

Commercialisation of smallholder irrigation: The case of horticultural crops in semi-arid areas of eastern Kenya

Commercialisation de la petite irrigation: Le cas de l'horticulture dans des zones semi-arides de l'est du Kenya

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Abstract

The paper reports a study of the economics of irrigated production of horticultural crops in the Makueni and Meru Central districts of eastern Kenya. These are semi-arid areas where water scarcity is an existing and growing problem. The producers who were studied are smallholders, operating both as individuals and in groups, and in many cases using pumps to lift river water for irrigation. The study indicates that the potential returns to Horticultural crops are good, but notes that these returns are to some extent offset by significant transaction costs, especially in relation to marketing. Problems were identified in several areas, including market information, access to credit, risk and uncertainty, difficulties of contract enforcement, insufficient numbers of traders acting as middlemen, and high costs for them in collection of small, dispersed product quantities.

Résumé

Cette communication présente les résultats d'une étude économique de l'horticulture irriguée dans des districts de Makueni et Meru Central dans l'Est du Kenya. Il s'agit des zones semi-arides où la pénurie d'eau pose un énorme problème. Les petits agriculteurs qui ont participé à cette étude fonctionnent aussi bien individuellement qu'en groupements, et ils utilisent souvent des motopompes pour amener l'eau d'irrigation depuis les fleuves et d'autres cours d'eau. L'étude montre que l'horticulture est potentiellement rentable mais que les gains sont plus ou moins neutralisés par les coûts de transactions, surtout liés à l'écoulement des produits. Des problèmes ont aussi été identifiés dans d'autres domaines : information sur les marchés, accès au crédit, risques et incertitudes, difficultés de faire respecter les obligations contractuelles, nombre insuffisant d'intermédiaires, et coûts élevés liés à la collecte de petites quantités de produits depuis des zones dispersées.

1. Introduction

The horticultural sector in Kenya has experienced tremendous growth over the last two decades. In 1996, total production of fruits and vegetables was estimated at 3.1 million tonnes. Of the estimated annual total produce marketed, over 3 million tonnes are consumed in local markets, about 250,000 tonnes are used as input in the processing industry, and about 90,000 tonnes are exported as fresh produce (Mulandi 1998). Thus, the horticultural sub-sector provides food, contributes to rural livelihoods through generation of employment in agriculture and related service sectors, and generates export revenue.

In semi-arid areas of Kenya the growth of production and commercialisation of horticultural crops are linked to the increase in smallholder irrigation and adoption of new technologies. This provides new opportunities for improving food security and livelihoods for large numbers of poor people who might not benefit from investments in high rainfall and more favourable agro-ecological environments. Irrigation can reduce crop production risk, providing greater incentives to increase input use, increase crop yields, intensify crop production, and encourage diversification into higher-valued crops. The resulting increase in marketable surplus and commercial activities has the potential to generate increased income for farmers. Yet, as smallholder commercial irrigation expands, issues relating to access to water among competing user groups, enterprise profitability, and access to markets take on added importance because they directly influence the size and distribution of benefits accruing to various stakeholders.

This study provides an overview of production and marketing of horticultural crops in Makueni and Meru Central districts of eastern Kenya where smallholder irrigation is an important activity.

2. Bio-physical and socio-economic profile of the study area

Table 1 shows that Makueni and Meru Central districts have a total area of 10,452 km², an estimated population of 1.3 million, and are characterised as arid and semi-arid agro-ecological zones. The rainfall pattern in these districts is bi-modal with the first season known as the long rains falling between March to May, and the second season known as the short rains falling from October to December. Average annual rainfall in both seasons varies from 500 mm to 2600 mm in Meru Central and slightly over 1,000 mm in Makueni.

Data for the study was collected from secondary sources and key informants in the study area. Rapid market surveys, using a checklist, were conducted to fill in data gaps. The results are used to draw implications for likely economic and social impact from the growth of smallholder commercial irrigation.

Production of horticultural crops is an important economic activity in Makueni and Meru Central districts. In 1998, total production of horticultural crops was estimated at 5,572 metric tonnes in Makueni and 21,592 metric tonnes in Meru Central. Although accurate estimates were not available at the time of our survey, anecdotal evidence suggested that smallholder farmers produced most of these crops.

Table 1. Area and population in the study area.

District	Total area (km ²)	Cultivable area (ha)	Proportion of cultivable land in total area (%)	Total population (000)	Population density (person/km ²)
Makueni	7,440	554,000	74	767	103
Meru Central	3,012	216,500	72	500	166

Sources: Ministry of Agriculture and Central Bureau of Statistics.

3. Production systems

In Kibwezi division of Makueni district, irrigation activities are concentrated along Kibwezi, Athi, and Thange rivers. In Meru Central, irrigation activities are concentrated along the main rivers originating from Mount Kenya, Kathita, Kithino, Thigithu, and Mutunga rivers, and their tributaries.

Access to water for irrigation is a key determinant of commercial production of horticultural crops in the study area. Smallholder farmers irrigate a wide range of vegetables and fruits, year-round for sale in domestic and export markets. These include Asian vegetables (brinjals, ravaya, chillies, okra, and karella, guar, dudhi, turia, curry leaves, patra, and saragua); vegetables for the domestic and export market (tomatoes, kale, onions, spinach, and baby corn) and fruits (mangoes, paw-paw, custard apple, and citrus).

Levels of production of some principal vegetable crops in recent years are shown in Tables 2 and 3.

Table 2. Trend in production of horticultural crops in Meru Central (1991 –1998).

Units : tonnes/year

Year	1991	1992	1993	1994	1995	1996	1997	1998
Cabbages	3,365	2,445	1,626	5,190	4,000	3,600	6,300	6,600
Tomatoes	1,164	1,300	1,680	1,988	2,400	3,420	4,000	5,160
Kale	854	754	224	278	264	300	210	340
Onions	334	245	636	1,270	1,600	3,600	3,900	4,200
Karella	-	-	198	287	609	400	558	700
Brinjals	-	-	214	366	296	264	360	468
Snowpeas	-	-	30	56	360	980	-	-
Fr. Beans	1,720	1,420	2,999	3,160	800	1,050	1,170	1,640
Okra	-	-	240	516	365	450	396	500
Dudhi	-	-	45	54	162	150	319	384
Valore	-	-	714	76	48	100	-	-
Carrots	444	440	368	344	545	720	1,300	1,600

Source: Ministry of Agriculture, Meru Central Annual Report, 1999.

Table 3. Trend in production (tonnes/year) of horticultural crops in Makueni (1996-1998).

	1996	1997	1998
Brinjals	3,200	4,050	1,800
Chillies	-	225	120
Okra	1,485	900	560
Karella	315	1,000	396
Tomatoes	1,800	2,000	1,400
Kale	144	720	800
Onions	90	240	192
Mangoes	120	-	42
Pawpaw	1,200	300	210
Custard apple	60	12	12
Citrus	850	120	40

Source: Ministry of Agriculture, Makueni District Annual Report 1999.

4. Organisation of irrigation

There were variations in the organisation of irrigated agriculture in the two sites. In Makueni district, many farmers used their own motorised pumps on their plots. These farmers made their own decisions on when to irrigate and were not affected by water rationing and management problems faced by those in the group-based schemes. They were, however, constrained by lack of investment capital, high maintenance costs, and low bargaining power in marketing. Though required by the Water Act (CAP 372 of laws of Kenya), few individual irrigators purchased water permits as a result of weak statutory enforcement by authorities and bureaucracy involved in getting permits.

Group-based irrigators pooled their resources by collective ownership of motorised pump sets and communal production. The groups were allocated water at different schedules. They seemed to benefit from pooling their resources, but were faced with frequent management problems. There was limited availability of water for group members at the lower end of the canal. Some farmers in irrigation schemes, mostly along the Kibwezi River, grew crops independently on their own plots but were also members of groups that controlled the supply of water. A water management committee allocated water according to a water allocation timetable. Most farmers in group-based schemes purchased water permits because many donors stipulated it as a requirement.

In Meru Central district group-based irrigation was dominant, but few individuals owned irrigation equipment. These group-based schemes were mostly donor-driven as some donors required the formation of groups as a prerequisite for funding. Many of these schemes operated on a cost-sharing basis with donor funds providing the initial investment for establishment of water intake pipes and storage tanks. The farmers generally managed these groups appointing a committee to manage the project while the farmers themselves enforced by-laws. Few individual farmers, mostly large-scale producers, used their own motorised pumps on their plots.

Farmers used different irrigation technologies in the two districts. In Makueni district motorised pump-fed furrow irrigation was dominant, but a few farmers used gravity-fed furrow irrigation. The Super Money Maker manual treadle pump was introduced recently but has not been widely adopted. A few large-scale farmers and institutional operators such as the University of Nairobi and Tana and Athi River Development Authority used drip and sprinkler irrigation systems.

In Meru Central district sprinklers were dominant due mostly to the nature of the topography. Furrow irrigation, where water flows by gravity, was another common irrigation technique. A few farmers used the bucket kit while some large-scale farmers used motorised pumps.

5. Organisation of marketing

Although marketing arrangements were similar across both sites, the marketing channels were different for domestic and export markets. The main crops sold in domestic markets were cabbages, onions, kale, tomatoes and "export crops," such as french beans, that were rejected by exporters because they did not meet export standards. Most farmers sold their crops at the farm-gate to rural traders within the village or to traders coming from out of the district both to save time and to avoid

farm-to-market transport costs. Rural assemblers sold to larger traders in local markets, who then sold to other traders in regional markets or large urban markets such as Nairobi and Mombasa. Some traders entered into informal contracts with farmers before the crop was harvested. Rural traders collected and assembled small quantities of produce from many farmers scattered all over the rural areas. However, a few farmers, especially those who were located close to market centres, sold crops directly in local markets because they could get better prices. Crops were mostly packed in bags, except for tomatoes that were packed in cartons. All transactions in local markets were in cash.

The major crops sold in export markets were french beans, baby corn, and Asian vegetables. There were several companies involved in marketing of export crops. In Meru Central it was estimated that the number of companies involved in marketing rose from 13 in 1997 to 20 in 1999, an increase of 54 percent in 2 years. Some of the exporting companies were seasonal, involved in crop marketing only during the peak season, while others were engaged in marketing year-round.

There were several marketing arrangements for export crops:

- Exporting companies organised marketing directly with individual farmers or farmers' co-operatives, with written contracts specifying volumes, dates of collection, and prices. This was a common practice with large-scale producers, but few smallholder farmers had formal contracts with exporting companies or their agents.
- Company agents or brokers entered into verbal and informal contracts with groups of farmers. Although they agreed to enforce penalties in case of a breach of contract without a written document it was difficult to effect them. Farmers were not restricted to sell to one agent, but they invariably sold to agents who provided farm inputs such as seeds and chemicals.
- Company agents or brokers entered into verbal and informal contracts with individual farmers.
- Individual farmers sold to company agents or brokers without a formal or informal contract. Transactions with informal contracts were usually on credit and it could take up to one month between collection of produce and payment.

Interlinked transactions were very common, with company agents providing farmers with seeds, chemicals, advice on planting, application of chemicals, grading, sorting, and packing. In some cases technicians hired by the exporting company supervised farm activities from production to marketing and scheduled planting through control over quantities of seed provided to avoid gluts in the market.

About 90 percent of total horticultural export from Kenya is destined for European markets. In these markets the EU sets the grades and standards for exports, including maximum pesticide residue levels, size, shape, and weight of packaging materials.

6. Marketing constraints at smallholder level

Farmers cited several marketing constraints. These included:

- Lack of physical infrastructure reflected in inaccessible roads, lack of market facilities, power, and electricity;
- Unavailability of quality seeds and other inputs, including production and trading capital;
- High levels of post-harvest losses;
- Lack of economies of scale leading to high cost of assembly;
- High level of crops rejected at both farm level and at company warehouses because products did not meet market standards. In some cases farmers were not compensated for rejected products;
- High levels of price risk and market uncertainty;
- Unreliable information on market trends or scheduling of production decisions to meet market needs. Farmers and other market intermediaries were not aware about important

information on price, marketing conditions, and grades and standards further up the marketing chain.

7. Profitability of horticultural crop production

Gross margin analysis was used to illustrate the profitability of investment in selected horticultural crops (Table 4).

The enterprise budget data in Table 4 suggests that smallholder production of horticultural crops is a highly profitable enterprise when compared to alternative crop investment options that farmers can undertake. For example, gross margin for the most profitable enterprise is about 400 percent higher than those for the competing maize crop. This raises the question why every farmer in the area is not jumping on to this. Several reasons explain why the industry has not seen a massive entry into horticultural crop production, as the profitability estimates would suggest. One important factor is that the enterprise budget figures do not include transaction costs that are not explicitly measured. These costs arise mainly from the specific institutional arrangements that determine the production, market access, and trade in horticultural crops. Because such costs are not included as monetary costs in the enterprise budget, it is likely that these budgets erroneously overestimate the actual profitability of horticultural crop enterprises by underestimating the cost of inputs and overestimating the price of farm output. Consequently, the enterprise budget makes horticultural crop enterprise more profitable than it actually is, especially in the study areas where poor rural infrastructure, risk, and other market imperfections lead to high transaction costs.

Table 4. Gross margins of (KSh per hectare per year)¹ selected crop enterprises in Meru Central and Makueni districts.

Activity	Meru Central			Makueni	
	French beans	Tomato	Potatoes	Karella	Ravaya long
Land preparation	3,705	3,705	3,705	7,200	7,200
Seeds	29,640	741	29,640	0	0
Planting	2,470	7,410	2,964	2,012	1,817
Weeding	5,928	5,928	4,940	5,415	10,381
Manure	0	17,290	17,290	0	0
Fertiliser	8,892	11,115	13,338	3,735	3,960
Irrigation	0	0	0	32,230	25,300
Chemical	16,796	55,328	21,489	29,208	21,872
Nursery management	0	4,940	0	0	0
Pruning	0	1,976	0	0	0
Ridging	0	0	3,705	0	0
Fertiliser application	1,482	0	988	0	0
Spraying	2,470	2,470	7,410	0	0
Harvesting	39,520	6,175	14,820	5,425	12,472
Others	0	0	0	13,469	0
Miscellaneous costs	0	0	0	9,869	14,048
TOTAL VARIABLE COST	110,903	117,078	120,289	108,563	97,050
Mean output (kg/ha)	9,880	24,700	19,760	12,500	20,000
Average price/kg	30	10	10	25	15
TOTAL REVENUE	296,400	247,000	197,600	312,500	300,000
GROSS MARGIN	185,497	129,922	77,311	203,937	202,950
US\$ equivalents:					
Total revenue	4,896	4,080	3,264	5,162	4,955
Gross margin	3,064	2,146	1,277	3,369	3,352

Source: Ministry of Agriculture and Meru Central Annual Report, 1999.

¹The average bank exchange rates of the Kenya shilling in 1998 and 1999 were US\$1 = KSh 60.54 and KSh 70.42, respectively.

8. Conclusions and implications

Several implications can be drawn from the overview of horticultural production and marketing presented in this paper. An important issue that needs serious attention is the question of water scarcity. As smallholder irrigation expands in a regime of lack of enforcement of water regulation, lack of water pricing, and uncontrolled water use, issues relating to water scarcity are likely to be an overarching concern that could lead to social conflicts. There is urgent need for policy reforms that will take into account the likely equity and efficiency considerations of growing water scarcity problems as well as the types of institutional innovations for allocating water that are likely to have the greatest impact on smallholder farmers.

Access to water and control over resources and income from sale of horticultural products are likely to influence gender relations with increasing commercialisation of smallholder agriculture. Interventions need to address the issue of how women farmers get access to resources and information as well as how access and control over resources influence their participation and investment decisions in profitable commercial activities.

Issues of produce marketing need to be resolved if the horticultural sector is to play an important role in poverty reduction. The conventional wisdom is that unscrupulous middlemen exploit farmers. While it is true that middlemen do act opportunistically the case study suggested that problems of market imperfection and high transaction cost feature prominently in smallholder farmers marketing decisions. For example,

- Market intermediaries rarely knew or provided important information such as price trends, seasonal requirements, market product specifications or quality standards. The cost of acquiring such information was high, precluding many smallholder farmers from using such information to make production and investment decisions.
- Rural assemblers faced high opportunity costs in collecting small volumes of product from large numbers of producers scattered all over the rural areas.
- Many producers continued to sell to particular market intermediaries even when they were dissatisfied with the service, because they could not find an alternative market outlet or the cost of finding and/or negotiating with an alternative buyer was too high.
- Market intermediaries could misinform farmers about overall market conditions, wrongly claiming that produce quality deteriorated in transit, or by delaying payments because of imperfections in information collection and dissemination systems.
- Most farmers and market intermediaries relied on their own funds to finance production and trading activities. There was a lack of credit available for lending despite the need for production and trading credit. Formal credit was not available for traders because lenders either found it difficult or encountered high costs in assessing the credit-worthiness of potential borrowers. This high cost of acquiring information on potential borrowers is reflected in widespread failures of credit markets.
- Farmers lost cash income because of the high cost of enforcing contracts.
- Both production and trading were characterised by high levels of uncertainty about the availability of markets, the quality of the product, and the conditions of trading.

Given the complex production and trading environment in which smallholder farmers operate, is it likely that they will survive in the highly competitive and exacting world of horticultural exports, where high transaction costs in the smallholder sector typically favour large producers? Our research suggests that many smallholder farmers can benefit from the opportunities created by commercialisation of irrigation. Nonetheless, for this to happen marketing interventions in the horticultural sector need to focus on improving the competitive advantage and increasing the returns to investments by smallholder farmers. This may be achieved through improvements in marketing

arrangements that reduce risk and uncertainty, lower transaction costs, improve co-ordination and information flows between market intermediaries and farmers, and promote transparent and trust-building relationships.

Several private companies and development organisations are increasingly promoting contract farming as a mechanism for linking smallholder farmers into high value horticultural markets. However, contract farming can be a relatively high-cost option when dealing with large numbers of widely dispersed smallholder farmers. They are not very effective when the legal system is weak and, as a result, cannot enforce the terms of the contracts. Collective or group marketing arrangements are also extensively promoted by development organisations as mechanisms for reducing transaction costs and improving sellers' negotiating power. Yet, the experience in rural Africa shows that in reality many collective and group marketing initiatives are not sustainable after support by the development agency is withdrawn. Organisational problems, competing interests, and high incidence of free riding frequently weaken collective or group marketing arrangements.

One option that has not been extensively investigated is improving the efficiency of rural collection points. Collection points are ubiquitous in rural Africa but they serve mostly as bulking facilities. However, the traditional bulking facilities could be improved upon and used as mechanisms to improve access to market services, dissemination of information on production conditions, prices, market conditions, and application of known grades and standards. The successful implementation of improved collection points by some private horticultural export companies in Kenya, such as Homegrown Ltd., suggest that these arrangements need not involve formal contracts (Evans 1999). On the contrary, their success is based on transparent marketing activities and trust building relationships between smallholder farmers and buyers.

The challenge of commercialisation of smallholder irrigation and its potential for income generation for the poor, therefore, needs to give a central role to innovative marketing interventions that focus on the realities of cost of production, marketing, and trade in rural areas.

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