



**Is Agricultural Research on the Relevant Trade?
A Critical Assessment with Evidences from West and East Africa**

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ABSTRACT

Despite increasing globalisation, some regions such as Africa still remain in poverty. Nevertheless, research for developing countries is primarily focused on improving agricultural production especially for staple food crops. But for many of these crops, African countries might be disadvantaged in comparison to agro-industrialised regions. Under these circumstances, measures will not result in efficient allocation of resources. This raises the important question of *how then should agricultural research move forward?*

Though responses to this question may be quite diverse, long-term research evidences from Kenya and Niger suggest interesting answers. In East Africa market oriented systems are found while the *Djerma* millet system of south-western Niger is rather subsistence-oriented. In contrast to Niger, Kenyan cropping systems are of higher potential, as they focus e.g. on perennials like coffee, where they have comparative advantages. Here, the success seems to be rather dependent on institutional conditions. For example farm size has an important impact on agricultural productivity. Thus, the relevant question also in Kenya as well as in Niger is, how to assist small farmers in gaining ground on markets.

These facts determine the future directions of agricultural research. For those most seriously affected by climatic and institutional shortfalls, policies should, in short term, aim on stabilising staple food production to maintain food security, but in the longer run seek for other opportunities than intensifying staple crops. Above all, *income generation to purchase food instead of inefficient subsistence farming* is the key word. For this, new products and new markets, in and outside agriculture, have to be sought. Agricultural research should also focus on niche-crops that are marketed, e.g. vegetables, or animal products. For the further development of farming systems that are promising in terms of an already existing market orientation, research and policies should aim at institutional strengthening and social organisation so as to enhance the access of small farmers to national and international markets.

1 Theoretical and empirical aspects on globalisation, agriculture and development

Despite increasing globalisation, fostered by trade liberalisation, new means of information and technological innovation, some regions such as Africa still remain in poverty, and the gap between the poor and the rest of the world increases. Recent publications show that absolute poverty – that is poverty defined as the percentage of people living with less than about one USD per day - has increased during the last decade in two regions: the region where poverty remains a growing threat is Sub-Saharan Africa (THE WORLD BANK ET AL. 2001), which may suggest that Africa is at the losing end of globalisation. It is thus of interest to discuss the relation between development, agriculture and trade or globalisation respectively. This is what should bring agricultural research closer to its role in alleviating poverty.

In traditional development theories, agriculture is expected to contribute to economic development through various factors, including the provision of food security, income generation and ensuring demand for industrial (upstream-sector) products, and transferring labour to other sectors. But even here, agriculture is not expected to be the sole engine of development: the mere "contribution" arguments are heavily criticised, as agriculture often does not seem to be productive enough, and labour cannot easily move from the agricultural to the industrial sector (VON URFF 1982).

Concerning agriculture and trade theory, there are several approaches that assign agriculture with negative impacts on development, especially the dependence theory (HEMMER 1988). Other theories, like the theory of comparative advantages, claim that trade *per se* is beneficiary (ROSE AND SAUERNHEIMER 1995). Newer approaches like the new foreign trade theory or the new growth theory claim that regional (or other) disparities might be due to economies of scale or institutional frictions (KRIEGER-BODEN 1995). Such theories seem to be a further development of the thesis that less developed groups mainly suffer from a poor endowment with factors of any kind (HEMMER 1988), and are thus trapped in a vicious circle of persisting and increasing marginalisation.

From the above discussion, it is clear that answering the question of how agricultural research should move forward in the case of Africa, implies a search for an answer to which of the above mentioned theories actually holds. In asserting such efforts, the dependence theory would be the first to be sidelined, simply because agricultural production and trade is not restricted to less developed countries. What might hold is that trade barriers still hamper trade, but that would not explain why only Africa seems to be excluded both from benefiting from trade, and especially from exports. Trade has been liberalised since the beginning of the nineties, while at the same time Africa's economic and social situation has worsened (FAO 2001). Classical and neo-classical trade theories are subject to quite restrictive assumptions, so that what is left is either the new trade theory and the new growth theory, or their ancestor, the theory of factor endowment. The subsequent case studies shall analyse a marginal West African farming system and a relatively developed East African one, and thus throw a light on the frictions that finally hamper agricultural market-induced development.

2 Farming systems, markets and innovations in Niger

2.1 The Study Region

Niger is one of the poorest countries in the world. It faces a broad scope of severe economic and natural problems. It is a landlocked country that heavily depends on agriculture which provides more than one third of the GDP and income for about 90 percent of the population. However, 65 percent of Niger's area is covered by the Sahara desert, another large part is the Sahelian zone, where only pasture and high-risk cropping are feasible. In the south of Niger rainfed agriculture with pearl-millet dominated systems, often intercropped with cowpea, prevail. In total, arable land covers only twelve percent of the total Nigerien area. As pressure grows on land through increasing population and simultaneous soil degradation, also conflicts arise between farmers and herders.

Niger's agricultural, macro-economic and trade policy during the sixties and seventies can be considered as a long-term series of failures, owing to a number of reasons. One of them was perpetual state intervention and the neglecting of agriculture in favour of the mining sector. Finally, trade policies in the eighties and nineties aimed at liberalisation which did not resolve the general problem of food deficits. However, the main agricultural trade axis is the one from the north of Nigeria through east-Niger to the South-western part of the country. Trade is dominated by the ethnic group of the *Haussa*, who live along both sides of the Niger-Nigerian border, leading to a situation of heavy dependence of Niger on its neighbour, Nigeria.

2.2 The Farming Systems in Southwest Niger

The farming systems in the area are characterised by subsistence, perpetual droughts and what one could describe as distress farming. The specific system investigated in the study are situated in the Southwest of Niger, in the Tillabery and Dosso region. In each region, farmers of two villages were subject to farm and household surveys in the eighties and nineties (MCINTIRE ET AL. 1989, GRINI 1999). Average annual rainfall range from 400 mm in the more towards the north situated area of Tillabery to 600 mm in the Southern part, the Dosso. The ethnic group is the *Djerma*, who traditionally do not participate as much in markets as the *Haussa*. Farming systems are based on pearl millet, frequently intercropped with cowpea. Other crops that play a minor role are sorghum, and, mostly on women's fields, groundnut and others like hibiscus and okra (for a closer description of production systems in Niger see ABELE AND GRINI 1999). The systems are mostly subsistence oriented (BAIDU-FORSON AND WILLIAMS 1996). Only a small share of the millet production is marketed, and especially in the northern, less favoured region, distress sales can be observed, as crops are sold immediately after harvest, when prices are low and debts have to be paid that arise from food-deficit purchases in the pre-harvest period. In the southern area, the situation is less drastic (a detailed description of marketing patterns is found in ABELE 1999). Other sources of income are sales of animals, and off-farm activities, be it in Niger or abroad (MCINTIRE ET AL. 1986).

Factors that determine productivity in such marginal areas are, of course, rainfall and its variability, but also infrastructure that provides access to scarce inputs like mineral fertiliser. Market access in terms of distance (or time) seems also to play an important role, but it seems that there is a certain chicken and egg phenomenon: while the

southern farms with good market access seem to be better off, one of the study villages in the north was quite productive already before it had a market. However, the market later developed on that site, so that one could say that markets improve farming, but they also develop where good farmers are to be found.

2.3 Functions and Limitations of Niger's Agricultural Markets

Agricultural trade seems to be dominated spatially through the axis Nigeria-East Niger, and ethnically by a certain group of rich *Haussa* traders, the so-called *al-hadji* that live in the East-Niger-Nigerian border region. Some state that these traders hold a monopoly in cereal trade which they exploit and thus gain rents up to 100 percent of the farm gate price (BERGSCHMIDT 1995). But our own model calculations show that such rents may only be possible in times of extreme scarcity, in "normal" years, that means in years of an average harvest, rents may only yield up to one third of the farm gate price, a reasonable margin when we take into consideration that with that margin, a whole network of traders and middlemen has to be kept functioning.

Demand for food in Niger is rather inelastic. Thus, prices react sensitively to both shortages after harvest failures and surpluses after good harvests. This may be fostered by the fact that there is a certain monopoly that yields high prices in times of scarcity. It is also due to the fact that the market outlets are scarce, so that post-harvest prices are low, especially in times of good harvests. These phenomena finally lead to a high price variability on cereal markets, that has to be taken into account when assessing farming systems and their potential for innovations.

Input, especially fertiliser markets, seem to be even more scattered. Supply is restricted, as fertiliser markets are heavily dependent on the Nigerian side, where liberalisation recently has increased fertiliser prices so that fertiliser is hardly available and if then only at high prices (BARHOUNI AND TODOU 1998).

2.4 The Potential for Innovations: Development or stabilisation?

The above mentioned facts set the framework for the analysis of technical innovations: farmers are subsistence oriented and face both climatic and institutional (market related) constraints. This leads to a certain risk aversion that has long ago been stated (ADESINA AND BRORSEN 1987), and to a relative importance of off-farm income that is hardly to be estimated correctly. Scarcity of inputs and the competition of main crops like pearl millet with crops that are cultivated, e.g. by women but are important as cash crops, like groundnut or others may be of additional interest. Against this background, new technologies have already been tested by HAIGIS ET AL. (1999). These technologies mainly focus on millet production and are the result of a 15-year long term special research project of the University of Hohenheim (see REISCH AND VON OPPEN 2000). Amongst them were high-input options like broadcast fertiliser, but also low input technologies like pocket-placed fertiliser, the leaving of crop residues on the field, or selected weeding, i.e. leaving certain shrubs on the plot.

Some of these options have to be rejected in an early stage of evaluation: Broadcast fertiliser application is hampered by the scarcity of mineral fertiliser. On the northern sites, pocket placed fertiliser burns the young plants while they are germinating, and crop residues are too scarce to be applied as effective organic fertiliser. So what is left is the pocket placed fertiliser and crop residues for the South and selected weeding for the North. These options have been tested by using a Markowitz Portfolio-non linear programme that includes risk aversion in the objective function and an interregional trade model in combination. Calibrating the risk aversion coefficient for both the North and the South, risk aversion was quite high with a renunciation of profits of nine percent

in the South and even 23 percent in the North. Under these circumstances, for the southern region, low-input fertiliser use seems to be a good option as long as prices are high, but when assuming lower prices that had been generated by the trade model under the assumption that parts of the production were brought on the market to cover the fertiliser costs – and therefore a certain inverse reaction –, the potential of such technologies was quite restricted. In the North, selected weeding proves to be a stable technology, as it does not induce higher costs or even higher risks but simply leaving shrubs on the field.

2.5 Lessons from Niger

The findings from above yield the following lessons: first, farmers are subject to many constraints and their willingness to use high-yielding technologies seems to be limited, be it that risk is too high, both in terms of production and market risks, or that alternatives like off-farm income are more attractive. Similar phenomena have been reported by MCINTIRE ET AL. (1986) and by HAIGIS (2000:180). Short term solutions might be to introduce stabilising technologies (e.g. selected weeding) for food crops, but in the long run, alternatives have to be sought. One might be the improvement of off-farm income. Another might be the quest for agricultural products that have better market chances, economically speaking products with higher price and income elasticity of demand, like horticultural products or leguminous crops. Research should consider these issues. It should also focus on risk assessment and on a closer market assessment, including institutional economics' approaches. This would mean to go beyond the present neo-classical approaches, where markets are only treated as perfectly functioning wealth generators.

3 The Kenyan Experience

The Kenyan experience is based on empirical data generated from a hundred farmers in Machakos District in the Eastern Province of the country, which is used to assess the role of agricultural marketing in the development of Kenya's rural economy, and to test some of the hypothetical questions on the role of markets that emerges from the theoretical review presented in Chapter One. Econometric methods are used to assess the relevance of agricultural trade theory, focusing on market access and associated multiplier effects on input use, aggregate productivity, and the distribution of market-generated efficiency gains across different regions and farmers. This forms a basis for recommendations on possible ways forward.

3.1 Background and Study Area

With over eighty percent of its total land area classified as having low potential for agricultural production (MAKANDA, 1987), Kenya has long realised the need for intensification in agricultural production. With a limited capacity to expand land area under cultivation due to climatic, agro-ecological and environmental constraints, the country has – in the past decades – embarked on market liberalisation in the agricultural sector so as to create price incentive to farmers. Micro-economic theory posits price incentives to be the major signals of production decisions, and thus influence the efficiency of resource allocation, and market orientation. The subsequent specialisation of farmers and intensification of input use is expected to increase productivity in the agricultural sector. All things being equal, increase in productivity increases farm income and subsequently facilitates the adoption and application of more yielding enhancing technologies and inputs (KAMARA AND VON OPPEN, 1999).

With diverging agro-ecological conditions and differential access to input and output markets, farmers may specialise in the production of crops for which they have a higher comparative advantage and become more market oriented, utilising economies of scope and scale. Economies of scale emerge as a result of many small farmers specialising in the production of a particular crop or similar crop mixtures that allow traders to fully utilise and expand their capacities for handling increased market arrivals and hence decrease per unit costs (IJAIMI, 1994). Thus, by taking advantage of these market-generated efficiency gains, farmers may be in a position to improve their livelihood standards as result of direct policy incentives. This is also viewed as a springboard for integrating farmers into their overall national economic systems and hence into the global economy. But are these efficiency gains equitably distributed between farmers of different socio-economic circumstances? Does the entire process of market integration only yields the desired outcomes for all farmers? It is the quest for responses to some of these questions that form the theme of this second part of the investigation. The study is located about 70 km north-west of Nairobi and covers an area of 5,818km² with a population of about 900,000 people that is largely constituted of subsistence farmers.

3.2 Farming Systems, Socio-economic and Agro-Ecological Profile

The surveys were administered in Mua, Iveti and Kangundo villages, which are the high potential areas in the district in terms of agricultural production. The other areas are mostly semi-arid and are dominated by extensive livestock production or pastoralism. Kangundo and Iveti consist mainly of smallholder subsistence farmers with farm sizes that range between 4 and 12 acres while the Mua area is dominated by large farmers with farm sizes ranging between 15 and 40 acres. Farm size was the major criterion for the selection of farmers, with the entire sample consisting of 55 small farmers and 45 large farmers. The dominance of small farmers in the sample is justified by the predominance of small farmers in the study area, which necessitates their proportional representation. Average household sizes fluctuate around seven people including the children, engaged mainly in crop production, and deriving over seventy percent of their livelihood directly from agriculture. The major crops grown in the area include maize, beans, coffee, vegetables, and to a lesser extent Persian fruits, avocados and sugar cane. Most of the farmers combine subsistence agricultural production with off-farm activities, while others produce on a comparatively larger scale both for consumption and marketing. The limited off-farm income opportunities include wage labour, sand mining, quarrying, charcoal production and firewood fetching. There is a strong correlation between household size and number of permanent farm workers, which is almost entirely constituted of family members. Seasonal wage labour is limited to the peaks of the growing season, especially during weeding and harvesting. Farm mechanisation is uncommon and is limited almost entirely to the large farmers.

3.3 Markets-generated Efficiency Gains

The output from the econometric analysis shows the impact of agricultural markets on farm productivity as depicted by specialisation in the production of crop mixture for which farmers have a relatively high comparative advantage, and intensified input use facilitated by proximity to markets. The use of productivity enhancing inputs (pesticides and high-yielding seed varieties) all increase with improved market access. The elasticity estimates show that improvement in physical market distance, *ceteris paribus*, increases aggregate farm productivity by two folds, while the response of productivity to fertilisers was even higher, as the high yielding varieties of maize, beans and vegetables, which are widely grown in the area, respond well to fertilisers. The effects

of the variables measure the direct effects of markets, which can be observed through the specialisation of farmers in situations of well placed socio-economic and other facilitating institutions such as credit, extension and regulatory institutions. Clearly, the observed overall welfare gains from improved market access may be desirable from efficiency perspectives, as is indeed intended by trade liberalisation policies in the developing world (WORLD BANK, 2001; FAO, 2001). What is however important is the distribution of these efficiency gains among small and large farmers, and subsistence and commercial farmers which is crucial for liberating for development and poverty alleviation.

3.4 Winners and Losers

The general recommendation of prioritising the improvement of markets as an important approach to rural development is clearly self-evident from the discussion thus far, as it gives farmers the opportunity to specialise and optimise their portfolios with respect to available resources and subsequently exploit economies of scope and scale. However, the results of the partial analysis shows that large farmers generally benefit more from market improvements than small farmers, as reflected by the realised increases in aggregate productivity. Since a considerable portion of the market generated gains (as depicted by the estimated elasticity) results from the direct effects of markets, small farmers find themselves at the losing end. It is therefore vital to note, especially at the policy making level, that in as much as a general improvement in market access improves the income of rural households, it can at the same time lead to inequity in the form of uneven distribution of these market generated efficiency gains between different groups: small versus large farmers; easy access versus difficult access, with the bulk of the small farmers falling into the latter category. To a large extent, the situation of the small farmers in Kenya could be representative of others in the region. Therefore, policies addressing these issues should be formulated such that the access of small farmers especially to credit and extension, which are key determinants of the use of other inputs, is guaranteed. Supporting small farmer initiatives, farmers' organisations and institutional support systems that keep small, resource-poor farmers on board decision making processes regarding market information and group-based credit could be an important step in the quest to integrate small, marginalised farmers into the global economy.

4 Conclusions and Policy Implications

Thus, the situation of farmers in East and West Africa, compared through the experiences in Niger and Kenya gives a diverse picture. While there is a general scepticism towards the adoption of yield-enhancing, but high input requiring technologies for staple crops in Niger, farmers in Kenya are relatively innovative but much constrained by the high degree of heterogeneity (small and subsistence versus large and commercial) which creates a distortion in the distribution of market-generated efficiency gains; this has implications for the levels of returns on capital investment in farm activities (through diverging levels of economies of scope and scale), and hence a potential for price fluctuations.

What now are the conclusions to be drawn? Kenyan farmers are possibly those who can benefit from trade and globalisation. The question that is to be solved is how allow the at present less favoured farmers to get their share of the wealth that is induced by market access. Solutions are the organisation of farmers to exploit economies of scope and scale, both in terms of access to factor markets and to gain a better position on output markets. Such ways are followed most recently by developing projects, like in

the case of contract farming (EATON AND SHEPHERD 2001), or other ways of organisation building. However, one should be well aware that such measures, as well as liberalisation itself, entails a bunch of further measures that have to aim at removing institutional frictions and make markets really function (SHEPHERD AND FAROLFI 1999). In Niger, the situation is a little more difficult. Constraints for agricultural development cover both natural conditions and institutional problems, including a geographical problem of being landlocked and thus having but a poor and costly access to international markets. Even on functioning markets, main crops like millet face low price and income elasticity of demand and are thus subject to price volatility, which leaves them with little attractiveness for intensification. Consequently, new ways have to be sought. *Stabilisation* of food production should be done with low input techniques, like selected weeding and – to a limited scope – pocket placed fertiliser. But *development* can only be reached with products that are better positioned on markets, i.e. with a higher demand elasticity of price and income. This could be horticultural products, leguminous crops like groundnuts, or animal products, as the income elasticity for the latter is expected to be quite favourable in Niger like elsewhere, too (HOPKINS AND DELGADO 1995), and Niger is a traditional exporter of animal products. Such issues should also be subject to market and marketing research, as marketing opportunities seem to be the bottleneck of Niger. Further, additional income has to be generated, as off-farm income already seems to be of a high significance for overall household income, even determining agricultural production decisions. This again is a challenge, as the whole region faces a difficult economic situation, and even jobs in the coastal areas are becoming scarce. However, it is a comprehensive point of view and set of measures that has to be envisaged.

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