable sanitation infrastructure, Pakistan can not only improve public health outcomes but also foster a more vibrant, economically robust rural sector, ensuring prosperity for future generations.

#### **Healthcare Savings**

Poor sanitation is a major contributor to a wide range of waterborne diseases such as diarrhea, cholera, and dysentery. In rural Pakistan, inadequate waste management and contaminated water sources are pervasive, leading to high incidence rates of these diseases. This situation not only places a heavy burden on families but also overwhelms local healthcare systems that are already under-resourced. According to the World Bank, every dollar invested in water and sanitation infrastructure can yield an average return of \$4.3, primarily driven by reductions in healthcare costs and improvements in overall productivity.

In many rural communities across Pakistan, frequent outbreaks of diarrhea force both children and adults to miss school and work, which disrupts education and diminishes household income. For example, a study by UNICEF found that diarrheal diseases are responsible for millions of lost workdays annually in Pakistan, significantly impacting economic productivity and placing further strain on community resources. By reducing the frequency of these disease outbreaks through improved sanitation, treatment costs would decline, hospital admissions would decrease, and

the overall financial strain on both rural households and government health services could be eased.

Furthermore, improved sanitation facilities would lead to a healthier population, reducing the long-term burden of chronic diseases related to poor hygiene. This, in turn, would free up significant public health resources, allowing for better allocation towards preventive care and other critical health services. Overall, investing in water and sanitation infrastructure is not only a key strategy for enhancing public health outcomes but also a critical economic intervention that can contribute to sustainable development in rural Pakistan.

#### **Increased Productivity**

Improved sanitation is a critical factor that can significantly boost productivity in rural Pakistan. Poor hygiene conditions lead to a high prevalence of waterborne diseases, which in turn cause frequent absenteeism and diminished work capacity among rural populations. In a country where agriculture is the primary livelihood for a large portion of the workforce, these productivity losses directly translate to lower crop yields and poorer quality produce. Rural communities, particularly those in areas where waterborne diseases such as diarrhea, cholera, and dysentery are rampant, face substantial economic setbacks as sick workers are unable to fully contribute to farming activities.

Empirical studies underline the potential benefits of improved sanitation. For example, a study by UNICEF indicates that enhancing sanitation facilities could increase labor productivity by as much as 20% in communities heavily burdened by disease. In Pakistan, where rural areas

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account for approximately 37% of the population, such improvements would reduce the incidence of illness and enable farmers to work more consistently and efficiently. This enhanced productivity leads to higher crop yields and improved quality of produce, contributing to food security and economic growth.

Furthermore, when labor productivity increases, the overall economic health of rural communities improves. With fewer days lost to illness, families can dedicate more time to productive farming practices and other income-generating activities, thereby boosting household incomes and stimulating regional development. Investing in sanitation infrastructure—such as reliable clean water systems and effective waste disposal mechanisms—not only curtails health-related productivity losses but also serves as a catalyst for sustainable agricultural development in rural Pakistan.

### Enhanced Education Outcomes

Sanitation plays a crucial role in shaping educational outcomes, particularly in rural areas where inadequate facilities contribute to high absenteeism and low academic performance. In Pakistan, rural schools often lack proper toilets, clean drinking water, and handwashing stations, exposing students to waterborne diseases and infections. According to UNESCO, the literacy rate in rural Pakistan stands at only 49%, significantly lower than the 74% recorded in urban areas. One contributing factor to this disparity is the frequent illnesses caused by poor sanitation, which lead to school absences and hinder students' ability to focus on learning.

Girls are disproportionately affected by inadequate sanitation in schools. A lack of separate and hygienic toilet facilities discourages adolescent girls from attending school, especially during menstruation, leading to higher dropout rates. The Pakistan Education Statistics report highlights that nearly 21% of rural schools lack functional toilets, creating further barriers to education.

Improving sanitation infrastructure in schools has been proven to increase attendance rates and enhance learning outcomes. The installation of clean and gender-segregated washrooms, along with safe drinking water facilities, significantly reduces the spread of diseases and promotes a healthier learning environment. Studies show that schools with adequate sanitation report up to 15% higher attendance rates.

Better educational attainment resulting from improved sanitation fosters a more skilled workforce, ultimately contributing to higher productivity and economic growth. By investing in school sanitation, Pakistan can ensure healthier, more educated rural communities, bridging the urban-rural education divide and securing long-term development.

### Long-Term Economic Development

Long-term economic development is closely linked to improved sanitation, as better hygiene and waste management systems contribute to a healthier, more productive workforce. Beyond the immediate benefits of disease prevention and reduced healthcare costs, investments in sanitation create a ripple effect that enhances human capital, strengthens economies, and promotes sustainable development. Access to proper sanitation increases school attendance rates by reducing waterborne illnesses, leading to a more educated and skilled workforce over time. According to the World Health Organization, every dollar invested in sanitation yields an average economic return of \$5.50 due to reduced healthcare expenses and increased productivity.

In addition to human capital development, improved sanitation boosts investor confidence, making rural areas more attractive for both domestic and international investment. Businesses and industries are more likely to establish operations in regions with reliable infrastructure, as proper sanitation reduces health risks for employees and minimizes disruptions caused by disease outbreaks. The Global Sanitation Fund reports that regions with upgraded sanitation infrastructure experience

economic growth rates that are 10-15% higher than those with inadequate facilities.

For Pakistan, enhancing rural sanitation could play a crucial role in poverty alleviation. With 31.3% of the rural population living below the poverty line (World Bank), better sanitation can lead to lower medical expenses, increased workforce participation, and improved agricultural productivity. Over time, these benefits contribute to a more balanced distribution of wealth, fostering regional development and national economic stability. Prioritizing sanitation investments is essential for sustainable, long-term economic growth.

### Environmental Sustainability

Environmental sustainability is a fundamental advantage of improved sanitation, particularly in rural Pakistan, where poor waste management leads to severe environmental degradation. Contaminated water bodies, polluted soil, and unsafe disposal of human and industrial waste pose serious threats to both public health and agricultural productivity. According to the Pakistan Council of Research in Water Resources, nearly 80% of Pakistan's water sources are contaminated, primarily due to inadequate sanitation infrastructure. This pollution not only contributes to waterborne diseases but also reduces soil fertility, leading to lower crop yields and food insecurity.

Investing in environmentally sustainable sanitation solutions can help mitigate these risks. Eco-friendly waste treatment facilities, decentralized wastewater management systems, and community-led recycling programs can significantly reduce pollution levels while conserving natural resources. Techniques such as biogas generation from organic waste and constructed wetlands for wastewater treatment offer both environmental and economic benefits. Additionally, sustainable sanitation can support water conservation efforts, ensuring that clean water remains accessible for drinking, irrigation, and industrial use.

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Beyond local benefits, improved sanitation contributes to broader climate action goals. Reduced contamination lowers greenhouse gas emissions associated with untreated waste, while cleaner environments encourage green investments and eco-tourism. Sustainable sanitation also aligns with Pakistan's commitment to international climate agreements, helping the country meet its environmental targets. By integrating sanitation improvements with long-term sustainability strategies, rural areas can protect ecosystems, support resilient agriculture, and ensure a healthier, more prosperous future for generations to come.

### Conclusion

Improving sanitation in rural Pakistan is not just a public health necessity—it is a crucial economic and environmental investment. The economic benefits of enhanced sanitation extend beyond immediate cost savings in healthcare, leading to long-term gains in productivity,

education, and regional development. Healthier communities experience fewer workdays lost to illness, increased labor efficiency, and a more skilled workforce, ultimately contributing to a stronger rural economy. Furthermore, improved sanitation infrastructure attracts investment, fosters agricultural sustainability, and enhances environmental resilience, ensuring that natural resources remain viable for future generations.

By prioritizing sanitation, Pakistan can bridge the rural-urban development gap, reduce poverty, and create a healthier, more productive society. Investing in clean water systems, eco-friendly waste management, and school sanitation facilities will not only safeguard public health but also drive sustainable economic growth. The potential return on investment in sanitation—through reduced medical expenses, increased agricultural output, and improved

educational outcomes—demonstrates its role as a catalyst for national progress.

Ultimately, a well-planned and sustained effort to improve sanitation in rural Pakistan can transform livelihoods, enhance economic stability, and promote environmental stewardship. As the country strives for inclusive and sustainable development, integrating sanitation into national and local policies is essential. By addressing this critical issue, Pakistan can build a foundation for healthier communities, stronger economies, and a more resilient future.

*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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## Sustainable Agriculture & Public Health in Pakistan

Explore the vital connection between sustainable agriculture and public health in Pakistan. Discover how integrating these fields can enhance food security, combat malnutrition, and promote climate resilience for healthier rural communities.

Hafiza Samara Fatima

2/10/2025

Sustainable agriculture and public health are deeply interconnected, particularly in Pakistan's rural sector, where farming remains the backbone of the economy and a primary source of livelihood for millions. Public health aims to prevent diseases, extend life expectancy, and promote overall well-being through coordinated efforts, while sustainable agriculture focuses on producing food in ways that protect the environment, conserve resources, and support long-term food security. Despite their distinct objectives, both fields share a commitment to social equity, environmental sustainability, and long-term human health.

The link between sustainable agriculture and public health is evident in multiple ways. The use of harmful pesticides, excessive fertilizers, and unsustainable irrigation methods not only degrade soil and water resources but also contribute to health problems such as respiratory diseases, waterborne illnesses, and malnutrition. On the other hand, sustainable farming practices—such as organic cultivation, crop diversification, and integrated pest management—can lead to healthier food production, cleaner water sources, and reduced environmental contamination.

Pakistan's rural sector faces significant challenges in balancing agricultural productivity with public health concerns. Poor sanitation, lack of clean drinking water, and exposure to agricultural pollutants create severe health risks for rural communities. To address these issues, policymakers must adopt holistic strategies that integrate sustainable agriculture with rural health initiatives. Strengthening regulations on agrochemical use, promoting eco-friendly farming techniques, and

improving access to healthcare services are crucial steps toward ensuring that both the agricultural sector and rural populations thrive together.

### **The Relationship Between Sustainable Agriculture and Public Health in Pakistan**

Sustainable agriculture plays a crucial role in shaping public health outcomes, particularly in Pakistan, where agriculture remains a key economic sector and a primary source of livelihood for millions. The interconnection between sustainable farming practices and public health extends beyond food production, influencing nutrition, environmental quality, and overall community well-being. By adopting sustainable agricultural methods, Pakistan can address critical public health concerns, improve food security, and reduce the adverse health impacts of harmful farming practices.

One of the most direct ways sustainable agriculture affects public health is through improved nutrition and food security. In Pakistan, a significant portion of the population faces food insecurity, with many individuals suffering from malnutrition due to inadequate access to diverse and nutrient-rich foods. Sustainable farming practices emphasize crop diversification, organic farming, and the cultivation of indigenous crops that are naturally resilient and rich in essential nutrients. Encouraging the production of staple grains alongside nutrient-dense foods such as pulses, millet, and sorghum can help combat micronutrient deficiencies, particularly in rural areas where dietary diversity is often limited. When communities have access to a variety of locally grown, healthy foods, they are

better equipped to maintain overall health and prevent diet-related illnesses.

The excessive use of chemical fertilizers and pesticides in conventional farming poses severe health risks to farmers and consumers alike. In Pakistan, the growing reliance on chemical inputs has led to increased cases of pesticide-related illnesses, including respiratory diseases, neurological disorders, and even cancer. Farmers who handle toxic agrochemicals daily are particularly vulnerable, as are rural populations exposed to contaminated water and soil. Sustainable agricultural practices such as integrated pest management, organic farming, and the use of natural fertilizers can significantly reduce reliance on harmful chemicals. By adopting safer pest control methods and soil enrichment techniques, farming communities can protect both their own health and the long-term viability of agricultural land.

The environmental impact of unsustainable agriculture extends to broader public health concerns. Pakistan is highly vulnerable to climate change, with rising temperatures, erratic rainfall, and frequent natural disasters threatening food production and rural livelihoods. Agricultural practices that deplete soil nutrients, contribute to deforestation, and waste water resources exacerbate these environmental challenges, increasing the likelihood of climate-induced health crises such as heat stress, malnutrition, and waterborne diseases. Sustainable agriculture offers solutions by promoting climate-resilient farming techniques such as agroforestry, soil conservation, and precision irrigation. These methods not only enhance food production but also improve the overall resilience of rural



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communities against climate-related health risks.

Another growing concern in Pakistan is the misuse of antibiotics in livestock farming, which contributes to the rise of antibiotic-resistant bacteria. Overuse of antibiotics in poultry and dairy farming has created a serious public health challenge, as resistant bacterial strains reduce the effectiveness of medical treatments for infections in humans. Sustainable livestock management prioritizes animal welfare, improved hygiene, and natural disease prevention methods, reducing the need for antibiotics. By addressing antibiotic resistance through responsible farming practices, Pakistan can help safeguard both human and animal health.

Beyond physical health, sustainable agriculture contributes to the mental and social well-being of rural communities. Farmers practicing sustainable methods often experience reduced financial stress due to lower input costs and improved yields. Additionally, communities with access to fresh, locally grown food tend to develop stronger connections to their food systems, fostering a sense of well-being and resilience. In a country where rural poverty and mental health struggles are widespread, sustainable agriculture can serve as a foundation for healthier, more empowered communities.

By integrating sustainable agricultural practices with public health initiatives, Pakistan can create a more resilient and prosperous rural sector. Encouraging eco-friendly farming, reducing harmful chemical use, and strengthening policies that support sustainable food production will not only improve public health outcomes but also contribute to long-term economic and environmental stability.

### **Challenges of Unsustainable Agricultural Practices in Pakistan**

Unsustainable agricultural practices in Pakistan pose significant threats to public health, environmental stability, and the economic well-being of rural communities. One of the most pressing

concerns is the rise of foodborne illnesses due to intensive farming methods. The widespread use of factory farming, particularly in the poultry and livestock sectors, increases the risk of bacterial contamination from pathogens like Salmonella and E. coli. Inadequate hygiene standards and improper waste disposal further exacerbate these risks, endangering both rural and urban populations that rely on these food sources. Pakistan has witnessed a growing number of foodborne disease outbreaks, with an estimated 40% of reported diarrheal cases linked to contaminated food and water.

Pollution and environmental degradation are also serious consequences of unsustainable farming. The excessive use of chemical fertilizers and pesticides has led to widespread soil degradation and water contamination. Pesticide runoff seeps into groundwater, which serves as a primary drinking water source for rural communities, increasing exposure to toxic substances. Fertilizer overuse has also contributed to algal blooms in rivers and lakes, depleting oxygen levels and harming aquatic ecosystems. According to the Pakistan Council of Research in Water Resources, nearly 70% of water samples from rural areas contain unsafe levels of agricultural pollutants, posing serious health risks.

The loss of biodiversity due to unsustainable farming methods further threatens food security and ecosystem resilience. Monocropping and deforestation, often driven by commercial agriculture, have drastically reduced natural habitats for pollinators and other beneficial organisms. The decline in biodiversity weakens natural ecosystem services such as soil fertility, pest control, and water purification, making farming systems more vulnerable to climate shocks. Experts warn that without immediate action, nearly 30% of Pakistan's agricultural land could become unproductive within the next two decades due to soil depletion and ecosystem decline.

Beyond environmental concerns, unsustainable farming practices also take a toll on the mental health of farmers. Small-scale farmers, who make up the majority of Pakistan's agricultural workforce, face immense financial stress due to rising input costs, crop failures, and market fluctuations. A 2022 study by the Pakistan Agricultural Research Council found that over 60% of farmers experience high levels of anxiety and depression, often linked to mounting debts and economic uncertainty. The lack of rural support systems exacerbates these challenges, leaving many farmers without access to mental health resources. This growing crisis highlights the urgent need for agricultural policies that prioritize both economic stability and mental well-being in farming communities.

Addressing these challenges requires a shift towards more sustainable farming practices that promote environmental conservation, public health, and economic resilience. Without urgent intervention, the long-term consequences of unsustainable agriculture will continue to threaten Pakistan's food security, environmental integrity, and the livelihoods of millions.

### **Policy Frameworks for Integrating Public Health and Sustainable Agriculture**

To maximize the health benefits of sustainable agriculture, Pakistan must implement integrated policy frameworks that bridge public health and agricultural sustainability. One of the most critical steps is promoting sustainable farming through government incentives such as subsidies, tax breaks, and financial support for organic and agroecological farming. Encouraging practices like integrated pest management and soil conservation can reduce environmental damage while ensuring healthier food production. Public awareness campaigns can further influence consumer behavior by increasing demand for sustainably grown food, encouraging farmers to adopt eco-friendly practices in response to market demand.

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Strengthening food safety regulations is equally essential, as industrial agriculture poses increasing risks to public health. Pakistan's food safety laws must be updated to enforce stricter controls on pesticide residues, antibiotic use in livestock, and waste disposal in large-scale farming operations. Enhanced monitoring and enforcement mechanisms can help track foodborne illness outbreaks and prevent the spread of contaminants. A well-regulated agricultural system will ensure that both producers and consumers benefit from safer food production and consumption.

As Pakistan faces severe climate risks, policies should also emphasize climate-smart agricultural practices. Investments in water conservation, improved soil health, and sustainable land-use planning can strengthen the resilience of rural communities. Government-led programs like the Ten Billion Tree Tsunami are a step toward environmental restoration, but additional efforts are needed to directly integrate climate adaptation strategies into agricultural development plans.

A stronger focus on research and education can further drive sustainable practices. Universities and research institutions should conduct studies on the health impacts of various farming techniques, while extension services should train farmers on sustainable production methods that improve both yields and public health.

Additionally, the mental health challenges faced by farmers require urgent attention. Small-scale farmers, particularly those in debt, experience high levels of stress due to economic uncertainty. Policymakers should establish rural mental health support networks, provide financial relief programs, and encourage farming cooperatives to reduce individual financial burdens. A holistic approach that considers both the economic and mental well-being of farmers will contribute to a more resilient and sustainable agricultural system.

### Conclusion

The integration of sustainable agriculture and public health is essential for ensuring the long-term well-being of

Pakistan's rural communities. Unsustainable farming practices not only threaten food security and environmental stability but also contribute to severe public health challenges, including malnutrition, pesticide exposure, water contamination, and antibiotic resistance. Addressing these interconnected issues requires a comprehensive policy approach that prioritizes sustainable farming techniques, strengthens food safety regulations, and promotes climate resilience. Additionally, investing in research, education, and mental health support for farmers can foster more resilient agricultural systems and healthier rural populations. By aligning agricultural development with public health objectives, Pakistan can create a more sustainable, equitable, and prosperous future for its people.

*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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## Enhancing Public Health for Agricultural Workers in Pakistan

Public health is crucial for improving the well-being of agricultural workers in Pakistan. By addressing occupational hazards and expanding healthcare access, we can enhance livelihoods and promote preventive measures, public health initiatives can enhance the livelihoods of the country.

Aima Munal

2/12/2025

Agriculture is the backbone of Pakistan's economy, employing nearly 40% of the workforce and contributing approximately 20% to the national GDP. The sector supports millions of rural households, yet the health and well-being of agricultural workers remain largely neglected. Many face poor working conditions, exposure to harmful chemicals, lack of protective equipment, and limited access to healthcare services, all of which significantly impact their productivity and quality of life.

One of the most pressing concerns is occupational health hazards. Farmers and laborers are frequently exposed to pesticides, fertilizers, and other agrochemicals, leading to respiratory illnesses, skin conditions, and long-term neurological disorders. According to the Pakistan Agricultural Research Council (PARC), nearly 30% of farmers suffer from pesticide-related illnesses annually due to improper handling and lack of awareness. Additionally, prolonged exposure to harsh weather conditions, extreme heat, and poor sanitation increases the risk of dehydration, heatstroke, and infectious diseases.

Another major issue is the lack of healthcare facilities in rural areas. Many agricultural workers do not have access to basic medical care, maternity services, or health insurance, leaving them vulnerable to preventable diseases. According to the Pakistan Bureau of Statistics, only 20% of rural workers have access to formal healthcare facilities. Women in agriculture face even greater health risks, including complications during pregnancy due to heavy labor and malnutrition.

Public health initiatives are crucial in addressing these challenges. The

government must expand mobile health clinics, awareness programs on pesticide safety, and affordable health insurance for agricultural workers. Investing in occupational safety training, improved farm equipment, and accessible rural healthcare services will enhance worker productivity and ensure the long-term sustainability of Pakistan's agricultural sector.

### Challenges Faced by Agricultural Workers in Pakistan

Agricultural workers in Pakistan face numerous challenges that significantly impact their health, safety, and overall well-being. The nature of agricultural work exposes them to a variety of occupational hazards, including pesticide exposure, improper handling of heavy machinery, and prolonged physical labor. Many farmers lack protective gear, increasing their risk of respiratory diseases, skin infections, and chronic illnesses. Studies indicate that pesticide poisoning is a major health concern among farm workers, with long-term exposure linked to neurological disorders and cancer. According to the International Labour Organization (ILO), agriculture remains one of the most hazardous sectors globally, and the situation is even more dire in developing countries like Pakistan, where safety regulations are weakly enforced.

Beyond workplace hazards, healthcare access remains severely inadequate for rural agricultural workers. Many live in remote areas where basic medical facilities are scarce, and trained healthcare professionals are in short supply. According to Pakistan's Health and Demographic Survey, only 30% of the rural population has access to proper healthcare services. The situation is

worsened by financial constraints, as most farmworkers earn less than PKR 570 per day (\$2), making it difficult to afford medical treatment.

Malnutrition is another critical issue, particularly among the families of agricultural workers. Limited incomes and lack of awareness about balanced diets contribute to widespread food insecurity and nutrient deficiencies. According to UNICEF Pakistan, 38% of children in rural areas suffer from stunted growth due to poor nutrition, directly affecting their long-term health and cognitive development.

Addressing these challenges requires stronger occupational safety regulations, expanded rural healthcare services, and targeted nutrition programs to improve the living conditions of agricultural workers. Investing in health and safety education, subsidized medical care, and improved farm technologies can enhance worker well-being and contribute to a more sustainable agricultural sector in Pakistan.

### Impact of Climate Change on Agricultural Workers

Climate change significantly worsens the difficulties faced by agricultural workers in Pakistan, exposing them to rising temperatures, erratic rainfall patterns, and extreme weather events such as floods and droughts. These climatic changes directly impact on labor productivity, health, and food security, making agricultural work even more challenging.

One of the most immediate risks is heat stress, which reduces the capacity of workers to perform physically demanding tasks. Prolonged exposure to high temperatures can lead to heat

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exhaustion, dehydration, and even heat strokes, increasing health risks for farm workers. According to the Global Climate Risk Index, Pakistan ranks among the most vulnerable countries to climate change, with rising temperatures expected to significantly reduce working hours in the agricultural sector.

Increased rainfall variability and water scarcity further worsen conditions. Heavy rainfall can cause flooding, soil erosion, and crop loss, while prolonged droughts lead to water shortages and lower agricultural yields. As a result, farm workers face job insecurity and reduced incomes, making it harder to afford food and healthcare. Waterborne diseases also become more prevalent, as floods contaminate drinking water sources, increasing cases of diarrhea, cholera, and skin infections.

According to a 2021 study by De Lima et al., a 3°C rise in global temperatures could reduce agricultural labor productivity by 30% to 50% in South Asia, including Pakistan. This would not only impact on food production but also drive-up food prices by 5%, placing additional financial strain on agricultural workers and their families. Addressing climate change impacts through adaptation strategies, improved irrigation techniques, and access to healthcare is essential for protecting the livelihoods of Pakistan's agricultural workforce.

### **Role of Public Health in Addressing These Challenges**

Public health plays a critical role in improving the well-being of agricultural workers in Pakistan by addressing their health risks and enhancing access to essential services. One of the most impactful public health interventions has been vaccination and disease prevention programs. The Expanded Program on Immunization (EPI) has significantly reduced preventable diseases such as polio, measles, and tetanus among agricultural workers and their families. However, challenges persist, with nearly 20% of children in rural areas lacking access to routine vaccinations due to

geographic barriers, misinformation, and limited healthcare infrastructure. Strengthening outreach programs can help close this gap.

The Lady Health Worker (LHW) Program, launched in 1994, has been a cornerstone of maternal and child healthcare in rural Pakistan. LHWs provide prenatal care, vaccinations, and health education, reaching millions of agricultural families. Despite its effectiveness, the program faces significant challenges, including underfunding, a shortage of trained personnel, and mobility constraints that limit its reach to remote areas. Expanding financial and logistical support for LHWs is crucial to sustaining and enhancing their impact.

One of the major occupational health risks in agriculture is pesticide exposure, which can cause respiratory illnesses, neurological disorders, and skin diseases. Public health initiatives, in collaboration with NGOs, provide training on pesticide safety, proper handling techniques, and the use of personal protective equipment (PPE). These programs have successfully reduced pesticide-related illnesses, but a lack of awareness and financial constraints prevent many small-scale farmers from fully adopting safe practices. Stronger enforcement of safety regulations and subsidies for protective gear could further improve outcomes.

Access to safe drinking water and sanitation remains a major challenge for agricultural communities. Programs like the Pakistan Approach to Total Sanitation (PATS) have improved water and sanitation facilities, reducing the spread of waterborne diseases such as cholera and diarrhea. However, 40% of rural households still lack access to clean drinking water, increasing their vulnerability to infectious diseases. Expanding infrastructure projects and promoting low-cost water purification solutions can enhance public health outcomes in these areas.

Malnutrition is another pressing issue among agricultural workers and their families. Initiatives led by organizations such as the World Food Programme (WFP) provide fortified meals and nutritional supplements to vulnerable populations. Additionally, nutritional education programs promote awareness of healthy eating practices. Tackling malnutrition requires a multi-faceted approach, including food security initiatives, improved agricultural practices, and social protection programs.

Finally, the mental health of agricultural workers is often neglected. Long working hours, job insecurity, and financial stress contribute to anxiety, depression, and other mental health conditions. Public health initiatives have recently started addressing this issue through awareness campaigns and counseling services, but efforts remain limited. Expanding mental health resources and integrating them into primary healthcare systems can help improve the overall well-being of agricultural workers in Pakistan.

### **Innovative Solutions and Future Directions**

To further improve the welfare of agricultural workers, Pakistan must adopt innovative solutions and strengthen its public health infrastructure. Several key strategies can help address the health challenges faced by this vulnerable population.

One of the most promising solutions is the expansion of mobile health units and telemedicine services. These initiatives are particularly valuable in remote areas where access to healthcare is limited. Mobile health units travel to rural communities, offering medical check-ups, vaccinations, maternal care, and emergency treatments. Telemedicine platforms, supported by smartphone applications and internet connectivity, allow farmers to consult doctors remotely, reducing the need for long and costly travel. Expanding these programs with government and private sector

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investment can make healthcare more accessible and affordable.

Another crucial step is educating farmers on climate-resilient farming techniques to mitigate the health effects of climate change. Rising temperatures and increased pest infestations have worsened heat stress, vector-borne diseases, and pesticide exposure. Public health programs now focus on promoting drought-resistant crops, shaded workspaces, and integrated pest management strategies to reduce reliance on harmful chemicals. Strengthening such initiatives will protect both agricultural productivity and worker health.

Occupational safety training is another critical area requiring investment. Government agencies and NGOs are providing training on safe machinery handling, pesticide application, and first aid response. These programs have improved awareness but scaling them up through subsidies and regulatory incentives will ensure wider adoption.

Finally, international partnerships with organizations such as the Food and Agriculture Organization (FAO) and World Health Organization (WHO) have significantly improved nutrition programs, water sanitation efforts, and disease prevention campaigns. Expanding these collaborations will bring in technical expertise, funding, and policy guidance, ensuring a healthier workforce and a more sustainable agricultural sector.

### Policy Recommendations

To ensure the long-term success of public health initiatives for agricultural workers, targeted policy measures must be implemented. Expanding rural healthcare infrastructure is a priority, as many workers lack access to Basic Health Units (BHUs) and Rural Health Centers (RHCs). The government should increase funding for rural healthcare facilities, provide incentives for doctors to serve in remote areas, and introduce mobile clinics to reach underserved populations. Strengthening occupational

health and safety regulations is also crucial. Policies should mandate protective gear for pesticide application, regular health check-ups for workers, and training on proper machinery usage to reduce workplace injuries and long-term illnesses.

Increased funding for public health programs is essential for expanding successful initiatives like the Lady Health Worker (LHW) program and the Expanded Program on Immunization (EPI). The government should allocate a larger budget for rural healthcare, ensure timely salary payments for LHWs, and integrate digital health records to track immunization and disease prevalence more efficiently.

To address the impact of climate change, policies must promote climate-resilient agriculture. This includes subsidizing drought-resistant crops, encouraging drip irrigation, and introducing heat-resistant shelters for workers to prevent heat stress. The government should also work with NGOs and agricultural extension programs to educate farmers on sustainable practices, organic pest control, and soil conservation techniques to improve productivity without compromising worker health.

A multi-sectoral approach involving government agencies, research institutions, private stakeholders, and international organizations is key to implementing these policies successfully. Regular monitoring, feedback mechanisms, and incentives for compliance will ensure the sustainability of these reforms and improve the health and well-being of Pakistan's agricultural workforce.

### Conclusion

Public health is vital to improving the well-being of agricultural workers in Pakistan. By addressing occupational hazards, expanding access to healthcare, and promoting preventive measures, public health initiatives can enhance the livelihoods of one of the country's most vulnerable populations. However, achieving these goals requires a systemic approach, involving collaboration between

governments, healthcare providers, and communities. With sustained efforts and targeted interventions, Pakistan can ensure the long-term prosperity of its agricultural sector and the health of its workers.

Improving the welfare of agricultural workers in Pakistan requires a comprehensive and sustained commitment to public health initiatives. The challenges faced by these workers, including occupational hazards, limited healthcare access, malnutrition, and the impacts of climate change—highlight the urgent need for policy interventions. Strengthening rural healthcare infrastructure, enforcing occupational safety regulations, and expanding vaccination and disease prevention programs are crucial steps toward safeguarding worker health. Additionally, integrating mobile health services and telemedicine can bridge the healthcare gap for remote communities, ensuring timely medical attention.

Addressing climate change-related health risks through climate-resilient agriculture and sustainable farming practices is equally important. Public health policies should focus on preventive measures such as providing protective gear, promoting safe pesticide use, and improving sanitation facilities. Furthermore, increased investment in nutrition programs and mental health resources will enhance the overall well-being of agricultural workers and their families.

A collaborative effort between the government, research institutions, private sector, and international organizations is essential to implement and sustain these initiatives effectively. By prioritizing agricultural workers' health and safety, Pakistan can not only improve productivity and economic stability but also ensure a healthier, more resilient workforce that contributes to the long-term sustainability of the agricultural sector.

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## Combatting Antibiotic Resistance in Veterinary Medicine

Antibiotic resistance in veterinary medicine poses a significant threat to animal health and public safety in Pakistan. With widespread antibiotic overuse in livestock and poultry, urgent action is required.

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2/17/2025

Imagine a world where once-curable infections become deadly again. This is not just a distant possibility but a growing reality due to antibiotic resistance (ABR). In Pakistan, this crisis is particularly alarming, as the country ranks among the top consumers of antibiotics in livestock and poultry farming. According to estimates, over 70% of total antibiotic sales in Pakistan are for veterinary use, contributing significantly to resistance development.

While much of the conversation around ABR focuses on human medicine, veterinary medicine plays a crucial role. In Pakistan, where livestock and poultry contribute nearly 60% to the agricultural GDP and provide livelihoods to millions, antibiotic misuse is widespread. A 2021 study found that over 50% of poultry farms in the country routinely use antibiotics as growth promoters, despite bans in many nations. The indiscriminate use of broad-spectrum antibiotics has led to resistant strains of *E. coli*, *Salmonella*, and *Staphylococcus aureus*, posing serious risks to both animals and humans through the food chain.

The consequences of ABR extend beyond veterinary medicine to public health. Studies indicate that over 90% of tested chicken meat samples in Pakistan contain antibiotic residues, making consumers vulnerable to resistant infections. As a veterinary pathologist, understanding the underlying mechanisms of ABR is crucial for disease diagnosis, treatment, and prevention. Addressing this issue requires urgent action, including stricter regulations, farmer education, and investment in alternative disease control strategies to safeguard

Pakistan's food security and public health.

### The Scope of Antibiotic Resistance in Veterinary Medicine

Antibiotic resistance occurs when bacteria evolve to survive antibiotic treatments that once killed them. In veterinary medicine, common bacterial infections such as mastitis in dairy cows, respiratory infections in poultry, and wound infections in companion animals are becoming harder to treat due to rising resistance. In Pakistan, the situation is particularly alarming. A 2020 study published in the *Journal of Infection and Public Health* found that over 70% of *Escherichia coli* (*E. coli*) isolates from poultry in Pakistan were resistant to commonly used antibiotics like tetracycline and ampicillin. Similarly, a 2021 report by the Pakistan Agricultural Research Council (PARC) revealed that antibiotic-resistant strains of *Salmonella* and *Staphylococcus aureus* are increasingly prevalent in livestock, posing significant risks to both animal and human health.

Globally, the injudicious use of antibiotics in food animals is a major contributor. Antibiotics are frequently used in sub-therapeutic doses for growth promotion and prophylaxis, exposing bacteria to constant low-level selective pressure. This practice fosters resistant strains, which can spread through animal products, farm environments, and even via direct human contact. In Pakistan, the lack of stringent regulations and oversight has exacerbated the problem, with antibiotics often being sold over the counter without prescriptions.

How antibiotic resistance develops, and spreads follows a simple yet alarming pathway that threatens both animal and human health. Bacteria naturally evolve, and some develop resistance through genetic mutations or by acquiring resistance genes from other bacteria. This process is accelerated when antibiotics are used excessively or improperly in livestock and poultry farming. In Pakistan, where over 70% of total antibiotic sales are attributed to veterinary use, the conditions for resistance development are particularly concerning.

When antibiotics are overused, only resistant bacteria survive and multiply, outcompeting susceptible ones. This selective pressure leads to the emergence of superbugs that render common treatments ineffective. A 2022 study on poultry farms in Punjab found that over 60% of tested bacterial strains were resistant to multiple antibiotics, including penicillin and tetracycline, drugs commonly used in both human and veterinary medicine.

Resistant bacteria can transfer from animals to humans through direct contact, contaminated food products, water runoff, or environmental exposure. In Pakistan, where hygiene standards in livestock farming are often suboptimal, the risk of transmission is particularly high. Poor slaughterhouse practices, unregulated antibiotic use, and lack of surveillance further compound the issue. Studies show that over 90% of retail chicken meat samples in Pakistan contain antibiotic residues, increasing consumer exposure to resistant pathogens.

The zoonotic implications of antibiotic resistance are severe. Resistant pathogens like *Escherichia coli*, *Salmonella*, and *Staphylococcus aureus* (including MRSA) are increasingly linked to human infections originating from animals. A 2019 study in *The Lancet Infectious Diseases* highlighted that Pakistan is among the countries with the highest rates of multidrug-resistant bacterial infections, many of which are zoonotic in origin. Addressing this crisis requires urgent policy changes, stricter regulations, and increased public awareness to safeguard both animal and human health.

### **The Role of Pathologists in Tackling Antibiotic Resistance**

As veterinary pathologists, our work extends beyond diagnosing diseases—we play a pivotal role in tackling antibiotic resistance (ABR) by monitoring resistance patterns, identifying emerging resistant pathogens, and advising on evidence-based antimicrobial use. In Pakistan, where over 70% of total antibiotic sales are for livestock and poultry, and resistance is rapidly rising, this role is more crucial than ever.

Through postmortem examinations, histopathology, and bacterial cultures, veterinary pathologists help detect antibiotic-resistant infections early, enabling targeted treatment plans that minimize unnecessary antibiotic use. A 2021 study in Punjab found that 60% of tested bacterial strains from livestock were resistant to at least three major antibiotic classes, underscoring the urgent need for improved diagnostic practices. By identifying resistance trends, pathologists provide crucial data that inform national antibiotic stewardship policies and veterinary guidelines.

Beyond diagnostics, veterinary pathologists contribute to research on novel antimicrobials, alternative therapies, and vaccine development, reducing reliance on antibiotics. In Pakistan, where less than 30% of

livestock farms have access to advanced diagnostic facilities, many infections are treated empirically, leading to overuse of broad-spectrum antibiotics. Strengthening diagnostic capacity and increasing the role of veterinary pathology in disease surveillance can help address this challenge.

Given Pakistan's high burden of multidrug-resistant infections, expanding the role of veterinary pathologists in guiding prudent antibiotic use is vital. Greater investment in diagnostic infrastructure, surveillance programs, and training for veterinarians will be key to mitigating the ABR crisis and ensuring sustainable livestock production and public health.

### **Impact of Antibiotic Resistance on Veterinary and Human Health**

Antibiotic resistance (ABR) has severe implications for both veterinary and human health, with far-reaching consequences for Pakistan's agriculture, economy, and public well-being. Once-effective antibiotics are now failing, leading to prolonged illness, higher treatment costs, and increased mortality rates in animals. In Pakistan, where livestock and poultry contribute nearly 60% to the agricultural GDP, ABR directly threatens food security and farm incomes. A 2021 study in Punjab reported that over 50% of dairy farms faced recurring infections due to antibiotic-resistant bacteria, significantly reducing milk production and overall productivity.

Economic losses due to ABR are substantial. Farmers experience increased veterinary costs, lower yields, and potential trade restrictions. In the poultry sector alone, where antibiotic overuse is widespread, resistant bacterial infections have led to over 20% mortality rates in broiler farms, causing financial strain on farmers. The Pakistan Bureau of Statistics highlights that the livestock sector provides livelihoods for millions, meaning ABR

not only affects food production but also rural economies.

Beyond economic losses, ABR poses a major public health threat. Resistant bacteria can transfer from animals to humans through direct contact, contaminated meat, or water. In Pakistan, where healthcare infrastructure is already burdened, the rise of multidrug-resistant (MDR) infections complicates treatment, leading to longer hospital stays and increased fatalities. A 2019 study in *The Lancet Infectious Diseases* ranked Pakistan among the highest MDR infection hotspots, making ABR a growing crisis.

Environmental contamination further accelerates ABR. Antibiotic residues from livestock farming seep into soil and water, promoting resistance beyond farms and hospitals. A 2022 study by UVAS Lahore found high levels of antibiotic residues in water sources near poultry farms, highlighting the urgent need for stricter regulations and waste management to control ABR's spread.

### **Strategies to Combat Antibiotic Resistance**

To curb antibiotic resistance (ABR) in veterinary medicine, a One Health approach is essential—integrating human, animal, and environmental health strategies. One of the most effective measures is prudent antibiotic use, which requires implementing Antimicrobial Stewardship Programs (ASPs) to ensure antibiotics are used only when necessary and at correct dosages. In Pakistan, where over 70% of antibiotic sales are for livestock and poultry, stricter regulation of antibiotic sales and better training for veterinarians are crucial.

Alternative therapies such as probiotics, vaccines, and herbal antimicrobials are gaining attention as substitutes for antibiotics in disease prevention. Research institutions like PARC and UVAS have initiated studies on these alternatives, but widespread adoption is still limited. Similarly,



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enhanced diagnostics through culture and sensitivity testing can help ensure targeted antibiotic use. In Pakistan, where empirical antibiotic use is widespread, investing in affordable diagnostic tools could significantly reduce unnecessary prescriptions.

Surveillance programs are also critical in tracking resistance trends. Strengthening pathogen monitoring systems in veterinary clinics and farms, alongside the establishment of a national ABR surveillance network, could be a game-changer for Pakistan. Additionally, farm-level biosecurity measures such as improved hygiene, vaccination programs, and nutrition management can reduce infections and lower antibiotic dependence.

Effective policy interventions are needed, including stricter regulations on antibiotic sales and bans on non-therapeutic antibiotic use in food-producing animals. While Pakistan's Drug Regulatory Authority (DRAP) has taken steps in this direction, enforcement remains weak due to a lack of monitoring and compliance mechanisms. Raising public awareness is equally important—educating farmers, veterinarians, and pet owners on responsible antibiotic use through community-based awareness campaigns can play a significant role in preventing resistance buildup.

The battle against antibiotic resistance requires global cooperation. Stronger collaboration between veterinarians, medical professionals, policymakers, and researchers is crucial in developing new antimicrobials, rapid diagnostic tools, and sustainable farming practices that reduce antibiotic dependency. In Pakistan, leveraging partnerships with international organizations like the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) can help build capacity, share best practices, and implement long-term solutions to combat ABR effectively.

### Conclusion

The fight against antibiotic resistance in veterinary medicine is a critical issue that demands immediate attention and coordinated efforts. In Pakistan, where antibiotic overuse in livestock and poultry farming is widespread, the risks to animal health, food safety, and public health are immense. The increasing prevalence of multidrug-resistant bacteria in farm animals and food products not only threatens agricultural productivity but also compromises the effectiveness of medical treatments for humans. Without decisive action, Pakistan could face a future where common bacterial infections become untreatable, endangering both economic stability and public health.

To address this crisis, a multifaceted approach is essential. Strengthening regulations on antibiotic use, promoting alternative disease control strategies, and investing in advanced diagnostic tools are crucial steps. Pakistan's research institutions, policymakers, and veterinary professionals must work together to implement sustainable practices that reduce antibiotic dependency. Furthermore, public awareness campaigns can empower farmers and consumers to make informed choices, reducing the indiscriminate use of antibiotics.

Ultimately, combating antibiotic resistance requires a global perspective. By collaborating with international organizations, adopting successful models from other countries, and investing in research and surveillance, Pakistan can mitigate the growing threat of antibiotic resistance and safeguard its agricultural and public health sectors for future generations.

*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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## Zoonotic Diseases & Agriculture: Challenges in Pakistan

Explore the critical interconnection between agriculture and zoonotic diseases in Pakistan. Learn how intensive farming, deforestation, and antibiotic use impact public health and economic stability.

Laiba Arooj

2/26/2025

Agriculture has long been the backbone of economies worldwide, providing food, raw materials, and livelihoods for billions of people. In countries like Pakistan, where agriculture contributes approximately 23% to the GDP and employs nearly 38% of the labor force, the sector is not only a driver of economic growth but also a critical component of food security and rural development. However, as farming practices evolve and intensify, the interconnections between agriculture and public health have become more complex, particularly concerning zoonotic diseases.

Zoonotic diseases, which are transmitted from animals to humans, pose a significant challenge for both public health and economic stability. These diseases include avian influenza, brucellosis, and bovine tuberculosis, which frequently emerge in agricultural settings where humans and animals interact closely. The expansion of intensive farming, deforestation, and livestock trade has increased the likelihood of zoonotic disease transmission, leading to severe health and economic consequences. For instance, outbreaks can result in reduced agricultural productivity, livestock losses, and trade restrictions, further straining the rural economy.

The economic impact of zoonotic diseases extends beyond agriculture, affecting healthcare costs, labor productivity, and global trade. In Pakistan, where a large portion of the population depends on livestock farming, an outbreak can lead to income losses, food insecurity, and increased healthcare expenditures. Moreover, zoonotic outbreaks often trigger international trade bans, reducing export revenues and disrupting supply chains. Strengthening biosecurity measures, improving

veterinary healthcare, and promoting awareness among farmers are essential steps to mitigate the risks associated with zoonotic diseases. Addressing these challenges requires a multi-sectoral approach that integrates agriculture, public health, and policy interventions to safeguard both human health and economic stability.

### Understanding Zoonotic Diseases

Zoonotic diseases are illnesses that are transmitted from animals to humans, either directly through contact with infected animals or indirectly through vectors such as insects, contaminated food, or water sources. According to the World Health Organization (WHO), more than 60% of all infectious diseases in humans are zoonotic, and an alarming 75% of emerging infectious diseases originate from animals. These include avian influenza, swine flu, Ebola, Lyme disease, and COVID-19, all of which have caused significant public health crises globally. Although zoonotic diseases have existed for centuries, their frequency and impact have been increasing in recent decades due to rapid urbanization, intensified livestock farming, environmental degradation, and human encroachment into wildlife habitats. These factors create ideal conditions for the spillover of pathogens from animals to humans, leading to disease outbreaks with severe health and economic consequences.

In Pakistan, zoonotic diseases pose a serious challenge to both public health and agricultural productivity. Diseases such as brucellosis, avian influenza, and rabies are particularly concerning due to their widespread prevalence and impact on both human and animal populations. Brucellosis, a bacterial infection transmitted from livestock to humans, has

been reported in various regions, especially among dairy farmers and veterinarians who handle infected animals. This disease leads to chronic health issues, including fever, joint pain, and fatigue, affecting the livelihoods of those dependent on livestock. Similarly, avian influenza outbreaks have periodically disrupted Pakistan's poultry sector, which contributes approximately 1.3% to the national GDP and provides employment to over 1.5 million people. These outbreaks not only lead to significant economic losses for farmers but also threaten food security by reducing the availability of poultry products. Addressing these challenges requires coordinated efforts in surveillance, vaccination programs, and public awareness campaigns to mitigate the risks associated with zoonotic diseases.

### The Intensification of Agriculture and Zoonotic Diseases

The intensification of agriculture, particularly industrial farming, has created conditions where the transmission of zoonotic diseases between animals and humans has become more likely. Various agricultural practices either contribute to preventing or exacerbating the spread of zoonotic diseases, making it essential to understand their impact on public health and the economy.

One of the primary contributors is intensive livestock farming, commonly known as factory farming. This method involves raising large numbers of animals in confined spaces to maximize production. While this approach has significantly improved food supply and economic output, it has also increased the risk of disease transmission. Overcrowded and often unsanitary conditions in these facilities provide an

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ideal environment for pathogens to spread among animals, with the potential to jump to humans. In Pakistan, the rapid growth of the poultry and dairy industries has led to widespread adoption of intensive farming practices. Although these industries contribute significantly to the national economy, they also pose serious health risks. The 2018 avian influenza outbreak, which led to the culling of millions of birds, is a prime example of how intensive poultry farming can contribute to the spread of zoonotic diseases. The outbreak resulted in heavy financial losses for poultry farmers and disrupted the food supply chain, highlighting the economic vulnerability of such farming systems.

Another major factor is the excessive use of antibiotics and other antimicrobial agents in livestock farming. Antibiotics are commonly administered to animals to prevent infections and promote growth, but their overuse has led to antimicrobial resistance (AMR), making it harder to treat both animal and human infections. In Pakistan, antibiotic use in livestock is widespread, often without proper veterinary supervision. A 2020 report by the Pakistan Agricultural Research Council (PARC) revealed that nearly 70% of all antibiotics used in the country are administered to animals. This indiscriminate use accelerates the development of resistant bacteria, which can spread to humans through direct contact with animals, consumption of contaminated food, or environmental exposure. The rise of AMR poses a serious threat to public health, as it diminishes the effectiveness of antibiotics in treating infections, leading to prolonged illnesses, higher medical costs, and increased mortality rates.

Deforestation and changes in land use for agricultural expansion also contribute to the spread of zoonotic diseases. In Pakistan, deforestation rates are alarmingly high, with approximately 27,000 hectares of forest lost annually. As natural habitats are cleared to make way for farmland, human-wildlife interactions increase, heightening the risk of zoonotic disease transmission. The encroachment

of agricultural activities into forested areas forces wild animals to move closer to human settlements, bringing with them pathogens that can jump species. Rabies, leptospirosis, and other zoonotic diseases have been linked to increased human exposure to wildlife due to habitat destruction. Addressing deforestation through reforestation initiatives and sustainable land-use planning is crucial to mitigating these risks.

Additionally, wet markets and the live animal trade play a significant role in zoonotic disease outbreaks. In many parts of the world, including Pakistan, wet markets are a critical part of the food supply chain, particularly in urban areas. However, poor hygiene and the close proximity of live animals from different species create conditions where diseases can easily spread. Major cities like Karachi and Lahore have live bird markets that have been identified as potential hotspots for avian influenza transmission. Without proper biosecurity measures, these markets can become breeding grounds for dangerous pathogens. Strengthening regulatory frameworks, enforcing hygiene standards, and promoting alternative food supply systems are necessary steps to reduce the risks associated with wet markets.

### **The Economic Impact of Zoonotic Diseases**

The economic impact of zoonotic diseases is profound and multifaceted. The effects of zoonotic diseases can be broken down into direct and indirect costs, which together create a substantial financial burden on economies. Direct costs include healthcare and treatment expenses, agricultural and livestock losses, and trade disruptions. Indirect costs include losses in productivity, lower wages, and a decline in consumer and business confidence. The economic toll on low-income populations, who are often most vulnerable to both zoonotic diseases and the economic fallout from outbreaks, is particularly severe.

In Pakistan, the economic impact of zoonotic diseases is significant. For instance, the 2018 avian influenza

outbreak resulted in estimated losses of over PKR 10 billion (approximately USD 60 million) to the poultry industry. Similarly, brucellosis, which affects both livestock and humans, has been estimated to cause annual economic losses of around PKR 2.5 billion (approximately USD 15 million) due to reduced milk production, infertility in livestock, and human healthcare costs.

The COVID-19 pandemic, which is believed to have zoonotic origins, has further highlighted the economic risks associated with zoonotic diseases. In Pakistan, the pandemic led to widespread disruptions in agricultural supply chains, reduced labor availability, and a decline in consumer demand for certain agricultural products. According to the State Bank of Pakistan, the agricultural sector experienced a contraction of 2.7% in FY 2020, partly due to the impact of COVID-19.

### **Economic Strategies for Addressing Zoonotic Risks in Agriculture**

The intensification of agriculture, particularly industrial farming, has created conditions where the transmission of zoonotic diseases between animals and humans has become more likely. Various agricultural practices either contribute to preventing or exacerbating the spread of zoonotic diseases, making it essential to understand their impact on public health and the economy.

One of the primary contributors is intensive livestock farming, commonly known as factory farming. This method involves raising large numbers of animals in confined spaces to maximize production. While this approach has significantly improved food supply and economic output, it has also increased the risk of disease transmission. Overcrowded and often unsanitary conditions in these facilities provide an ideal environment for pathogens to spread among animals, with the potential to jump to humans. In Pakistan, the rapid growth of the poultry and dairy industries has led to widespread adoption of intensive farming practices. Although these industries contribute significantly to the

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national economy, they also pose serious health risks. The 2018 avian influenza outbreak, which led to the culling of millions of birds, is a prime example of how intensive poultry farming can contribute to the spread of zoonotic diseases. The outbreak resulted in heavy financial losses for poultry farmers and disrupted the food supply chain, highlighting the economic vulnerability of such farming systems.

Another major factor is the excessive use of antibiotics and other antimicrobial agents in livestock farming. Antibiotics are commonly administered to animals to prevent infections and promote growth, but their overuse has led to antimicrobial resistance (AMR), making it harder to treat both animal and human infections. In Pakistan, antibiotic use in livestock is widespread, often without proper veterinary supervision. A 2020 report by the Pakistan Agricultural Research Council (PARC) revealed that nearly 70% of all antibiotics used in the country are administered to animals. This indiscriminate use accelerates the development of resistant bacteria, which can spread to humans through direct contact with animals, consumption of contaminated food, or environmental exposure. The rise of AMR poses a serious threat to public health, as it diminishes the effectiveness of antibiotics in treating infections, leading to prolonged illnesses, higher medical costs, and increased mortality rates.

Deforestation and changes in land use for agricultural expansion also contribute to the spread of zoonotic diseases. In Pakistan, deforestation rates are alarmingly high, with approximately 27,000 hectares of forest lost annually. As natural habitats are cleared to make way for farmland, human-wildlife interactions increase, heightening the risk of zoonotic disease transmission. The encroachment of agricultural activities into forested

areas forces wild animals to move closer to human settlements, bringing with them pathogens that can jump species. Rabies, leptospirosis, and other zoonotic diseases have been linked to increased human exposure to wildlife due to habitat destruction. Addressing deforestation through reforestation initiatives and sustainable land-use planning is crucial to mitigating these risks.

Additionally, wet markets and the live animal trade play a significant role in zoonotic disease outbreaks. In many parts of the world, including Pakistan, wet markets are a critical part of the food supply chain, particularly in urban areas. However, poor hygiene and the close proximity of live animals from different species create conditions where diseases can easily spread. Major cities like Karachi and Lahore have live bird markets that have been identified as potential hotspots for avian influenza transmission. Without proper biosecurity measures, these markets can become breeding grounds for dangerous pathogens. Strengthening regulatory frameworks, enforcing hygiene standards, and promoting alternative food supply systems are necessary steps to reduce the risks associated with wet markets.

Given the increasing threats posed by zoonotic diseases, it is imperative to adopt sustainable agricultural practices, enforce biosecurity measures, and improve public awareness. Collaborative efforts between policymakers, farmers, and public health experts are essential to minimizing the risks and ensuring that agriculture remains a source of economic stability without compromising human health.

### Conclusion

The interconnection between agriculture and zoonotic diseases presents a significant challenge for economic stability and public health, particularly in

countries like Pakistan, where agriculture is a vital sector. Intensive farming, deforestation, excessive antibiotic use, and live animal markets have heightened the risk of disease transmission, leading to outbreaks that impact food security, livestock productivity, and international trade. The economic burden extends beyond agriculture, affecting healthcare costs and labor markets. Addressing these challenges requires a comprehensive approach that integrates sustainable farming practices, stringent biosecurity measures, and public awareness campaigns. Strengthening veterinary services, regulating antibiotic use, and enforcing hygiene standards in livestock markets can mitigate zoonotic risks. Additionally, investing in research and inter-sectoral collaboration between agriculture and health policymakers will help develop strategies for early disease detection and prevention. As Pakistan continues to modernize its agricultural sector, balancing economic growth with public health safeguards is imperative. Sustainable agricultural policies, combined with proactive health interventions, can reduce the risks associated with zoonotic diseases while ensuring long-term economic resilience. By adopting a multi-sectoral approach, Pakistan can mitigate the threats posed by zoonotic diseases, safeguard livelihoods, and enhance food security, ultimately fostering a healthier and more sustainable agricultural economy.

*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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## Arsenic Contamination Crisis in Sindh

Discover the complexities of the arsenic contamination crisis in Sindh, impacting public health, agriculture, and the local economy. High groundwater arsenic levels lead to severe health issues, reduced crop yields, and increased healthcare costs for affected communities.

Abdul Sattar Laghari

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Arsenic contamination in drinking water is a significant public health concern worldwide, and Sindh, a province in Pakistan, is no exception. Arsenic is a naturally occurring element found in the Earth's crust and is classified as a metalloid, meaning it exhibits properties of both metals and non-metals. It exists in various forms, including organic and inorganic compounds, with inorganic arsenic—particularly arsenite (AsIII) and arsenate (AsV)—being the most toxic. These highly hazardous forms of arsenic are the primary contaminants in groundwater, posing serious health risks to exposed populations.

Arsenic can enter the environment through natural processes such as the weathering of rocks, volcanic activity, and hydrothermal reactions, as well as through anthropogenic activities including mining, industrial waste disposal, and the extensive use of arsenic-based pesticides. Once arsenic leaches into groundwater, it can persist for decades, contaminating water sources used for drinking, irrigation, and other essential purposes.

Sindh, located in the southeastern part of Pakistan, has a population of over 47 million people, many of whom depend on groundwater for their daily water needs. Unfortunately, water quality studies in the region have revealed alarmingly high arsenic levels, often exceeding the World Health Organization (WHO) guideline of 10 micrograms per liter ( $\mu\text{g/L}$ ). In some areas, concentrations have been reported at levels far beyond safe limits, placing millions at risk of chronic arsenic exposure. Long-term consumption of arsenic-contaminated water can lead to severe health complications, including skin lesions, cancer, cardiovascular

diseases, and developmental issues. Addressing arsenic contamination in Sindh requires urgent intervention through improved water testing, mitigation strategies, and public health awareness campaigns to protect communities from its harmful effects.

### Sources and Location of Arsenic in Sindh

The primary source of arsenic contamination in Sindh is geological in nature. The Indus River, which flows through the province, carries sediments from the Himalayas that contain arsenic-bearing minerals. Over thousands of years, these sediments have been deposited in the alluvial plains of Sindh, leading to naturally elevated arsenic levels in the groundwater. The problem is further aggravated by human activities, particularly the excessive extraction of groundwater for agricultural and domestic purposes. Over-pumping of groundwater disrupts the natural balance, causing arsenic to be released from sediments into the water supply. Additionally, the widespread use of arsenic-containing pesticides and fertilizers in farming contributes to both surface and groundwater contamination, further compounding the issue.

Arsenic contamination in Sindh is not uniform, with certain districts experiencing significantly higher levels of pollution. Some of the most affected areas include Tharparkar, Matiari, Hyderabad, Tando Allahyar, and Badin. In these districts, arsenic concentrations in groundwater have been reported as high as 500 micrograms per liter ( $\mu\text{g/L}$ ), which is 50 times higher than the World Health Organization (WHO) guideline value of 10  $\mu\text{g/L}$ . This level of contamination

poses a severe health risk to the local population, particularly in rural areas where access to safe drinking water is extremely limited. Most residents rely on untreated groundwater, exposing them to long-term arsenic toxicity.

Urban areas, though relatively better off due to municipal water treatment facilities, are not entirely safe. Aging infrastructure, poorly maintained water supply systems, and inadequate treatment facilities often lead to compromised water quality. Without effective monitoring and mitigation measures, arsenic contamination in Sindh will continue to pose a severe threat to public health, necessitating immediate intervention through improved water management, alternative water sources, and widespread awareness campaigns.

### Health Impacts of Arsenic Exposure

Arsenic is a potent carcinogen and can cause a wide range of health problems, both acute and chronic, depending on the level and duration of exposure. One of the earliest and most visible signs of chronic arsenic exposure is the development of skin lesions, including hyperpigmentation (dark spots), hypopigmentation (white spots), and keratosis (thickening of the skin, particularly on the palms and soles). These lesions can progress to more severe conditions, such as skin cancer. Long-term exposure to arsenic is strongly associated with an increased risk of various cancers, including skin, lung, bladder, kidney, and liver cancer. The International Agency for Research on Cancer (IARC) has classified arsenic as a Group 1 carcinogen, meaning it is carcinogenic to humans. Arsenic exposure has been linked to an increased risk of cardiovascular diseases, including

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hypertension, ischemic heart disease, and peripheral vascular disease. These conditions can lead to serious complications, such as heart attacks and strokes. Chronic arsenic exposure can have detrimental effects on the nervous system, leading to cognitive impairments, memory loss, and peripheral neuropathy. Children are particularly vulnerable to the neurotoxic effects of arsenic, which can result in developmental delays and reduced intellectual function.

Arsenic exposure during pregnancy can have serious consequences for both the mother and the developing fetus. It has been associated with an increased risk of spontaneous abortions, stillbirths, and low birth weight. Additionally, arsenic can cross the placental barrier, exposing the fetus to its toxic effects, which can result in developmental abnormalities and long-term health issues. Arsenic exposure has also been linked to a range of other health problems, including diabetes, respiratory diseases, and gastrointestinal disorders. The cumulative impact of these health effects can significantly reduce the quality of life and life expectancy of affected individuals.

### **Socio-Economic Consequences of Arsenic Contamination**

The arsenic crisis in Sindh has profound socio-economic repercussions that extend far beyond its immediate health effects. The burden on affected communities is immense, particularly due to the high cost of treating arsenic-related illnesses. Chronic arsenic exposure is associated with severe health conditions such as cancer, cardiovascular diseases, diabetes, and neurological disorders. The financial strain of long-term medical treatment, hospital visits, and medications places a heavy toll on families, many of whom already struggle with limited financial resources. The economic burden also extends to the healthcare system, which faces increasing pressure to provide services for arsenic-affected individuals, often without adequate infrastructure or resources.

Beyond healthcare costs, arsenic contamination leads to significant losses

in productivity. Many individuals suffering from arsenic poisoning experience fatigue, weakness, and other debilitating symptoms that impair their ability to work. This not only reduces household income but also negatively impacts the local economy, particularly in rural areas where agriculture and manual labor are primary sources of livelihood. In extreme cases, premature deaths caused by arsenic-related diseases result in the loss of wage earners, leaving families in financial distress.

Social consequences are also severe. Individuals with visible signs of arsenic poisoning, such as skin lesions, may face stigma and discrimination. This can lead to social isolation, reduced marriage prospects, and diminished quality of life. Women, in particular, may experience additional social hardships, as skin discoloration or other symptoms can lead to exclusion from community activities.

Arsenic contamination also threatens food security. Water from contaminated sources used for irrigation leads to arsenic accumulation in soil and crops, affecting agricultural productivity and posing serious risks to food safety. Consuming contaminated crops further increases arsenic exposure, creating a cycle of health hazards. In severe cases, arsenic contamination has forced entire communities to migrate in search of safe drinking water, leading to the displacement of families, loss of livelihoods, and increased vulnerability to poverty.

### **Current Efforts to Address Arsenic Contamination in Sindh**

Addressing the arsenic crisis in Sindh requires a multi-faceted approach that involves government agencies, NGOs, international organizations, and local communities. Some of the current efforts to tackle the issue include the regular monitoring and testing of water quality are essential for identifying areas with high arsenic levels and ensuring that appropriate interventions are implemented. The Pakistan Council of Research in Water Resources (PCRWR) and other organizations have conducted

extensive water quality assessments in Sindh, providing valuable data on the extent of arsenic contamination. Providing access to safe drinking water is a critical component of any strategy to address arsenic contamination. This can be achieved through the installation of deep tube wells, which tap into arsenic-free aquifers, or the implementation of water treatment technologies, such as reverse osmosis and activated alumina filters. Raising awareness about the dangers of arsenic contamination and promoting safe water practices are essential for reducing exposure. Public education campaigns, community workshops, and the dissemination of informational materials can help empower communities to take action to protect their health. Ongoing research is needed to better understand the sources, distribution, and health impacts of arsenic in Sindh. This includes studies on the geological and hydrogeological factors contributing to arsenic contamination, as well as the development of cost-effective and sustainable water treatment technologies.

Effective policy and regulation are crucial for addressing the arsenic crisis. This includes the enforcement of water quality standards, the regulation of groundwater extraction, and the promotion of sustainable agricultural practices. The government of Sindh, in collaboration with federal authorities, has a key role to play in developing and implementing policies to mitigate arsenic contamination.

### **Challenges and Barriers to Mitigation**

Addressing arsenic contamination in Sindh remains a complex challenge due to several interrelated barriers. Limited financial and technical resources significantly hinder the implementation of effective mitigation strategies. Many rural communities in Sindh lack the necessary infrastructure for water treatment facilities, and even when filtration systems are installed, maintaining them remains a challenge due to a lack of technical expertise and funding. Without sustained investment, mitigation efforts

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often remain short-term, leaving communities vulnerable to continued exposure.

Another critical issue is the lack of awareness among affected populations. Many residents, particularly in rural areas, are unaware of the dangers of arsenic contamination and the long-term health consequences of consuming tainted water. In some cases, even when safer alternatives exist, people may continue using contaminated water sources due to deeply ingrained cultural practices, misinformation, or distrust of external interventions. Public education campaigns and community engagement are essential to ensuring that people understand the risks and adopt safer water consumption habits.

Political and institutional challenges further complicate the situation. Political instability, inefficient bureaucratic processes, and a lack of coordination among government agencies slow down efforts to implement effective arsenic mitigation programs. Corruption and mismanagement of resources can divert funds away from critical projects, leaving affected communities without support. Strengthening governance, enhancing transparency, and fostering collaboration between governmental and non-governmental organizations are crucial for overcoming these barriers.

Additionally, climate change is emerging as a growing threat to groundwater quality in Sindh. Changing precipitation patterns, increasing temperatures, and rising sea levels affect groundwater recharge and can alter the geochemical processes that influence arsenic mobilization. As freshwater sources become scarcer due to prolonged droughts and shifting weather patterns, the reliance on arsenic-contaminated groundwater may increase, exacerbating the crisis. Addressing arsenic contamination in Sindh requires a multi-pronged approach that tackles these challenges while ensuring long-term sustainability.

### **Recommendations for Addressing Arsenic Contamination in Sindh**

Addressing arsenic contamination in Sindh requires a multi-faceted approach that combines scientific research, infrastructure investment, community engagement, and policy reform. Strengthening water quality monitoring is a critical first step in managing the crisis. A robust monitoring network equipped with modern testing facilities and trained personnel is necessary to regularly assess groundwater quality. This will help identify high-risk areas and track changes in arsenic levels over time, allowing for targeted interventions.

Investing in safe water infrastructure is another crucial aspect of the solution. Developing deep tube wells, installing arsenic removal filters, and constructing water treatment plants are necessary to ensure access to clean drinking water. These efforts must be accompanied by proper maintenance and sustainable management practices to ensure long-term functionality. Additionally, promoting community-based solutions, such as household water filters and village-level treatment systems, can provide cost-effective and accessible alternatives for rural communities.

Public awareness and education play a vital role in mitigating the impact of arsenic contamination. Many residents in affected areas are unaware of the health risks associated with arsenic exposure. Educational campaigns should be implemented in collaboration with local leaders, schools, and religious institutions to inform people about the dangers of contaminated water and encourage the adoption of safer alternatives.

Strengthening policy and regulation is also essential in addressing this crisis. The government must enforce water quality standards, regulate excessive groundwater extraction, and promote sustainable agricultural practices that minimize arsenic contamination. Effective policies should be backed by scientific research and integrated into regional development plans.

Collaboration and partnerships among government agencies, non-governmental organizations, international institutions,

and local communities are key to success. Sharing resources, expertise, and best practices will help develop innovative and sustainable solutions to mitigate arsenic contamination and protect public health in Sindh.

### **Future Researchable areas**

Further research is crucial for gaining a deeper understanding of the sources, distribution, and health impacts of arsenic contamination in Sindh. While existing studies have identified arsenic as a major concern, more comprehensive research is needed to map contamination levels across different regions and determine the factors influencing its spread. This includes studies on geological and hydrogeological processes responsible for arsenic leaching into groundwater, the role of sediment composition, and the impact of excessive groundwater extraction on arsenic mobilization.

Additionally, research should focus on assessing the long-term health effects of arsenic exposure, particularly in vulnerable populations such as children and pregnant women. Epidemiological studies can help establish links between arsenic contamination and diseases such as cancer, cardiovascular conditions, and developmental disorders. Understanding the social and economic consequences of arsenic poisoning is also necessary to develop holistic intervention strategies.

Another key research area is the development of cost-effective and sustainable water treatment technologies. Innovative filtration methods, low-cost adsorbents, and community-based purification systems require further exploration to ensure accessibility and affordability for rural populations. Research on alternative water sources, including rainwater harvesting and deep aquifers, can also provide sustainable solutions.

Collaboration between universities, research institutions, and government agencies is essential to generate actionable data and guide policy decisions for effective arsenic mitigation.

**Conclusion**

The arsenic contamination crisis in Sindh presents a complex challenge that significantly impacts public health, agriculture, and the local economy. The presence of high arsenic levels in groundwater has not only led to severe health issues but has also undermined the agricultural sector, which forms the backbone of Sindh's economy. Contaminated irrigation water has resulted in decreased crop yields, compromised food safety, and economic hardships for farmers who rely on agriculture for their livelihoods. The socio-economic burden of arsenic poisoning extends to increased healthcare costs, reduced productivity, and social

discrimination against affected individuals.

Efforts to mitigate arsenic contamination have faced numerous barriers, including inadequate resources, lack of awareness, weak policy enforcement, and the growing threat of climate change. While various interventions such as improved water treatment infrastructure, public awareness campaigns, and policy reforms have been initiated, their effectiveness remains limited due to financial and technical constraints. Addressing this crisis requires a comprehensive approach that includes scientific research, sustainable water management strategies, and community-based solutions.

Moving forward, urgent action is needed to implement long-term solutions that

ensure access to safe drinking water, protect agricultural productivity, and reduce health risks. Collaboration among government agencies, research institutions, and local communities will be essential in mitigating the impacts of arsenic contamination and securing a healthier future for Sindh's population.

*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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