

CHAPTER 7

CONCLUSIONS AND IMPLICATIONS FOR RESEARCH AND POLICY

The objective of this study was to assess the role of new production technologies and Ethiopia's New Extension Program in promoting efficiency of production in eastern Ethiopia. As part of the agricultural development-led industrialization development strategy, the Ethiopian government introduced the New Extension Program based on the experiences of the Sasakawa-Global 2000 project. The rapid expansion of the program has taken place at a time of major changes in markets, policies, and institutions affecting the agricultural sector. It is now argued that agricultural production has shown considerable improvement over the 1970s and 1980s during which policies were against smallholder farming. Despite the growing number of farmers encompassed in the New Extension Program over the years and the increased use of improved technologies, however, cereal yields remained low. There has been a growing concern about the effectiveness of the extension program in enhancing new technology utilization and raising production efficiency.

There are a considerable number of studies that have dealt with the technical efficiency of farmers in developing countries. However, only very few studies have analyzed the technical as well as allocative and economic efficiencies. These studies employed the stochastic efficiency decomposition technique. However, this technique involves scale biases arising from imposing an input-orientated framework on the output-orientated stochastic production frontier results. The resulting efficiency estimates will either overestimate or underestimate the true measures depending on the returns to scale associated with the production technology and are thus inconsistent.

This study employed an extended efficiency decomposition technique that accounts for scale effects to analyze smallholders' technical, allocative and economic efficiencies under traditional and improved production technologies in eastern Ethiopia. Specifically, the extended efficiency decomposition approach was employed to assess the impact of improved maize technologies on the efficiency of maize production and the impact of the New Extension Program on farmers' overall technical, allocative, and economic efficiency. Socio-

economic and institutional factors influencing farmer efficiency were also analyzed both at crop and farm levels. Further, to assess cropping system performance and its role in smallholders' production efficiency, resource use efficiencies of alternative cropping systems and technologies were derived and innovative practices identified using total factor productivity analysis.

The study used data obtained from a survey of two sample households, participants and non-participants in the New Extension Program, in two districts of East Hararghe Zone in eastern Ethiopia. Meta and Babile districts were selected to represent distinct agro-climatic zones in eastern Ethiopia. Two hundred farm households, one hundred households from each district consisting of a comparable group of participants and non-participants, were intensively surveyed for the entire 2001/2002 agricultural year. Data collection was accomplished in three major phases identified based on the major cropping operations in the respective districts, including land preparation and planting, weeding and cultivation, and harvesting and threshing of the major food crops.

7.1 Conclusions

Despite a positive impact of improved maize technology on maize production efficiency, the results indicated considerable inefficiencies of production under both traditional and improved technology. For traditional maize production, the study obtained mean technical, allocative, and economic efficiency estimates of 68 percent, 83 percent, and 56 percent, respectively. The corresponding results for hybrid maize production were 78 percent, 77 percent, and 61 percent. This indicated the possibilities of raising traditional maize production by an average 44 percent and that of hybrid maize by 39 percent through full efficiency improvement. While much of the production inefficiency in traditional maize production is attributed to technical inefficiency, the production inefficiency in hybrid maize production is equally attributed to technical and allocative inefficiencies. In other words, improvement in technical efficiency of traditional maize production needs a priority attention as it provides a significant source of growth in maize output.

The results support the argument that adopters of improved technologies encounter substantial technical and allocative inefficiencies due to their lack of familiarity with new technologies

and failure to adjust quickly to new production and market conditions. Although there are technical and allocative inefficiencies associated with both traditional and improved maize technology, allocative inefficiencies under traditional technology are not significant relative to those associated with improved technology, which are considerably higher. Further, although improved technology has a slightly positive impact on technical efficiency, relative to traditional technology, a considerable potential for increased maize production remains to be exploited through raising technical efficiency. The study further revealed that education, access to credit, and greater security of tenure are the key determinants of the efficiency of maize production.

The analysis of overall farm level production efficiency revealed that both participant and non-participant farmers in the two agro-climatic zones have considerable overall productive inefficiencies. In the wet highland zone, the participants in the program used a superior technology and have higher technical but lower allocative efficiencies than the non-participant farmers, relative to their respective technologies. This indicated that both groups of farmers exhibited greater and comparable overall productive inefficiencies. In the wet highland zone, the participant farmers' mean technical, allocative, and economic efficiency levels were estimated at 79, 80, and 65 percent, respectively, and the corresponding results for non-participants were 72 percent, 85 percent, and 63 percent. This implied that participants and non-participants can achieve, respectively, an average 35 percent and 37 percent growth in food production through full technical and allocative efficiency improvements. This indicated that the New Extension Program has had no impact on production efficiency in the wet highland zone.

In the dry land zone, the participant and non-participant farmers used homogeneous production technologies, confirming the serious shortage of appropriate technologies for the low moisture areas. In the dry land zone, the participant farmers' mean technical, allocative, and economic efficiency levels were estimated at 68 percent, 81 percent, and 54 percent, respectively. The corresponding results for non-participants were 66 percent, 84 percent, and 57 percent. The results suggest that the participants and non-participants can achieve, respectively, an average 46 percent and 43 percent growth in food production through full technical and allocative efficiency improvements. Further, apart from using homogenous technologies, the two groups do not have significantly different technical and allocative

efficiencies. The results thus indicated that the New Extension Program has had no positive impact on production efficiency of farmers in the dry land zone.

On average, the participant and non-participant farmers in the wet highlands zone have higher production efficiencies than their counterparts in the dry land zone. This indicated the low productivity in the dry land zones mainly due to poor support services such as extension, credit, input supply, and adverse climatic conditions. A regression analysis of the determinants of efficiency revealed that education, credit, previous participation in extension programs, and the share of the maize-potatoes cropping system positively influence production efficiency in the wet highland zone. In the dry land zone, on the other hand, education, off-farm income, and the share of the cereal-pulse cropping system have a positive impact on efficiency.

The results from the productivity analysis indicated considerable variation in resource use efficiency among the cropping systems in both areas. This confirmed that part of the variation in resource use efficiency at farm level could be explained by the variation in cropping systems practiced. The results showed, in general, that as land and other resources become increasingly limiting and agricultural production highly conditioned by weather, farmers have greater incentives for pursuing more efficient cropping practices. When land available to a household is too small to produce subsistence requirements from sole cropping and risk considerations become increasingly important, farmers tend to intercrop in order to produce sufficient food for the household and hedge against production risks. But if sufficient land is available to support subsistence requirements, the farmer resorts more to sole cropping of both food staples and cash crops even though those may not be the most efficient.

The results suggest that farmers pursue objectives other than higher yield levels, such as satisfaction of subsistence needs and risk management (i.e., stability of yield) in making their cropping system choices. For instance, while cropping systems involving maize were superior to sorghum in terms of productivity, sorghum systems are widely practiced in the dry land zone due to higher tolerance to drought under the prevailing unreliable weather conditions. On the other hand, intercropping of maize with potatoes showed the highest efficiency advantages over other cereals (wheat and tef) and potatoes combinations in the wet highland zone. In both areas, improved crop varieties such as improved maize appeared superior when planted as sole crops or intercropped with other crops. Intercropping of these varieties with

potatoes in the wet highland zone and with pulses like haricot beans in the dry land zone offers the largest benefits. This confirmed the critical role of integrating improved production technologies into the traditional farming systems.

7.2 Implications for Research and Policy

The results of this study provided empirical evidence of the positive impact of new maize technologies on maize production efficiency. However, the study found no evidence of impact of Ethiopia's New Extension Program on the overall food production efficiency of smallholder farmers. It may yet be difficult to draw definite policy recommendations based on these results. This is because of the fact that the study was based on limited macro level data and cross-sectional data covering only one production year. Nevertheless, the results could still be very informative for re-designing agricultural development strategies aimed at raising the productivity of smallholder agriculture through technological change. The results could help design appropriate strategies to enhance the effectiveness and relevance of improved technology to the priority needs of the various agro-climatic zones in the country. Based on the results obtained, therefore, some important policy implications and recommendations can be drawn.

Greater availability and accessibility of appropriate agricultural production technologies for all agro-climatic zones is very crucial. This could help enhance the efficiency of smallholder agriculture and the effectiveness of the New Extension Program. Despite the emphasis on raising agricultural productivity and food security through improved technologies in all zones, there is actually a serious shortage of improved and appropriate crop technologies especially for the dry lands. This lack of appropriate technology has in turn undermined the role and effectiveness of the New Extension Program. This is because it is narrowly organized and properly functions only when there are appropriate and adequate packages of technologies to be promoted. Therefore, generation and adaptation of appropriate cereal technologies such as high-yielding and drought-resistant crop varieties for the dry lands would yield greater benefits in terms of increased food crop production and productivity.

The substantial inefficiency of production under both traditional and improved technology indicated the availability of ample opportunities to raise food crop production with existing

technology. Therefore, given the country's existing capacity constraints to modernize agriculture, a feasible short term strategy to raise food production would be to raise the efficiencies of production under both traditional and improved technology. To properly tap the potentials implied by higher inefficiencies, agricultural development policies and strategies need to be redesigned to provide adequate support services to smallholder agriculture to help improve the efficiency of the agricultural and food systems in general. Agricultural research, extension, education, credit, and input supply systems need to respond to the technological, financial, infrastructural, and market demands of smallholder food production.

Policies and strategies that improve access to rural education, credit and inputs, and off-farm employment opportunities could help raise the efficiency of food production. Appropriate policies need to be designed to provide adequate and effective basic educational opportunities to the rural farming households. Extension services are poor mainly due to the poor technical and communication skills of the extension agents coupled with limited availability of trained agents. There is thus an urgent need for upgrading the quality and adequacy of the extension services. This could be done mainly through better pre-service as well as in-service training schemes for a greater number of extension staff in line with the agricultural development strategy that places emphasis on raising smallholder agricultural productivity. Further, given the complementarity of education and extension services, expansion of basic and functional educational provisions in the rural areas must also be considered a key strategy for achieving increased smallholder agricultural productivity.

This study provided evidence of the critical role of credit and off-farm income in raising efficiency of production. These enable timely and adequate use of new inputs like fertilizer and improved seeds in the face of serious liquidity constraints facing smallholder farmers. The existing off-farm employment opportunities, especially in the dry land zone, greatly relieve farmers' liquidity constraints. Off-farm incomes enable them to buy critical inputs, to settle the down payments for input credit, and to acquire food during critical times of food shortage, thereby maintaining the productive capacity of the household. Farmers have little or no access to both formal and informal credit, especially in the dry land zones, where there are frequent crop failures and consequent loan defaults. Strategies that strengthen existing off-farm employment opportunities would thus help enhance the use of improved technologies. Raising farmers' access to formal production credit in the short run may not be as feasible

under the current production technology that fails to hedge against crop failures due to climatic shocks. In the long term, increased access to formal credit could be combined with the generation and promotion of more appropriate crop technologies especially for the dry land zone.

The complex and innovative traditional farming systems in eastern Ethiopia have evolved over time in response to changing agro-climatic and demographic conditions. The productivity of these systems has yet been greatly undermined by adverse climates and frequent shocks. Agricultural research and extension must thus play a greater role in generating, adapting, and integrating new technologies into such systems in order to raise their productivity.