

AGRICULTURAL DEVELOPMENT AND RURAL POVERTY IN PAKISTAN: IMPACT OF MODERN FARMING TECHNIQUES

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Abstract

Agriculture has always provided the heart-beat of the Pakistani economy in that most rural citizenry is employed by the sector and patterns of poverty and development activities as a result of it. This paper focuses on agricultural productivity and the effects of modern farming practices- such as high-quality farming seeds, improved irrigation systems, mechanization, precision farming, and others- on livelihoods of rural populations. It contends that although technological adoption has contributed considerably towards the high yields and minimizing risks of production, the ability to reduce poverty is lopsided since there is rigidity caused by structural limitations like inequality in land, lack of access to credit, as well as poor extension services. This study, applying a literature-based approach determined by secondary evidence found in scholarly books, peer-reviewed articles and institutional reports places a judgement on how modern methods can ameliorate as well as strengthen rural poverty and provides an understanding of policy interventions requisite to more inclusive agriculture in Pakistan.

Key Words: Agriculture, Modern Farming Techniques, Rural Poverty

1. Introduction

Agriculture plays a fundamental role in the Pakistan economy, providing the source of employment to almost 40 per cent of the workers in the Pakistan economy and contributing significantly to the GDP. It does not only bring about food security but also serves as raw materials to the other large industries like the textile and the agro-processing industry. Nevertheless, the agricultural sector has been characterized by low productivity, poor practices, and poverty in the rural areas that an enormous number of people still face. These issues have raised controversies over the role of modernization in changing the sector and enhancing the livelihoods of people in rural areas (Ali & Abdulai, 2010).

Promotion of modern farming technology has been the most touted avenue to agricultural development. Technology advancements have come in the form of the Green Revolution using high yielding seed varieties and drip irrigation to the latest methods of mechanization and precision farming. The techniques are promising to increase the yields and the efficient use of available sources and increased tolerance to weather stress. They have however not been uniformly adopted in Pakistan which is significantly dependent on farm size, access to capital and institutional arrangement (Hassan, 2019).

Rural poverty is still common and a challenge in Pakistan whereby, millions of smallholders and landless laborers are below the poverty line. Modern farming practices have the potential of increasing incomes and decreasing vulnerability yet they can also increase inequalities when only rich farmers are able to adopt the modern method of farming. Another example is that, mechanization and biotechnology might accrue to the benefit of the large holders at the expense of small farmers who do not have access to credit or extension services. Therefore, the linkage between modernization of agriculture and poverty alleviation is not direct (Qureshi, 2018).

Researchers have pointed out that such structural constraints need to be addressed by ensuring equitable land distribution, water resources management and general lack of infrastructure in the rural areas. Unless such systemic limitations are overcome, the advantages of the modern methods could instead be missed by the poorest households. In addition, poor institutional capacity to control seed quality, access to credit and extension services undermines the poverty-reduction potential of the emerging technologies. These processes mean that we must carefully

evaluate not only the economic gains of modernized farming but also social and distributional consequences (Dorosh & Salam, 2008).

This article, thus attempts to examine how contemporary farming methods have affected rural poverty and agricultural development amongst Pakistanis. It is based on scholarly and empirical research, as well as institutional reports to evaluate the prospects of modernization of agriculture and challenges it raises. By defining technological change within the larger socio-economically and policy environment, the paper seeks to present a balanced picture of whether modern farming is actually a poverty-reducing tool or it has ended in the emancipation of a select group of, so called, winners (Naseer, Ashraf, & Saleem, 2021).

2. Literature Review

The history of Pakistan's agrarian transformation and the issue of poverty is set within an enduring set of structural problems, including land tenure, water governance, technologies spread, and longer historical strands of policy interest, traceable to the heyday of development planning, to recent decades. Initial studies by Mahbub ul Haq emphasized the key role of agriculture in growth strategy, and subsequent studies developed the connection between farm productivity growth and the key welfare and employment multiplier in the rural economy (Haq, 1966). More recent and detailed studies by IFPRI researchers summarize evidence about regional and crop-wise patterns in productivity trends, use of new technology and policy priorities in the face of obstacles to adoption and market access, rendering agriculture a motor of growth and as a means of relieving poverty, where adoption and market access constraints are dealt with (Spielman, Malik, Dorosh & Ahmad, 2016). Collectively, these pieces show that the challenges of modernization should be framed not merely in terms of inputs and machines, but as an institutional and policy venture whose equity consequences hinge on the means of funding and directing and regulating technologies.

Included in the saga are the successes and failures of the Green Revolution, which remains the example of what modern farming can be. According to classic and neo-readings, although high-yielding varieties (HYV) and intensification of inputs increased aggregate production and led to a decline in staple prices, distributional impacts varied dramatically with farm size, tenant farming, and regional water control. Pakistan evidence indicates not only poverty-reducing effects (through food prices and agricultural labor) and exclusionary mechanisms such that asset-poor households experienced a barrier to adoption; critics suggest that the Revolution did not fulfill the expectation recorded in rural poverty regions where agrarian institutions remained untransformed (Spielman, Malik, Dorosh, & Ahmad, 2016). The larger global synthesis also finds powerful productivity and poverty impacts but attaches more weight to mediating factors of policies and local circumstances. These arguments pre-point the policy conundrum today: are the new waves of technology reducing or increasing rural inequality unless it comes with concomitant reforms?

Examples of irrigation efficiency innovations demonstrate the opportunities of the so-called modern techniques outside of seeds and fertilizers in welfare terms. In Punjab, the benefits of high efficiency systems (such as drip and sprinkler) are evident in project and empirical documentation (e.g., project report) showing high levels of water savings and yield increase e.g., 50 percent average water savings and an increase of yields on key crops by more than double-digit percentage values). Furthermore, World Bank programs have facilitated the adoption of these systems even by small and medium farmers. In the case of rural poverty, these technologies can increase gross margins, decrease input risk where canal supplies are erratic, and stabilize income even across drought years, which are of greatest importance to liquidity-constrained households. Adoption costs, maintenance capacity, and extension support are, however, binding constraints; appropriate subsidies and service designs (e.g., working with

a vendor-managed maintenance) are frequently the key factors that influence whether poor farmers get in on the action or default (Ali & Abdulai, 2010).

One of the most profoundly investigated household-level poverty-poverty channel yield-enlarging technologies in Pakistan is the biotech cotton. Peer-reviewed predictions envision large per-acre yield improvements and profit increments with varieties, a reduction in insecticide spending and exposure--factors that get credit as translated into increased net farm income and downside risk aversion, especially among smallholders in high-pest zones. The early econometric analyses, as well as recent syntheses, agree that there is a positive income effect, with a reasonable extent of poverty alleviation provided seed quality can be trusted and extension advice can be found; where the seed available is counterfeited or where stewardship is lacking, weaker impacts are observed. This literature reveals that identical "modern" input will bring varied results in welfare depending on the integrity and farmers' support systems in the market (Gazdar, 2009).

A newer frontier in modernization is represented by digital and precision agriculture: soil testing, variable-rate input application, remote sensing-enabled irrigation, and smartphone-based decision tools. Reflecting on international and Pakistan-specific studies, there is high potential to develop climate resilience and enhance factor productivity through optimal use of seed, water, and nutrients at the plot level. Adoption across Pakistan, however, is patchy: high costs of capital, digital literacy, and coverage of services limit uptake in non-progressive clusters. New studies can connect precision practices and lower emission intensities of grains and define livelihood pathways based on the Sustainable Livelihoods Framework (human, financial, and social capital gains). The evidence in the literature is skeptical optimism: precision tools will reduce expenditure and increase yields among smallholders as long as they are sold as low-cost services (custom hiring, bundled advisory), as opposed to being sold as individual high-capex devices.

The aspect of mechanization goes further into the story of modernization by bringing about changes in labor demand, timeliness, as well as the scale economies. The recent FAO briefs about Pakistan and reviews in contemporary literature have revealed a two-fold reality: on the one hand, the use of mechanization increases productivity and helps curtail post-harvest losses; on the other hand, its poverty effects depend on the models of access. Service markets (rental, custom hiring centers) may smooth smallholders' lumpy capital and maintain employment through the creation of complementary job tasks at the same time producing productive labor through well-timed activities (e.g., laser land leveling). Mechanization can pass by the poorer farmers and squeeze wage opportunities in the absence of inclusive service ecosystems and credit. Subsidized service delivery, operator training, and rural finance thus emerge as important requirements without necessarily having to mention machines in the policy literature. Lastly, the poverty implications of technology are mediated by institutions and public policy-land relations, input markets, and extension, rural nonfarm linkages. The land reform literature asserts that highly concentrated landholding and tenants' lack of right to the land dulls the diffusion and inclusiveness of the use of modern techniques; historical study of the experience of the reforms in Pakistan reports that redistribution is not extensive, and differences in power structure determine the pattern of adoption and the beneficiaries of the reforms. Meanwhile, more recent empirical research links agricultural growth and favorable policies (such as aid-led initiatives) to quantified agriculture-driven reductions in rural poverty, and the general rural transformation literature documents how on-farm gains leak to nonfarm employment and incomes. The meta message of all the books and articles is as follows: in Pakistan, pro-poor modern farming practices are possible provided they are anchored in equitable land/tenancy systems, credible input and seed control, easy linkages to finance and service markets, and effective, climate-sensitive extension systems.

3. Research Methodology

This paper uses a qualitative and descriptive research design whereby secondary data are used as the basis of evaluating the effects of the modern methods of farming on the development of agriculture as well as poverty reduction in Pakistan. The research information has been collected into scholarly books, peer-reviewed journals, government and institutional publications including publications of the World Bank, FAO, and IFPRI. Literature was organized in terms of key themes such as high-yielding varieties, irrigation technologies, mechanization, biotechnology and precision agriculture using a thematic review methodology. Comparative angles are also provided in the analysis by integrating the goals that these contemporary practices have on productivity as well as when it comes to alleviating poverty under different social and economic settings. The study offers an insightful comprehension of the possibilities and constraints of the contemporary methods of agriculture in rural poverty alleviation in Pakistan by synthesizing the previous empirical knowledge and the theoretical discussions.

4. Discussion

Over the years, agriculture has been the focal point in the development strategies in Pakistan, however, even the achievement of growth has been marred by its inability to spread to the rural population, making the growth process in Pakistan, not that inclusive. The Green Revolution of the 1960s was presented as a solution to increasing food insecurity by improving production through promulgating modern farming technologies, which would boost food yields. Although these technologies expanded production of such staple crops as wheat and rice, the gains were not necessarily spread equally among all farmers since larger landowners more easily could implement high-yielding varieties and markets, fertilizer, and irrigation (Spielman, Malik, Dorosh, & Ahmad, 2016). Such biased usage embedded rural inequalities as opposed to eradicating them.

As it was played out during the Green Revolution, technological innovations in isolation could not solve issues of structural nature like unequal land distribution and credit inaccessibility. Owing to high cost of seeds, fertilizers and machinery poor farmers were characterized to be left out of the benefits. As a result, there was improvement in the national food production but it was still incomplete and national (Ahmed & Amjad, 1984). This emphasizes the idea that in Pakistan the institutional patterns of agricultural modernization have traditionally generated a process of macro-economic growth, which has been, and continues to be, associated with the production of growth without equity in terms of its long-term impact on the rural society.

Irrigation is one of the hot topics of modernization in contemporary times. Water is one of the most important resources, and its scarcity has become a very serious issue because the agriculture industry requires more than 90 percent of freshwater resources compared to other industries in Pakistan (Qureshi, 2018). There has been integration of high efficiency irrigation systems which include drip, sprinkler system and others in order to improve the productivity of the water. In empirical studies done in Punjab, water savings up to 50 percent and increased crop yields are reported in these systems (World Bank, 2013). The use of adoption, however, is low due to expensive initial investment costs that are not affordable by smallholders. It presents the nature of the poverty-reducing potential of modern irrigation regarding its reliance on state subsidies and patterns of service delivery.

Another revolutionary technology in agriculture in Pakistan has been bio text or in this case Bt cotton. Research studies have revealed that the adoption of Bt cotton incurs high agricultural yields and cut pesticide expenditure and enhance profits on farms (Ali & Abdulai, 2010). Such effects have direct benefits on the household incomes and increased resistance to losses of crops. However, benefits are conditional: those farmers who labored with fake or unqualified seeds tend to lose but not gain. The example of small farmers demonstrates that governance is

a determinant factor in the increased or perpetuated poverty via adoption of modern technologies unless effectively governed through regulation of seeds and extension services. There has been open promotion of mechanization to manage the problem of labor shortages and timeliness in the cultivation. Harvesters, Laser land leveling, and Tractors can be a great addition to efficiency and minimization of losses during post-harvest (Hassan, 2019). Mechanization however is also a two-edged sword -it may open up a situation that may threaten to depress the rural demand of labor, especially amongst the landless who rely on agricultural earnings. Rental service markets or custom hiring centers act as a means to an inclusive mechanization since they help smallholders obtain equipment at reduced capital cost. Therefore, the effect of mechanization on poverty will be based on the way in which markets of services are organized and whether they will incorporate marginal farmers.

The new era of modernity is digital farming and precision agriculture. Soil analysis, mobile apps against pests, and satellite steered irrigation scheduling are tools which provide a chance to increase productivity and climate adaptation. Initial findings indicate that these technologies could streamline the use of inputs and their cost, therefore, increasing net farm incomes (Naseer, Ashraf, & Saleem, 2021). However, adoption occurs in a very small scale owing to poor digital literacy, poor infrastructure and expensive services in rural areas in Pakistan. There are risks that precision agriculture will just become another tool of the elite farmers unless they make the available technologies affordable and farmer-friendly.

Institutional and structural aspects come to the fore because of the inability to curb rural poverty even after decades of making efforts into agricultural modernization. The most serious impediment is perhaps the land inequality. Small farmers/tenants continue marginalized due to lack of access to technology, credit and markets with big landholders occupying the majority of the cultivable land in Pakistan (Gazdar, 2009). The land reform initiatives have failed to the extent that even more modern innovations in farming have been monopolized by a few individuals thus misplaced the class hierarchies in rural regions. It implies that rural poverty may not be eliminated even though there is no redistribution of land and tenants mentioned by modernization policies.

The second institutional vulnerability is in the sphere of agricultural extension services. Pakistan suffers poor extension that is under-funded and mishandled because modern agricultural methods rely on technical expertise. Informal seed merchants and sellers of pesticides may provide advice to farmers and hence cause misinformation and misuse of technologies (Dorosh & Salam, 2008). It is very important that extension services should be strengthened to ensure that smallholders make effective use of innovations in a sustainable manner. Without this, the rural poor are left to respond to uncertain information sources which restricts their productivity and income level.

The modernization-poverty nexus is rectangularwise with the role of climate change. Small farmers are the most impacted by the effects of climate change, which include rising temperatures and water shortages, as well as extreme events, and therefore, the implementation of climate-smart practices is inevitable. Practices like drip irrigation, drought resistant seeds and conservation tilling can be used to increase resilience, but only when farmers are provided with credit, training, and infrastructure (Qureshi, 2018). In the absence of inclusive adaptation policies, climatic change might reverse all the gains made in poverty averting that modernization has already taken place.

Lastly, one should mention that positive agricultural modernization impacts are not limited to farm households because they spill over to the nonfarm economies in the rural area. An increase in agricultural productivity is capable of spurring agricultural activities in the rural area in the areas of trade and transport and agro-processing (Spielman et al., 2016). Nevertheless, the connection can only be realized when growth is wide- based and inclusive. With the case of

large-farm modernization, the spillover effects are low and rural poverty is still experienced. Hence, any agricultural development policies need integrating the technology innovation and structural adjustments, social safety nets and inclusive institutions so that modernization is shifted into authentic poverty reduction.

5. Conclusion

The field of agriculture in Pakistan has involved the profitable prospect of modern agricultural practices since the days of the Green Revolution right up to the most recent breakthroughs in biotechnology, improved irrigation, automation, and precision agriculture. The clues indicate that these technologies on average have led to substantial increase in crop yield, enhance efficiency in usage of resources and even raising incomes in rural settings. They have however been an uneven force as far as poverty reduction is concerned. More prosperous landowners and more-connected farmers have been availing themselves of more advantages, whereas smallholders and landless laborers continue to exhibit impediments in the form of access to credit, quality input, and extension services. This disproportional introduction lends curtailing effects in favor of prior social-economic sets in rural Pakistan.

It is a point brought out by the discussion that modernization is incapable of eliminating rural poverty unless structural constraints that hinder its success like land inequitable distribution, institutional capacity malfunctioning and poor policies on land issues are dealt with. Proper land reforms, regulation of seeds and inputs, firmly rooted extension systems and comprehensive service markets to those facing contestation (mechanisation and digital agriculture) are needed to guarantee technology-related gains trickle down to marginalised farmers. Moreover, in the climate-change era, when diminishing water resources and climate change-induced risks in production are on the rise, modern agriculture methods have to become a part of the overall climate-resistant farming policy.

Overall, modernization of agriculture in Pakistan can become a great force of development and poverty alleviation only on the condition that it will be followed by inclusive and equitable policy-making. Combining technological advancements with institutional change, access and service delivery to the agrarian sector Pakistan will be able to turn its agricultural sector not only into an engine of growth but also into a means through which sustainable poverty reduction in rural areas is achieved and rural people are empowered.

6. References

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