Food and Nutrition Studies Programme

Horticultural Production and Marketing in Kenya

Part 3:
Taita Taveta District

T. Dijkstra & T. D. Magori

Report No. 51/1994

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Wassenaarseweg 52
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ISBN 90 5448.017.3

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Published by:
Ministry of Planning and National Development, Nairobi
African Studies Centre, Leiden

Research carried out by:
African Studies Centre, Leiden
Egerton University, Njoro

CIP-GEGEVENS KONINKLIJKE BIBLIOTHEEK, DEN HAAG

Horticultural

Horticultural production and marketing in Kenya. - Nairobi
: Ministry of Planning and National Development ; Leiden
: African Studies Centre.- Ill. - (Report / Food and
Nutrition Studies Programme ; no. 51)
Pt. 3: Taita Taveta District / T. Dijkstra & T.D. Magori.
Research carried out by: African Studies Centre, Leiden ;
Egerton University, Njoro. - Met lit. opg.
ISBN 90-5448-017-3
Trefw.: voedselvraagstuk ; Kenya.

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Abbreviations

CBS	Central Bureau of Statistics
HPC	Horticultural Produce Centre
MOA	Ministry of Agriculture
MOALDM	Ministry of Agriculture, Livestock Development and Marketing
MPND	Ministry of Planning and National Development
TFCS	Taita Farmers Cooperative Society
THPCS	Taita Horticultural Cooperative Society, also called Taita HPC

Currency rates

November 1991: KSh 1 = Fl 0.07; KSh 1 = $ 0.038

Acknowledgements

We would like to express our appreciation to all the people who made this study possible. First of all, we wish to mention the support of Mr. E.S. Osundwa, Chief Economist of the Office of the Vice-President and Ministry of Planning and National Development, Prof. J. Hoorweg, Head of the Socio-Economic Department of the African Studies Centre, and Mr. A. Tola, field coordinator of the Food and Nutrition Studies Programme. We would also like to mention the district officials in Taita Taveta District who made it possible to carry out the research and disseminate the findings at a seminar in Taveta town. They are the District Commissioner Mr. S.K. Limo, the District Agricultural Officer Mr. O.H. Muliro, the District Marketing Officer Mr R.K. Chumba, and the acting District Statistical Officer Mr. N.M. Mwasigwa. Assistance was also provided by the market master of the Kongowea wholesale market in Mombasa Mr. Mohammed Lamtane, and officials of the Taita HPCS Ltd., namely the horticultural consultant Mr. J. Kori, the present manager Mr. Z. Mutungi and the former manager Mr. Mwangangi.

The farm survey was carried out by field officers of the Central Bureau of Statistics in Taita Taveta District, including Mr. D.M. Mwashighadi, Mr. H. Mwabili, Mr. S.W. Ndolo, Mr. S. Mwachugu, and Mr. J. Ngolo. The trade survey was carried out by research assistants of Egerton University, namely Mr. F. Ndago, Ms. Z. Challa, Mr. S. Mazera and Mr. M.M. Masai. The subsequent data entry was done by two members of the Food and Nutrition Studies Programme, namely Mr. J. Abich and Ms. J. Chebet. Mr. R. Dzala of the programme took care of the financial aspects. Mr. W. Veerman and Mr. H.F. van Driel of the African Studies Centre gave guidance and assistance during the data processing and analysis. Thanks are due to them all. Needless to say, they cannot be held responsible for possible errors and misinterpretations in this report.

Last but not least we are indebted to all the farmers and traders who participated in the study and during the seminar. We hope that they will ultimately benefit from our research findings.

Summary

Taita Taveta District is one of the major suppliers of vegetables and fruits to urban consumers in Mombasa and other towns along the Kenya Coast. The two main areas of horticultural production in the district are the Taita Hills and the land around the Taveta springs. In 1991, a farm survey was carried out in eight sub-locations to analyze economic differences between households who did and who did not sell horticultural commodities. In addition, a trade survey was carried out to study the structure and performance of horticultural marketing channels, and the conduct of the traders involved. Horticultural traders were questioned near the farms and in marketplaces, the latter including the Voi, Taveta and Wundanyi markets in Taita Taveta, and the Kongowea and Majengo markets in Mombasa.

Horticulture is one of the most important sources of income to farmers in the district. Households without horticultural sales have considerably lower incomes or rely heavily on off-farm employment. Constraints that keep them from going into commercial horticulture are land shortage and lack of capital in the Taita Hills, and water shortage in Taveta. Land shortage can at least partly be overcome by intensifying agricultural production and growing maize during the long rains. Lack of capital can be tackled through improved credit facilities. Group lending can be a successful means to reach a larger number of farmers. The repayment rate on group loans increases with proper support by extension workers, establishment of a security fund out of membership contributions, and group responsibility in the case of loan defaulting by individual members. Shortage of irrigation water in Taveta can only be solved by initiating new irrigation schemes. In addition, drainage systems of existing schemes have to be improved to solve the problem of increasing salinity of the soil.

Tomatoes and cabbages are the most important horticultural crops in the Taita Hills, and tomatoes, onions and bananas in Taveta. All of them have good marketing prospects because of a high demand in Mombasa and increasing transport costs that affect supplies from Central Province. For the future, decisions on produce packages have to be based

on continuous scanning of the market, and planned market-oriented production. The Taita Horticultural Cooperative Society has applied this approach successfully, adding improved grading and packing, and cooperative marketing by means of own truck and stall in the Mombasa wholesale market. It will be worthwhile to investigate whether a similar organization could be set up in Taveta.

Taita Taveta has a limited number of local horticultural markets. They serve local consumers or function as primary or secondary collecting centres, depending on the location and accessibility of nearby production areas. Various (overlapping) categories of horticultural traders operate in and around the marketplaces, including farmer-traders, mobile traders, resident traders, collecting traders and middlemen. In Mombasa, three additional categories are found, namely specialized wholesalers, auctioneers, and suppliers of institutions. The presence and importance of each type of trader is related to the functions of the market. In all marketplaces, competition among traders is high while trader incomes are usually low to moderate. Traders do not deliberately restrict output levels, neither do they operate some kind of price or buying cartel.

Middlemen are the biggest income earners. Their substantial revenues are related to quantities handled and trade risks involved. The latter are high because of perishability of the commodities, poor infrastructure, scarcity of trucks for hire, poor trading conditions in marketplaces and scarcity of timber to build boxes for packaging. Marketplaces and roads in the horticultural production areas need to be upgraded. It will decrease trade risks and attract more middlemen and transporters, leading to increased competition and subsequent smaller margins to the benefit of local farmers and urban consumers. The Taveta marketplace and Taveta-Mwatate road deserve to be on top of the list because of Taveta's major collecting function with regard to commodities destined for Mombasa and Nairobi. Display of ruling Mombasa prices in local market centres could further improve the bargaining position of horticultural farmers towards middlemen.

Cooling of produce and large-scale processing of vegetables and fruits are absent in the district. Both are, however, not necessary, as long as market-oriented production is applied. It is a much cheaper and less risky alternative, more so because of the high demand for fresh produce in Mombasa and Nairobi.

In conclusion, the horticultural sub-sector in Taita Taveta, which is a major supplier of income, employment and food, has to cope with various production and marketing constraints that deserves to be given top priority by all authorities involved.

Introduction

Kenya produces a large variety of horticultural commodities, including temperate and tropical vegetables, fruits and cut flowers.[1] They originate from ten major horticultural production areas, situated in twenty-one of the forty-two districts of the country.[2] Most production is rain-fed, but irrigated vegetable and flower cultivation can be found in some dryer parts of the Coast and Rift Valley Provinces. Vegetables and fruits are grown both for home consumption and for sale in order to generate income, while cut flowers are only cultivated as commercial crops. The large majority of horticultural commodities meet domestic demand, but some are exported to overseas markets.[3]

The importance of the horticultural sector as producer of food and source of income, employment and foreign exchange has been recognized by the Kenyan Government. According to the 1989-1993 National Development Plan, horticulture should be one of the major commodities to be promoted (GOK, 1989). District authorities have to play an important role in this respect, but many of them lack up-to-date information about horticultural production and marketing within their boundaries. The present study was therefore developed to cover major horticulture producing districts in various parts of the country.

The study, which is part of the Food and Nutrition Studies Programme, was undertaken by the Ministry of Planning and National Development (Nairobi, Kenya), Egerton University (Njoro, Kenya), and the African Studies Centre (Leiden, the Netherlands). The main objective was to study the production and marketing of horticultural commodities in selected Kenyan districts, with an eye to future improvements in Kenya in general and the districts concerned in particular. A comprehensive description of research

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[1] See Dijkstra & Magori (1991), Appendix 1.
[2] See Dijkstra & Magori (1991), Table 2, p.12-13.
[3] See Dijkstra & Magori (1991), Appendix 2.

Map 1. Location of Taita Taveta District, Kenya

questions and study design has been given in Part 1 of the series of reports.[4] Parts 2A and 2B deal with horticultural production and marketing in Nyandarua, the pilot district. The present report (Part 3) deals with Taita Taveta District.[5] The research results were discussed during a one-day seminar with about thirty district officials, farmers, and representatives from local government institutions in Taveta town on the 8th of December 1993.

Chapter 1 presents general information on horticultural production and marketing in the district, together with a brief explanation of the research methodology. The subsequent chapters discuss the results of the farm and trade surveys: Chapters 2 to 4 deal with horticultural production, and Chapters 5 to 7 with horticultural marketing. Finally, Chapter 8 offers conclusions and recommendations.

[4] Horticultural Production and Marketing in Kenya; Part 1: Introduction, Research Objectives and Methodology; by T. Dijkstra & T.D. Magori; FNSP report 41/ 1991.
[5] Part 4 of the series deals with the Kisii and Nyamira Districts.

Chapter 1. Taita Taveta District

1.1. Introduction

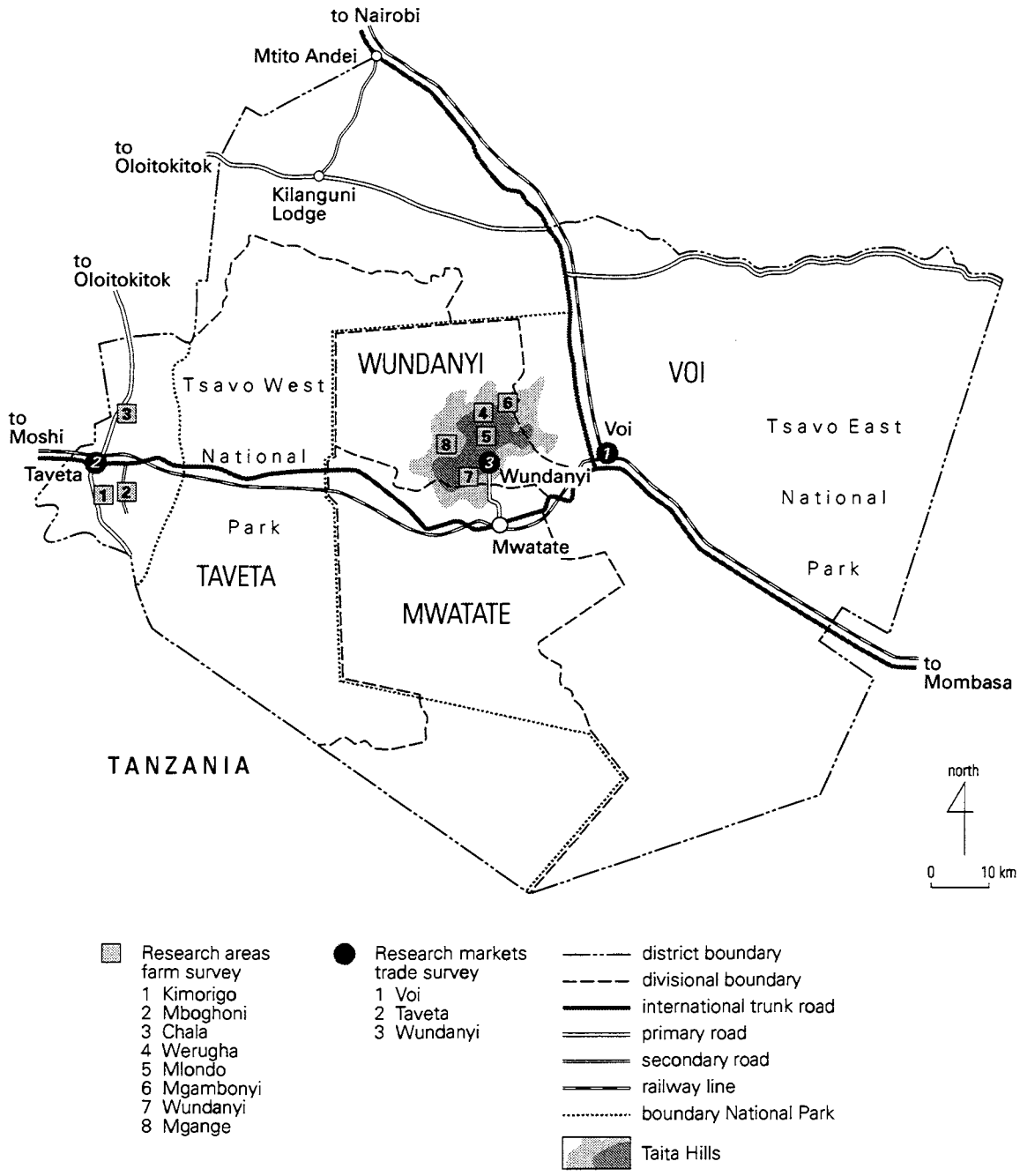
Taita Taveta is one of the six districts of Coast Province, Kenya. It is situated in the south-western part of the province, between 2°S and 4°S latitude and between 37°E and 39°E longitude. It borders Tana River, Kitui and Machakos Districts to the north; Kwale and Kilifi Districts to the east; Kajiado District to the north-west and the Republic of Tanzania to the south and south-west. The district, which covers an area of approximately 16,975 sq km, is unsuitable for agriculture except for the higher rain catchment areas (Taita Hills) and their foothills, and part of Taveta Division near Kilimanjaro where rainfall increases and irrigation possibilities exist. Altogether, 11% of the area is suitable for agriculture, whereas 24% is range land, 62% is national park (Tsavo East and Tsavo West) and 3% consists of rocky and water areas (MPND, 1989).

The district is mainly occupied by the Taita people who live in Wundanyi, Mwatate and Voi Divisions, and the Taveta people in Taveta Division. Other ethnic groups residing in the district are Kamba in Taveta Division who are both farmers and traders, Kikuyu in major trading towns, Luo who work on the sisal plantations, and Somali and Boran who are employed on the ranches. Many migrants can be found at the border with Tanzania where business transactions are the order of the day.

The 1989 population census indicates a district population of 207,270 in 1989 and a projected population of 220,370 in 1991, based on an annual growth rate of 3.11% (CBS, 1991; 1994). This implies a population density of 12 to 13 persons per sq km which is very low.[6] The population distribution within the district is, however, strongly

[6] For comparison: Kiambu and Muranga Districts in Central Kenya have population densities of over 400 persons per sq km, while Kisii District in Western Kenya has a population density of over 500 persons per sq km.

Map 2. Taita Taveta District



governed by rainfall distribution and land use patterns. 57% of the total population is concentrated in Wundanyi and Mwatate Divisions, 26% in Voi Division and 17% in Taveta Division. The areas of agricultural importance are characterized by a relatively high population density: Wundanyi has about 50 persons per sq km, Taveta 54 persons per sq km, and Mwatate 42 persons per sq km, whereas Voi has 4 persons per sq km. Nevertheless, densities remain low in comparison to other agriculturally important districts in Kenya.

Taita Taveta District has two urban centres (Voi and Wundanyi), one rural centre (Taveta), and 29 smaller centres classified as either market or local centre. The bigger centres have at least a school, shops, post office, commercial bank and some other social amenities. They are linked by an extensive road network that has been developed despite the difficult terrain. The steep slopes in the Taita Hills, for instance, make the building of roads very complicated. These roads play an important role in transporting agricultural produce in and out of the district. The Nairobi-Mombasa tarmac road traverses the district (Map 2). Another major road runs from Voi to Taveta and further onwards to Moshi in Tanzania. The tarmac on this road ends at Mwatate, and although the road beyond Mwatate is passable most of the year, such is not always the case during the rainy season. A short tarmac road links Mwatate and Wundanyi. The rest of the district is reached by a network of 242 km unclassified and 908 km classified roads. Most of the roads in Voi and Mwatate Divisions are in a good state, but those in Wundanyi and Taveta Divisions are at best classified as fair (MPND, 1989). The emphasis in the District Development Plan is on improvement of these access roads in order to upgrade them to all-weather roads. It will facilitate efficient marketing of agricultural produce and make the provision of other essential services to the rural population possible.

The Nairobi-Mombasa railway line also passes through the district. A branch line from Voi to Taveta provides additional means to transport agricultural produce to other parts of Coast Province and beyond. The line used to be connected to the Tanzanian railway system but this is no longer the case. Nowadays, the train stops at the border, which is at the edge of Taveta town.

1.2. Agro-ecological zones

Taita Taveta lies between 610 en 1680 m above sea level, most parts of the district being part of the lowlands of Kenya. Based on altitude, rainfall, temperature and soil types, the

land has been divided into different agro-ecological zones. A small area has been classified as Lower Highland zone (LH). The rest has been classified as Upper Midland Zones (UM), Lower Midland Zones (LM) and Lowland Zones (L). In the Lower Midland zone 6 (LM6) and the Lowland zone 6 (L6) rain-fed agriculture is not possible except with runoff catching techniques. Table 1 shows the different agro-ecological zones and their characteristics.

The high altitude in the Taita Hills leads to lower temperatures, which give the area a comparative advantage in the production of certain crops, notably coffee, vegetables, maize and beans. The dominant soils are Cambisols which are not very much weathered, well drained, moderately deep, and of moderate fertility. At the Taita foothills and the slopes of the Sagala and Kasigau ranges the dominant type of soils are Luvisols which are characterized by low fertility. The best suited agricultural activities for these lower midlands and lowlands are ranching and cultivation of cotton, sisal and other drought resistant crops. Part of the lowlands are covered by Ferrasols, especially in the national parks. These highly weathered soils are best for grazing and wildlife preservation.

The high potential areas in the Taita Hills (LH2 & UM3) receive more than 900 mm of rainfall per year, spread over two rainy seasons.[7] Descending the hills, rainfall becomes less and less reliable. Medium potential areas receive 700-900 mm whereas the low potential areas receive 450-700 mm of rainfall per year. Farmers in the low potential areas have to rely on irrigation if it is not possible to depend on rain-fed agriculture. This is the case in Taveta Division, where opportunities for irrigated production exist due to the availability of surface water from Mt. Kilimanjaro.

1.3. Horticultural production

In 1991, about 11,900 ha of the district area were used for agricultural production. Cereals & pulses claimed most of the land (54%), followed by vegetables, fruits and tubers (26%) and industrial crops (20%) (Table 2). The value of horticultural production in the previous year (1990) was K£ 6.2 million, of which about 90% was sold (MPND, 1989; MOA, 1990). Cereals and pulses were mainly for own consumption, whereas the coffee and cotton fetched K£ 87,600 and K£ 24,500 respectively. It can therefore be concluded that horticulture was an important sub-sector of the district's economy.

[7] The high potential areas cover 420 sq km (6.5%) of the available agricultural land in the district.

Table 1. Agro-Ecological Zones and their characteristics in Taita Taveta district

Zone	*Division(s) covered*	*Altitude (m)*	*Rainfall (mm/year)*	*Cropping seasons*	*Horticultural commodities*		*Other commodities*	
					Good yield potential	*Fair yield potential*	*Good yield potential*	*Fair yield potential*
Wheat/maize-pyrethrum LH2	Wundanyi	>1680	>1200	one medium short season	potato,pea cauliflower,carrot spinach,lettuce plums, p/fruit	sweet potato	wheat,barley maize	finger millet tea,sunflower pyrethrum,beans
Marginal coffee UM3	Wundanyi	1370-1680	900-1200	two medium to short seasons	onion,cabbage p/apple	s/potato,tomato banana,pawpaw kale,citrus,p/fruit	maize,sorghum macadamia	coffee
Sunflower-Maize UM4	Wundanyi	1220-1520	700-900	two short seasons	cowpea	tomato,s/potato pawpaw,p/apple citrus,onion	sorghum,maize millet	finger millet beans
Marginal cotton sisal LM4	Wundanyi Mwatate Taveta	910-1220	600-800	one short to very short season	cowpea	tomato,onion s/potato	sorghum,maize bulrush millet g/grams,sisal	maize,beans p/peas,cassava macadamia
Livestock-Millet LM5	Wundanyi Mwatate Taveta,Voi	790-980	480-700	two very short to short seasons	-	pumpkin other fruits and vegetables	millet,sisal	maize,b/millet grams,peas groundnuts dwarf sorghum
Ranching LM6	Tsavo N. park Mwatate, Voi	<790	Bimodal	NOT SUITABLE FOR AGRICULTURE				
Livestock-Millet L5	Taveta, Voi Mwatate	610-790	480-680	one weak very short season and intermediate rains	-	pumpkin cowpea	beans,millet buffalo gourds millet,sorghum	sunflower,grams oilseed
Ranching L6	Tsavo N. park Voi	<610	Bimodal	NOT SUITABLE FOR AGRICULTURE				

Source: Jaetzold and Schmidt,1983
Abbreviations: p/fruit = passion fruit; s/potato = sweet potato; p/apple = pineapple; b/millet = bulrush millet; g/grams = green grams; p/peas = pigeon peas

Bananas, cabbages, onions, tomatoes, cassava, citrus and mango trees accounted for 88% of the area under horticulture in 1991, the remaining 12% being taken up by other vegetables, including Asian vegetables with exotic names like karela and turia. Onions and Asian vegetables were grown in large quantities at the Njukini irrigation scheme in Taveta Division.[8] The onions found their way to Nairobi and Mombasa, either direct or through mediation by the Horticultural Crop Development Authority (HCDA), which acts as a kind of buyer of last resort. The Asian vegetables were exported to European markets by a Kenyan trading company of Asian origin (Makindu Growers Ltd). This company bought the vegetables through bigger farmers who acted as agents.[9] The farmers were content with the marketing arrangements and the income they received. Unfortunately, Makindu Growers stopped collecting the vegetables in 1992. According to the manager, the company was increasingly obtaining supplies from Murang'a which was nearer to Nairobi and accessible by tarmac road. Other exporters were not around and the farmers shifted to maize, tomatoes and onions for the local market.

Bananas can be found in large quantities in Mboghoni Location (Taveta Division) where surface irrigation is applied by means of water from the slopes of Mount Kilimanjaro, as in Njukini. Because of the dominance of banana production, especially at Kimorigo Sub-Location, and lack of rotation with other crops, farmers in the area have to cope with rising problems of diseases and pests like nematodes, banana weevil and the Panama disease. Farmers with irrigated farms all over Taveta have to cope with increasing salinity of the soil which hampers the growth of tomatoes, onions and even maize. The main cause seems to be a lack of proper drainage systems. The irrigated areas have to cope with seasonal floods that drain away very slowly, causing salt crystallization in the soil.

In Wundanyi Division and the wetter parts of Mwatate Division over twenty different types of vegetables are grown, including tomatoes, cabbages, brinjals, sweet peppers, okra, green peas, carrots, baby marrow, cauliflower, cucumber, leafy vegetables like kale, spinach, lettuce, leeks, and pot herbs like celery and parsley. Tubers in those areas

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[8] All farmers within the scheme are organized into a cooperative organization called the Njukini Farmers Cooperative Union which has bought the land on behalf of its members. The size of a member's plot depends on the number of shares he has. One share resembles one acre. Smaller farmers have one share, bigger ones 5 to 7 shares. The cooperative assists in obtaining the title deeds. Apart from the union, a water committee has been set up to coordinate maintenance of the irrigation furrows.

[9] The smaller farmers took the commodities to these agents, and received their payment through them. Makindu came to collect the vegetables three times a week and paid once a month. The agents were responsible for the book keeping. Farmers did not receive any payments in advance.

Table 2. Land use per crop in Taita Taveta District (ha)*

Crop	*1987*	*1988*	*1989*	*1990*	*1991*
Coffee	597	680	600	260	257
Cotton	662	750	1,093	1,672	1,890
Macadamia	50	16	40	40	41
Sugar cane	44	57	80	58	-
Coconut	41	58	60	82	80
Cashew nuts	44	50	75	68	67
Bixa & Castor	6	17	72	17	-
Simsim	-	4	9	1	6
Total industrial crops	1,444	1,632	2,029	2,198	2,341
Maize	5,187	6,089	6,705	5,297	3,299
Beans	2,025	2,352	1,895	1,890	1,933
Millet/Sorghum	87	70	175	213	663
Rice	12	9	5	5	3
Cow peas	592	800	290	431	253
Green grams	-	100	83	226	177
Pigeon peas	181	214	66	390	141
Total cereals/legumes	7,722	9,634	9,219	8,452	6,469
Irish potatoes	61	43	52	50	46
Onions	41	33	33	291	250
Pineapples	2	2	8	8	-
Cabbages	112	98	68	141	412
Kale	99	131	97	304	80
Tomatoes	244	261	176	170	93
Bananas	1,076	1,195	1,195	1,102	1,290
Citrus	97	83	83	103	179
French beans	2	-	1	4	12
Avocados	18	18	46	49	46
Mangoes	205	62	62	68	121
Brinjals	56	27	16	41	12
Okra	4	25	26	8	11
Cucumber	2	5	5	6	6
Spinach	7	3	20	14	12
Turia	5	-	-	2	1
Karela	13	6	7	13	1
Lettuce	36	28	7	18	7
Leeks	12	30	22	-	-
Garden peas	1	5	12	2	10
Cauliflower	5	8	9	9	-
Capsicums	82	78	9	8	3
Carrots	7	13	5	9	9
Sweet potatoes	3	3	36	35	81
Cassava	1,718	510	137	323	332
Arrow roots	3	15	47	42	-
Papayas	8	16	47	35	39
Total horticulture	3,919	2,650	2,212	2,855	3,053
Grand total	13,085	13,916	13,460	13,505	11,863

Source: MOA (1987; 1988; 1990), MOALDM (1992)
* The large sisal estates are not included in the table. Their total acreage is 62,200 ha.
Note: in case of a dash the figure is not available.

are mainly for own consumption except for Irish potatoes, which, however, do not do very well because of blights and other diseases.

Irrigated horticultural crops are planted and harvested throughout the year, whereas rain-fed crops in the Taita Hills are planted at the start of the long rains in March/April and short rains in October/November, to be harvested three to four months later. Not all farmers in the hills grow maize during the long rains because of problems with pests like the stock borer. Extension officers advise improved fertilizer application and use of chemicals like Furadan, but these inputs are expensive and credit is difficult to get.[10] The limited production of maize during the long rains causes a seasonal problem of food scarcity at the household level. The district is a net importer of cereals, while being a net exporter of vegetables and fruits (MPND, 1989).

1.4. The Taita Horticultural Produce Cooperative Society

The Government of Kenya, in its effort to stimulate the productivity and efficiency of the horticultural sub-sector, has decided to set up Horticultural Production Centres (HPC's) in areas with a potential for horticultural development either under rain-fed conditions or through irrigation. Such an endeavour has been realised in the Taita Hills by means of the newly established Taita Horticultural Produce Cooperative Society (THPCS, also called Taita HPC).[11]

The HPC at Taita started its operations in 1990 in Wundanyi Division, an area with a long history of vegetable production for the Mombasa market. The objectives of the centre are:
i) to increase yields by providing technical know-how and inputs such as seed, fertilizers and pesticides through a seasonal credit scheme;
ii) to streamline the marketing of farmers' produce by supplying transport to Mombasa which reduces the role of middlemen, by producing at the right time for the market, by providing continuity in production, and by standardizing, grading and packing the produce before it goes on transport.

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[10] The Agricultural Finance Cooperation (AFC) requires a collateral, but not all farmers have title deeds. When a title deed is available, problems often arise when sons act as power of attorney, applying for loans with title deeds in the name of their fathers.
[11] The THPCS was registered as a separate cooperative society in August 1992. Until then, it was part of the heavily indebted Taita Farmers Cooperative Society.

The Taita HPC recruited 600 farmers who were entitled to supplying 1/4 acre of produce each. It set up three collecting centres at Wundanyi, Mugange, and Werugha. In 1991 and 1992, the cooperative handled around 500 tonnes of produce per annum through these centres, worth KSh 3.1 million and KSh 4.2 million, respectively. The average pay-out ratio to the farmers was high, namely 94% in 1991 and 86% in 1992 (Technoserve, 1993).

The Taita HPC has a crop package of a limited number of vegetables from which the farmers are allowed to select two types per season.[12] Farmers are told when to sow, various sub-groups having differing sowing dates. Through this method, the cooperative applies a regulated production strategy. The vegetables concerned are of high value at the Mombasa market. Tomatoes, white cabbage and spinach remain the core of the business, not only because they are part of the traditional package of the member-farmers, but also because of a high demand in the Mombasa market. With increasing transport costs during recent years, tomatoes, and cabbages from the central highlands of Kenya have become relatively expensive and the demand for produce from Taita Taveta has increased.[13]

The Taita HPC has rented a wholesale stall at Kongowea Wholesale Market, Mombasa. The vegetables are collected from the farmers and transported to the market every day of the week except Friday. This activity is continuous all year round with a slack period between February and April, due to dry weather, and a period of oversupply between June and September. During dry periods most vegetables fetch higher prices in the market than during the rains (Figure 1). The Taita HPC therefore tries to maximize its turnover during the dry period, but this requires irrigation by its farmers. Since rain-fed production is still the rule in the Taita Hills, the bulk of the vegetables is supplied to the cooperative towards the end of the long rains. A second supply peak occurs towards the end of the short rains but it is less extreme because planting of maize has first priority for the farmers during this period.

Farmers are provided with farm inputs on cash or credit to make sure that they use the

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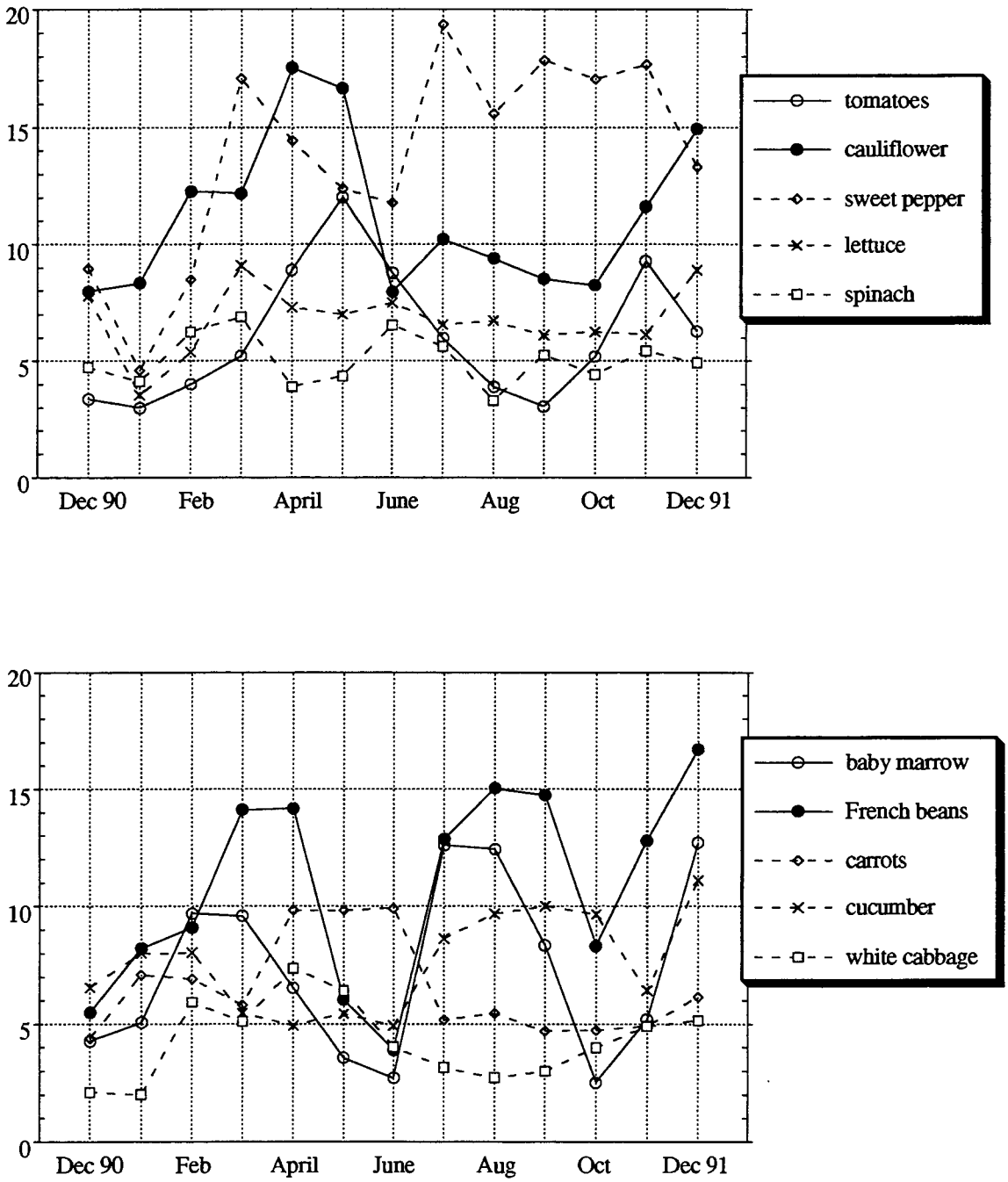
[12] Between 1991 and 1993 the package was composed of white cabbage, tomatoes, spinach, lettuce, capsicums, French beans, baby marrow, cucumber, cauliflower, leeks, garden peas, carrots, red cabbage, and Chinese cabbage. In the course of time tomatoes, cauliflower, capsicums, lettuce and spinach became more important, at the expense of carrots, white cabbage, baby marrow, French beans and garden peas. In 1994, the Taita HPC started to include maize and beans as rotational crops for three reasons: to battle seasonal shortages of food, to fix nitrogen in the soil, and to fight soil-borne diseases like nematodes.

[13] Until 1993, January/February and August/September were periods of cabbage-oversupply in the Mombasa market. However, in 1993 this was no longer the case because of smaller supplies from Central Province.

Figure 1. Price developments of horticultural commodities in the Mombasa wholesale market, 1991



Source: THPCS, Wundanyi.
Note: prices refer to commodities of the first grade, as sold in the THPCS stall in Kongowea wholesale market, Mombasa.

correct inputs to sustain high yields and deliver good quality produce. This is necessary because the cooperative faces a lot of competition in Mombasa, both from middlemen who buy in Taita and from middlemen who bring produce from the central highlands of Kenya. A strategy of excellent quality produce is, therefore, necessary. The market is normally scanned for what is available from other parts of the country in order to avoid unnecessary competition that would affect market prices. If the cooperative truck is not completely full, cargo space is offered to middlemen and farmer-traders for rent. It provides an additional income flow to the project. Due to the focus on quality and market-oriented production, produce of the cooperative has always sold in the Kongowea wholesale market so far. The produce is patronized by a wide cross-section of buyers including tourist hotels, ship chandlers, retailers and consumers.

1.5. Local markets

In 1991, Taita Taveta had five officially registered marketplaces, in addition to a large number of unofficial road-side markets. Table 3 summarizes the five registered markets, and eight unofficial ones that handled considerable amounts of agricultural produce.

None of the marketplaces had separate wholesale and retail sections, nor did they have concrete floors or roofed stalls for all traders. In Voi market the oldest section of the market is made of brick, but it is very small and can only harbour a dozen or so permanent traders of vegetables, fruits and cereals. All other traders, who usually come to the market during official market days, use one of the ramshackle wooden sheds that surround the old market hall or sell their commodities on the ground. The same applies to Wundanyi market, where permanent wooden stalls bordering the marketplace are occupied by traders of bread, cooking utensils, spices, etc. Almost all horticultural traders sell their commodities on the ground, unprotected against sun and rain.

Taveta market serves as a focal point of marketing activity in the district. It serves traders from as far afield as Mombasa and Nairobi, as well as Arusha and Moshi in Tanzania. Locally produced bananas, onions and tomatoes are available in the market in large quantities. Moreover, Tanzanian onions, tomatoes and avocados find their way to Taveta, in addition to non-agricultural goods such as cloth, baskets, batteries, radios, watches, etc. Trading activities in the market have increased tremendously during recent years due to improved diplomatic relations between Kenya and Tanzania. The marketplace is not

Table 3. Selected markets and their characteristics in Taita Taveta District

Name of market	*Division*	*horticultural trade*	*type of trade* *	*market days*
official markets (registered)				
Voi	Voi	Yes	W,R	Tue, Fri
Wundanyi	Wundanyi	Yes	(W),R	Tue, Fri
Taveta	Taveta	Yes	W,R	Wed, Sat
Mwatate	Mwatate	Yes	R	Wed, Sat
Chumvini	Taveta	Yes	W,R	Tue, Fri
road-side markets (not registered)				
Mgambonyi	Wundanyi	Yes	(W),R	
Mgange	Wundanyi	Yes	R	
Mwanda	Wundanyi	Yes	R	
Werugha	Wundanyi	Yes	R	
Bura	Mwatate	Yes	R	
Mukuyuni	Taveta	Yes	W,R	
Kitobo	Taveta	Yes	R	
Kungu	Mwatate/ Wundanyi	Yes	R	
Dembwa	Mwatate	Yes	R	

* W = wholesale trade, (W) = minor wholesale trade, R = retail trade

able to absorb the increasing number of sellers and buyers, so that the actual market is by now more than twice as big as the official marketplace. This place is not more than an open area bordered by wooden stalls, with most of the traders selling their commodities on the ground. After a heavy shower the whole place turns into a large mud pool. The area in front of the market is also used to load the many busses and trucks that come from Mombasa, Nairobi and elsewhere, making the place even more crowded, hectic, and muddy than elsewhere. The market masters have become very pragmatic under these conditions. They charge everybody in or outside the market who is found with produce and looks like a trader. Even if a trader is only buying, or when he uses Taveta to change cargo from a smaller to a bigger truck, he is charged.

Chumvini market along the Taveta-Oloitokitok road is much smaller than the Taveta market and serves local consumers. Outside the fenced areas some cattle trade takes place. However, the market also functions as the collecting centre for commodities destined for Taveta and beyond, as we will see in Chapter 5. The same applies to Mukuyuni market, although the place could hardly be called a market as it consists only of some square metres of grass at the end of a muddy road. Mgambonyi in the Taita Hills has also a minor collecting function, all other roadside markets in the district being pure retail markets where small quantities of vegetables and fruits are sold, or only cloth, cooking utensils and cereals can be found.

1.6. Research methodology[14]

The farm survey

A farm survey was carried out that aimed to analyse differences between rural households who did and who did not sell horticultural commodities.[15] Thus, the relative importance of horticulture as source of wealth could be analyzed, and the constraints on horticultural cash crop production investigated. Prior to the survey, the main horticultural production areas of the district were identified, namely Wundanyi and Taveta Divisions.[16] Then, eight clusters in those areas were selected with the help of the District Statistical Officer (see Map 2).[17] Subsequently, household listings were carried out in those clusters to identify households who did and who did not sell horticultural commodities in 1991. Those who did sell in Wundanyi Division were asked whether they were a member of the Taita HPC, to evaluate the impact of the cooperative. Appendix 1 shows the results of the household listing.

The household listing was used to carry out a systematic sampling per group, with two groups in Taveta (households with and without horticultural sales), and three groups in Wundanyi (households without horticultural sales, Taita HPC members, other horticultural farmers). The Taita and Taveta research groups were analyzed separately because of the divergent agro-ecological circumstances and related production problems in both divisions. Appendix 2 shows the number of analysed households per group and cluster.[18] Altogether, 153 farm questionnaires were included in the analysis, covering 54 households in Taveta and 99 in Wundanyi.

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[14] Part 1 of the series on Horticultural Production and Marketing in Kenya (Dijkstra & Magori,1991) explains the research methodology and research questions in detail. It also contains the farm and trade questionnaires.

[15] A household is defined as a group of people who reside together under one roof or under several roofs within a single compound who are answerable to the same head and share a common source of income. A similar definition is used by the Central Bureau of Statistics of Kenya (CBS).

[16] The third division with horticultural production, Mwatate, was not included because of its relatively low potential and production levels. Moreover, HPC farmers were not found in Mwatate Division.

[17] Existing CBS clusters were used.

[18] The clusters were not stratified according to agro-ecological zone because of relatively small inter-zonal differences.

The trade survey

A trade survey was carried out that aimed to study horticultural marketing in Taita Taveta District with an eye to future improvements. The specific research questions focused on market structure and performance, and trader conduct. This so-called SCP concept has been discussed in detail in Part 1 of the series on horticultural production and marketing in Kenya (Dijkstra & Magori, 1990).

Three markets were selected that served as important outlets for horticultural produce in the district, namely Voi, Wundanyi and Taveta. Map 2 shows their location. In each market a trader listing was carried out which included registration of the assortment of all traders selling horticultural commodities.[19] Subsequently, part of the traders were randomly selected and interviewed.[20] Altogether, about 30% of the traders in Voi and Wundanyi markets and 20% of the traders in Taveta market were questioned.[21]

Farmers were asked about their market outlets and sources of price information as part of the farm survey. In addition, middlemen who bought produce in the markets and at the farms of Taveta Division were interviewed. In the Taita Hills, middlemen could not be found at the time of the 1991 survey, because the rains were too late and farmers had not yet started harvesting. Therefore, a short follow-up study was carried out in 1993, focusing on horticultural middlemen in the Taita Hills. Only quantitative data of this survey are used in the analysis because of the analytical problem of changing prices and marketing costs over time due to inflation and government policies.

The majority of the horticultural commodities from Taita Taveta are destined for Mombasa. Therefore, commodity flows were followed to this city to get a full picture of the marketing channel right from the farmers to the urban consumers. Surveys were carried out in two Mombasa markets, namely the horticultural wholesale market at Kongowea, and the retail market at Majengo. The wholesale market also proved to have retailers, who were therefore included in the survey. A trader listing was carried out, distinguishing three groups, namely traders in Majengo market, who were all retailers,

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[19] Appendix 3 shows the results of the trader listing.
[20] Initially the survey meant to concentrate on traders who sold major horticultural commodities in the markets like tomatoes, bananas, mangoes, onions, kale and cabbage. Analysis of the trader listing showed, however, that almost all traders had at least one of these commodities in their assortment, which meant that the sampling was random even when focusing on traders with major crops.
[21] Voi: 57 out of 184 horticultural traders; Taveta: 95 out of 452 traders; Wundanyi: 56 out of 199 traders.

retailers in Kongowea market and wholesalers in Kongowea market.[22] Thereupon traders were randomly selected by group. The sample was restricted to traders who dealt with commodities that came at least partly from Taita Taveta District. Altogether, 59 traders in Majengo market, 15 retailers in Kongowea market and 39 wholesalers in Kongowea market were interviewed.

[22] Appendix 3 shows the listing of the assortment per group.

Chapter 2. Household characteristics

The present chapter deals with the characteristics of households in the horticultural areas of Taita Taveta District. Households which sell horticultural commodities are compared with those which do not, to identify constraints to horticultural cash crop production. Moreover, horticultural farmers in the Taita Hills who are members of the Taita Horticultural Produce Cooperative Society (also called Taita HPC) are compared with those who are not, to establish which household characteristics define cooperative membership.

2.1. Taita

All farmers in the Taita Hills are indigenous to the area. The land has been inherited from their fathers and passed down to new generations. The farms are concentrated along the steep Taita Hills and to a lesser extent at the foothills. Farming on these slopes requires a lot of care to prevent soil erosion. Many households have to cope with stony patches on their farms but in general the soils are moderately fertile and ideal for horticultural and other crops (see sections 1.2 and 1.3). Therefore, the quality of the land does not influence household decisions on farming. Other factors are of importance, which will be analyzed in this section.

General Household Characteristics

According to the survey, households without horticultural sales had on average smaller holdings than others (Table 4). Getting hold of more land was difficult, as renting out of land was not common due to land pressure in the area. Taita HPC members had on average bigger holdings than other households.

Households without horticultural sales had fewer resident household members than others, while the number of part-time residents was about the same (Table 4). More often the head of the household was female, and/or without formal education. Households that sold horticulture were more often polygamous, whereby polygamy might be seen as a result of wealth or as a source of family labour.

Table 4. General characteristics of households in Taita by research group, 1991

	hh's without hort sales (n=20)	*Taita HPC farmers (n=27)*	*other horticultural farmers (n=52)*
size of holding (acres)	1.9	4.6	3.3
no. of residents	4.9	7.2	6.2
no. of part-time residents	1.3	1.0	1.2
total no. of household members	6.2	8.2	7.4
female-headed households (%)	25	7	19
polygamous households (%)	15	30	35
household head without formal education (%)	50	30	35

Source: farm survey
Note: for distribution of household members by age group and further specification of educational levels see Appendix 4.

Farming activities

Almost all households in the Taita Hills grow cereals and pulses, which is their staple food, but only a minority within each group sold the commodities (Table 5). The same applies to bananas which are grown by a majority of the households but sold by a minority. Other fruits are less common, especially among households that do not sell horticultural commodities. Most households within the latter group do not grow vegetables either, that is on specific plots. A few stems of kale are usually found in every compound.

Coffee is the main industrial crop in the hills.[23] Nevertheless, only a minority of the households were involved in this enterprise at the time of the survey (Table 5). A larger proportion of the Taita HPC farmers had coffee trees than other farmers, but not all

[23] Given the prevailing climate in the Taita Hills, cotton growing is not possible on the higher slopes where most of the households are situated. Farmers might have a plot at the foot of the hills near for instance Mwatate where cotton cultivation is possible. This was, however, exceptional. Only one of the sampled households, which was part of the HPC group, grew some cotton.

coffee growers sold coffee. Coffee farms were neglected in 1991 because of the low coffee prices, high input costs and severe payment delays at that time. Farmers were not allowed to uproot the trees which left the alternative of intercropping with for instance bananas. The fact, however, that Taita HPC farmers had more trees than other farmers, suggests that they made at least more money out of coffee in the past, that is before the decline of coffee prices.

Table 5. Households cultivating and selling agricultural commodities in Taita by research group, 1991 (%)

	hh's without hort sales (n=20)		*Taita HPC farmers (n=27)*		*other horticultural farmers (n=52)*	
	growing	*selling*	*growing*	*selling*	*growing*	*selling*
Cereals & Pulses	85	5	100	15	100	13
Vegetables	15	0	100	100	85	85
Bananas	60	0	81	15	67	12
Other fruits	35	0	59	30	63	50
Coffee	10	0	30	22	15	8

Source: farm survey

Livestock

Livestock is of considerable importance for the welfare of the Taita people, both as insurance against financial calamities, and as a source of income. Cows are the most common type of cattle. Many households have one or two graded or upgraded cows, but only a minority sells milk. Fewer households without horticultural sales had cows at the time of the survey than households with horticultural sales (Table 6).

Traditional cows, sheep and goats were less common than (up)graded cows (Table 6). Interesting enough, a larger part of the Taita HPC farmers had traditional cows and goats if compared to the other farmers. The number of traditional cows per owner was also much bigger. It probably means that Taita HPC farmers made more money in the past than the other farmers, since traditional cows are used as a way to invest money that would otherwise remain idle. Since the Taita HPC is only a few years old, it implies that these farmers were already wealthier at the start of this project.

Table 6. Livestock in Taita by research group, 1991

	hh's without hort sales (n=20)	*Taita HPC farmers (n=27)*	*other horticultural farmers (n=52)*
hh's with (up)graded cows (%)	45	89	65
average no. of (up)graded cows per (up)graded cow owner	1.6	1.4	1.2
hh's with cows selling milk :			
- locally (%)	40	38	47
- to KCC (%)	0	0	3
hh's with traditional cows (%)	5	26	13
average no. of traditional cows per traditional cow owner	2	16	6
hh's with goats (%)	0	19	6
hh's with sheep (%)	15	19	21

Source: farm survey
Note: for more information on livestock see Appendix 5

Off-farm employment

Over 70% of the households in Taita had one or two members with an off-farm job. Agriculture offered good opportunities followed by desk jobs in the service and manufacturing sectors. Most of the people involved were permanently employed, over half of them working away from home and visiting the compound only now and then. Differences between the three research groups were not large in this respect (Table

Table 7. Off-farm employment in Taita by research group, 1991

	hh's without hort sales (n=20)	*Taita HPC farmers (n=27)*	*other horticultural farmers (n=52)*
hh's with off-farm income (%)	75	70	73
average no. of jobs per hh	1.5	1.6	1.6
average no. of months employed per year	11.2	10.9	10.6
type of employment (%):			
- agriculture	20	23	20
- manufacturing	0	13	16
- services	20	12	27
- office/clerical	20	23	18
- professional/managerial	20	15	6
- other	20	14	13
place of work (%):			
- in the neighbourhood	40	42	37
- elsewhere	60	58	63

Source: farm survey
Note: for more information on off-farm employment see Appendix 6

7). It seems that off-farm opportunities were open to all households in the Taita Hills, although it often implied leaving the area to apply for jobs in Mombasa or at a tourist hotel within or outside the district.

Constraints regarding horticultural production

Table 8 summarizes the differences between households with and without horticultural sales. Households of the latter group were asked for their reasons not to sell. The answers referred to four kinds of constraints.[24] The first was land shortage, caused either by the size of the holding that was just large enough to feed the household members, or by poor conditions of the soil. Our survey results confirm the relatively small holding size of households without horticultural sales (Table 4). The poor soil mentioned by some of the respondents casts doubt on our earlier remark about the possibility to grow horticultural crops all over Taita Hills. This appears not to be true, most probably because some patches of land are too rocky or too steep to cultivate vegetables.

Table 8. Summary of the characteristics of the research groups in Taita

	hh's without hort sales	*Taita HPC farmers*	*other horticultural farmers*
size holding	-	+	0
no of residents	-	+	0
female-headed households	+	-	0
polygamous households	-	+	+
no formal education household head	+	-	-
coffee trees/sales	-	+	0
cereals & beans selling	-	+	+
(up)graded cows	-	+	0
traditional cows	-	+	0
off-farm jobs in the neighbourhood	0	0	0

Based on Tables 4 to 7
Note: the signs refer to relative size, importance, number, etc. when comparing survey group. A plus means bigger, more, higher, etc. than the other groups, and a minus smaller, less, lower, etc. than the other groups. A group that has a medium value is indicated by a zero. If two or more groups have about the same value they have the same sign. If all groups have about the same value, they all have a zero.

The second constraint mentioned by the respondents concerned labour shortage. It was caused either by the limited size of the household - sometimes in combination with the advanced age of the household head - or by obligations elsewhere due to off-farm employment. Our survey results confirm the smaller number of resident members among

[24] See Appendix 7.

households without horticultural sales (Table 4). Off-farm employment, however, is of the same importance for all groups. The reason why it could cause a bigger constraint among households without horticultural sales is that the head is more often the one with the off-farm job within this group. The question then remains whether the head has left the farm by his or her own free will or because commercial horticultural production was not possible.

A third constraint concerns capital shortage. Respondents refer to this when mentioning the high costs of inputs. As horticultural production is profitable, even with the present high prices for inputs, it most probably means that they are not able to come up with the initial capital required to start the business. Our survey results confirm that households which sold horticulture had more capital available, either through income out of coffee and cereal selling, or through cattle (Tables 5 and 6). As stated, many households without horticultural sales had a member with an off-farm job, like the other households (Table 7), but those jobs were often far from home, and the visits to the compound irregular, both of which affect the contributions to the household by the person concerned.

It can be concluded that households not selling vegetables or fruits in the Taita Hills have to deal with various constraints that prevent such an undertaking. They do not ignore commercial horticulture of own free will, except for some households where such an enterprise would have been feasible if the household head had not left for an off-farm job. In general, land, labour and capital shortage are the main constraints.

Taita HPC farmers versus other horticultural farmers

Table 8 also summarizes differences between Taita HPC farmers and other horticultural farmers. The former had on average larger holdings than the latter (Table 4). Cooperative members also owned more coffee trees, and more (up-)graded and traditional cows (Tables 5 and 6). It suggests that Taita HPC farmers were in general better off than other horticultural farmers, even without taking the horticultural enterprise into account. This was confirmed by the management of the Taita HPC during the FNSP seminar in 1993. The reason is that the cooperative was operational for only one year at the time of the survey, and farmers were very sceptical about the initiative because of bad experiences

with the already existing Taita Farmers Co-operative Society (TFCS).[25] Therefore, only bigger farmers were willing to join the Taita HPC project initially, as they are more innovative-oriented and able to face the financial risks. When the project appeared to be successful also smaller farmers applied for membership in 1992 and 1993. Towards the end of 1993, the Taita HPC membership list was a better reflection of the farming community in the Taita Hills than it was in 1991.

2.2. Taveta

General household characteristics

Households with and without horticultural sales in Taveta did not differ much in terms of holding size (Table 9). The importance of female versus male-headed households was also about the same, as was the level of education of the household head. The number of resident household members was, however, smaller in the case of households with horticultural sales, while polygamy was less important. The latter could be related to ethnic differences as all households without horticultural sales were Taveta, while part of the households with horticultural sales belonged to other ethnic groups (e.g. Kamba settlers at Njukini irrigation scheme).

Table 9. General household characteristics in Taveta by research group, 1991

	hh's without hort sales (n=16)	*hh's with hort sales (n=38)*
size of holding (acres)	3.0	2.9
no. of residents	7.2	5.4
no. of part-time residents	0.3	0.3
total no. of household members	7.5	5.7
female-headed households (%)	25	26
polygamous households (%)	25	5
household head without formal education (%)	38	32

Source: farm survey
Note: for distribution of household members by age group and further specification of educational levels see Appendix 4.

[25] The TFSC deals mainly with coffee. Initially, the HPC was supposed to become part of the TFSC after the first phase, but in 1993 the Taita HPC was registered as an independent cooperative.

Farming activities

Cereals and beans, which are staple foods in the area, were grown by the majority of the households in both groups. A considerably larger proportion of the households without horticultural sales did, however, also sell them (Table 10). Cotton did not seem to be an attractive alternative to these households, probably because of low prices, high input costs, and severe payment delay. The crop was more common among households which sold horticultural commodities, probably because of the availability of water, which allowed higher yields, making the enterprise more profitable.

Households which did not sell horticultural commodities did not in most cases grow vegetables and fruits for own consumption either. This is also related to the availability of irrigation water.

Livestock

(Up)graded cows were not found in Taveta Division at all. Traditional cows, goats and sheep were more common, which can be explained by the climatic conditions in the area (hot and dry). Milk was not sold but fed to the calves or consumed within the household. Differences between households with and without horticultural sales were small (Table 11).

Off-farm employment

Off-farm employment was slightly more common among households without horticultural sales than households with horticultural sales (Table 12). This suggests that the need to look for additional sources of income was more pressing when selling of horticultural commodities was not possible.

Off-farm work in the agricultural sector was more common for households with horticultural sales. The presence of other irrigated farms near their own farm probably made it easier to find work as a farm labourer. An additional explanation might be the presence of a large sisal plantation near one of the clusters where a lot of horticultural farmers lived (Kimorigo). These farmers had settled in the area to work on the plantation and later on gone into horticulture as additional source of income.

Table 10. Households cultivating and selling agricultural commodities in Taveta by research group, 1991 (%)

	hh's without hort sales (n=16)		*hh's with hort sales (n=38)*	
	growing	*selling*	*growing*	*selling*
Cereals & Pulses	94	56	84	21
Vegetables	19	0	71	68
Bananas	13	0	84	76
Other fruits	0	0	82	79
Cotton	13	13	39	39

Source: farm survey

Table 11. Livestock in Taveta by research group, 1991

	hh's without hort sales (n=16)	*hh's with hort sales (n=38)*
hh's with (up)graded cows (%)	0	0
hh's with traditional cows (%)	31	32
hh's with cows selling milk (%)	0	0
hh's with goats (%)	69	58
hh's with sheep (%)	19	26

Source: farm survey
Note: for more information on livestock see Appendix 5

Table 12. Off-farm employment in Taveta by research group, 1991

	hh's without hort sales (n=16)	*hh's with hort sales (n=38)*
hh's with off-farm income (%)	56	42
average no. of jobs per hh	1.0	1.1
average no. of months employed per year	12.0	11.1
type of employment (%):		
- agriculture	22	44
- trading	33	13
- services	22	19
- office/clerical	0	13
- professional/managerial	11	6
- other	12	5
place of work (%):		
- in the neighbourhood	56	75
- elsewhere	44	25

Source: farm survey
Note: for more information on off-farm employment see Appendix 6

Trading was a relatively important type of off-farm employment among households without horticultural sales. It is favoured because of the location of Taveta division along the border with Tanzania, but difficult to combine with intensified agriculture like irrigated vegetable production.

Constraints regarding horticultural production

Differences between households which sell and which do not sell horticultural commodities in Taveta district are first and foremost related to access to water. Without irrigation horticultural production is not possible, leaving rain-fed cotton and cereals as possible alternatives. Thus, the primary reason for not selling horticultural commodities is clear in Taveta. The question remains whether other factors are also of importance.

Table 13 summarizes the differences and similarities between households without and with horticultural sales. Households of the former group were asked for their reasons not to sell. The majority did mention water shortage, as was expected.[26] Land shortage was only mentioned by a few of them, which is in accordance with our findings of on average equal holding sizes for households with and without horticultural sales (Table 9). Labour shortage was not a major constraint either, which is understandable as the average number of residents in households without horticultural sales was even bigger than in

Table 13. Summary of the characteristics of the research groups in Taveta

	households without horticultural sales	*households with horticultural sales*
size holding	0	0
no. of residents	+	-
female headed households	0	0
polygamous households	+	-
no formal education household head	0	0
cotton selling	-	+
cereals & beans selling	+	-
traditional cows	0	0
off-farm jobs in the neighborhood	0	0

Based on Tables 9 to 12
Note: the signs refer to the relative size, importance, number, etc. when comparing the two survey groups. A plus means bigger, more, higher, etc. than the other group, and a minus smaller, less, lower, etc. than the other. Both groups received a zero when the values did not differ much.

[26] See Appendix 7.

households with horticultural sales (Table 9). Capital constraints, which prevented purchase of inputs, were not mentioned at all. Households without horticultural sales would probably have had enough sources of cash money to finance horticulture, namely cattle and selling of cereals and beans (Tables 10 and 11). It can, therefore, be concluded that water was the only major constraint to commercial horticulture in Taveta, because households with and without horticultural sales had to cope with the same land, labour and capital conditions.

Chapter 3. Household income

3.1. Introduction

Now that the characteristics of households with and without horticultural sales are known, their economic situations can be compared by looking at the estimated incomes for 1991. First, however, some economic terminology has to be explained.

A distinction is made between farm income, land income and off-farm income. Farm income refers to cultivated crops, livestock and livestock products (milk, eggs, etc.). Land income is treated as a separate category because renting out of land is not regarded as an agricultural activity. Off-farm income concerns all activities outside the farm, for example wages earned from regular employment, revenues obtained through shop keeping, bar tending, fishing, food preparation, brewing, shoe mending, shoe shining, casual farm labour, lumbering, transporting, etc.

Apart from the above-mentioned sub-categories, two more distinctions are made, namely between gross income and net income, and between total income and cash income. Gross farm income concerns the total value of farm output against selling prices, whereas net farm income is calculated by deducting all farm costs from the gross farm income. In respect of land, gross and net income are normally equal because of absence of costs. Net off-farm income has to be calculated by deducting possible cost of transports and lodging from the remuneration.

Total versus cash income is of paramount importance in respect of farm activities. The cash component of the farm income consists of those agricultural crops, animals and livestock products that have been sold by the farmer or farm operator. The non-cash component on the other hand consists of household consumption of vegetables, fruits, milk and meat, and produce set aside as seed. The non-cash component of livestock also

includes the value increase of the herd.[27] The concepts of total versus cash income and gross versus net income are normally combined to calculate net incomes and net cash incomes.

3.2. Taita

The average net household income of Taita HPC farmers was estimated at over KSh 31,000 in 1991 of which over KSh 20,000 were cash revenues. The other farmers had calculated total and cash incomes of less than half these amounts (Table 14). It can therefore be concluded that Taita HPC farmers were significantly better off than other farmers, both in terms of wealth (total household income) and welfare (household cash income).[28] Horticultural farmers who were not a member of the Taita HPC were better off than households without horticultural sales in terms of total income, whereas their cash revenues were about the same.

Table 14. Average household income and cash income in Taita by research group, 1991 (KSh)

	hh's without hort sales (n=20)		*Taita HPC farmers (n=27)*		*other horticultural farmers (n=52)*	
	*total**	*cash*	*total**	*cash*	*total**	*cash*
net livestock income	2,430	1,488	7,133	3,405	3,339	1,818
net staples income	2,590	8	3,810	280	4,844	-51
net horticultural income	342	0	16,125	9,773	3,587	2,232
net coffee income	7	7	134	134	16	16
net farm income	5,369	1,503	27,202	13,592	11,786	4,015
net off-farm income	8,385	8,385	6,459	6,459	5,422	5,422
net land income	0	0	6	6	7	7
net household income	13,754	9,888	33,667	20,057	17,215	9,444

Source: farm survey
* includes cash and non-cash income
Note: Appendix 8 explains the calculation method, while Appendix 9 presents the extreme cases and proves the significance of the averages by means of analysis of variance.

The major sources of cash to Taita HPC farmers were, in order of importance, horticulture, off-farm employment, and livestock (Table 15). Coffee generated very little income, which indicates that it was unimportant as commercial enterprise to households

[27] New-born calves increase the value of the herd as long as they are not sold. Value increases also take place when heifers become lactating cows, or cows become better milkers. All are included in the household income, but not in the household cash income.
[28] According to the FAO, the total household income is a measure of wealth, and in case of self-sufficiency in food production, the total household cash income is a measure of welfare (FAO, 1980).

in Taita at that time. Income received through renting out of land was negligible, which can be attributed to scarcity of land, a well-known phenomenon in the Taita Hills. The parcels of land are too small to leave a surplus that can be rented out for agricultural purposes.

Off-farm employment was the most important source of cash income to horticultural farmers who were not a member of the Taita HPC, followed by horticulture, and livestock. Households without horticultural sales relied heavily on off-farm employment for their cash revenues with some additional income out of livestock (Table 15).

Table 15. Composition of average household income and cash income in Taita by research group, 1991 (%)

	hh's without hort sales (n=20)		*Taita HPC farmers (n=27)*		*other horticultural farmers (n=52)*	
	*total**	*cash*	*total**	*cash*	*total**	*cash*
net livestock income	18	15	21	17	19	19
net staples income	19	0	11	1	28	0
net horticultural income	2	0	48	49	21	24
net coffee income	0	0	0	1	0	0
net off-farm income	61	85	19	32	31	57
net land income	0	0	0	0	0	0
	100	100	99	100	99	100

Based on Table 14
* includes cash and non-cash income

About two-thirds of the households in the Taita Hills sell vegetables and fruits.[29] It can be concluded that horticulture is an important source of cash income to them. About one third of the households does not sell any vegetables and fruits. To them the only real alternative is off-farm employment, which, however, is often only found far from home. When judging the effects of the Taita HPC project, the farmers involved make much more money out of horticulture than other households in the area. At the time of the survey, this could, however, not completely be attributed to the Taita HPC, because its members were already more wealthy to start with, as shown once more by their higher returns out of livestock and coffee (see also section 2.1).

[29] See Appendix 1, the household listing.

3.3. Taveta

In Taveta Division, households with and without horticultural sales did not differ much in terms of household income. The total income was on average between KSh 14,000 and KSh 16,000, of which KSh 8,000 to KSh 9,000 were cash revenues (Table 16). The farmers belonged to the same income group as horticultural farmers without HPC membership in Taita.

Table 16. Average household income and cash income in Taveta by research group, 1991 (KSh)

	hh's without hort sales (n=16)		*hh's with hort sales (n=38)*	
	*total**	*cash*	*total**	*cash*
net livestock income	3,492	2,747	1,012	207
net staples income	8,948	1,478	1,653	131
net horticultural income	286	0	7,297	5,347
net cotton income	128	128	357	357
net farm income	12,854	4,353	10,319	6,042
net off-farm income	4,022	4,022	3,786	3,786
net land income	0	0	9	9
net household income	16,876	8,375	14,114	9,837

Source: farm survey
* includes cash and non-cash income
Note: Appendix 8 explains the calculation method, while Appendix 9 presents the extreme cases and looks at the significance of the averages by means of analysis of variance.

Although the total income of households with and without horticultural sales was about the same, the composition differed considerably (Table 17). Off-employment was again an important source of cash revenues to households without horticultural sales, although livestock and cereal selling generated also substantial cash revenues. This was in contrast with similar households in Taita. Horticulture was the main source of cash to households with horticultural sales, followed by off-farm employment. Livestock and staple crops hardly counted in terms of sales to them, which shows their specialization into horticulture.

It can be concluded that horticulture in Taveta is not so much a way to increase farm revenues, as in Taita, but rather a completely different mode of farming. The choice for either rain-fed cereal production and livestock on the one hand, or irrigated horticulture on the other depends on the availability of water (see section 2.2). If the water constraint can be solved households normally opt for commercial horticulture for two reasons.

Table 17. Composition of average household income and cash income in Taveta by research group, 1991 (%)

	hh's without hort sales (n=16)		*hh's with hort sales (n=38)*	
	*total**	*cash*	*total**	*cash*
net livestock income	21	33	7	2
net staples income	53	18	12	2
net horticultural income	1	0	52	54
net cotton income	1	1	2	4
net off-farm income	24	48	27	38
net land income	0	0	0	0
	100	100	100	100

Based on Table 16
* includes cash and non-cash income

First, it offers a more regular cash flow than rain-fed cereal production which is a seasonal activity. Second, the risk of crop failure due to lack of rain is nil. Irregular rainfall is an increasing problem to rain-fed agriculture in Kenya in general and Taita Taveta in particular.

Chapter 4. Horticultural income

The present chapter looks into the composition of the horticultural cash income of households in Taita Taveta, to investigate the balanced or lopsided character of commercial vegetable and fruit production in the district. Households without horticultural sales are left out of the analysis at this stage.

4.1. Taita

Vegetables are a much more important source of cash revenues in the Taita Hills than fruits and nuts. About 90% of the horticultural earnings came from vegetables in 1991, both for Taita HPC farmers and other horticultural farmers. The most important vegetables for the cooperative farmers were tomatoes, cabbages, spinach and Irish potatoes (Table 18). The same assortment applied for the other farmers except for Irish potatoes which were less important, and kale which was more important. The difference suggests a more Mombasa-oriented approach of Taita HPC farmers than other horticultural farmers, as Irish potatoes were in high demand in the Mombasa market while kale mainly served local consumers.[30] Vegetables like French beans, carrots, sweet pepper, cauliflower and lettuce were also bigger income earners to Taita HPC farmers than to other horticultural farmers, which is understandable as they were part of the cooperative package while their demand in local markets was limited. Other horticultural farmers most probably did not grow them because of lack of knowledge about these crops and a relatively small demand by middlemen to whom tomatoes and cabbages were the core of the business.

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[30] Irish potatoes were not part of the HPC package. According to the HPC, the commercial production of Irish potatoes in the Taita Hills should be discouraged because of disease problems and high costs of seed potatoes and chemicals. The altitude seemed to be too low to compete with potatoes from Central Province. In 1993, the HPC started trials with sweet potatoes, which seemed to be a more promising crop.

Table 18. Average net cash revenues out of selling of horticultural commodities in Taita by research group, 1991

	Taita HPC farmers (n=27)		*other horticultural farmers (n=52)*	
	income (KSh)	*%*	*income (KSh)*	*%*
Vegetables				
Tomatoes	2,124	21	767	33
Cabbage	1,727	17	452	20
Spinach	935	9	8	0
Irish potatoes	1,193	12	119	5
French beans	575	6	22	1
Carrots	521	5	36	2
Kale	453	4	406	18
Lettuce	476	5	46	2
Sweet pepper	428	4	28	1
Cauliflower	356	3	0	0
Baby marrow	198	2	22	1
Cucumber	257	3	18	1
Other vegetables*	307	3	91	4
All vegetables	9,550	94	2,015	88
Fruits and nuts				
Macadamia	541	5	9	0
Mangoes	47	0	107	5
Passion fruit	43	0	111	5
Other fruits**	97	1	52	2
All fruits	728	6	279	12
All hort commodities***	10,278	100	2,294	100

See Appendix 10
* Other vegetables include green peas, leek, Cape tomatoes and onions
** Other fruits include bananas and lemons
*** Total gross margin. Net income found after deduction of the fixed costs (see Appendix 10).

It can be concluded that the vegetable assortment of Taita HPC farmers is larger than of other horticultural farmers in Taita Hills, which is in accordance with the cooperative's strategy. On the other hand, tomatoes and cabbages remain the two most important commodities both to Taita HPC farmers and other horticultural farmers in the hills. Therefore, differences between the two groups are not only related to assortment but also to acreage, yields and returns.

The question remains to what extent cooperative members received their revenues through the Taita HPC and to what extent by selling to private traders like the other horticultural farmers. Calculations show that Taita HPC farmers received about two-thirds of their total vegetable cash income through the cooperative in 1991.[31] When looking at crops that

[31] See Appendix 11.

were part of the Taita HPC package, members received on average 80% of their revenues through the cooperative. It shows that they were willing to deliver their produce to the Taita HPC and were not just members on paper, which is a positive sign.

Fruits and nuts are relatively unimportant as sources of cash revenues to the Taita farmers. Bananas are grown by the majority of the households but only a minority sell them (see section 2.1). It is a traditional crop to the Taita people and does quite well in the hills. The required input levels are fairly low since the banana trees are either planted along the edges of the farm or intercropped with coffee. In the latter case the trees profit from attention given to the coffee.[32] Most of the bananas are consumed within the households, resulting in limited sales quantities and low cash revenues (Table 18).

Macadamia seemed to be the most important source of cash out of fruit and nut sales to Taita HPC farmers. The average figure in Table 18 is, however, misleading as only four of the sampled cooperative farmers had macadamia trees, including three with just a couple of trees and one with 200 of them (Table 19). The latter farmer inflates the average cash income out of macadamia sales among Taita HPC farmers.

Table 19. Households with fruit and nut trees and number of trees per owner in Taita by research group, 1991

	Taita HPC farmers (n=27)			*other horticultural farmers (n=52)*		
	hh's with trees (%)	*av no of trees**	*max no of trees*	*hh's with trees (%)*	*av no of trees**	*max no of trees*
Bananas	89	55	600	73	26	200
Avocados	48	3	15	46	3	7
Passion fruit	41	6	27	40	5	25
Guavas	15	4	7	2	3	3
Macadamia	15	54	200	2	3	3
Cape tomatoes	15	11	20	4	12	20
Pawpaw	4	2	2	0	-	-
Apricots	7	1	1	0	-	-

Source: farm survey
* averages refer to households with the type of fruit tree

Almost half of the horticultural farmers had a few trees of avocados or passion fruits (Table 19). The average revenues out of passion fruit sales were, however, very low while avocados were not sold at all in 1991. Both types of trees are normally planted for commercial purposes as the fruits are not part of the traditional diet of the Taita people. It can, therefore, be concluded that the low cash revenues indicate a marketing constraint.

[32] Weeding between the banana and coffee trees is done at the same time. The banana trees do not need a lot of labour for pruning.

Farmers are not able to sell the fruits, although the demand in urban and export markets is substantial. Most probably the supply per farmer is too small and the supplying farmers live too far apart to attract specialized exporters from Mombasa and Nairobi. The only solution seems to be group marketing by the farmers themselves.

4.2. Taveta

In the previous chapters, households with horticultural sales in Taveta were treated as a single group. Two sub-groups can, however, be distinguished, namely households which sell all their vegetables and fruits to traders at the farm gate, and households which sell at least part of their produce to traders and consumers in a local marketplace.[33] The former depend on middlemen who come to the farm, making them more vulnerable to price manipulation due to the lack of up-to-date market information. The question is to what extent they differ from farmers who do go to the market to sell produce, both in terms of revenues and assortment.

The average horticultural cash income of farmers who did not sell in the market was about KSh 4,200 in 1991, compared to KSh 7,800 for farmers who did.[34] The difference is substantial, which suggests that only bigger farmers went to the market to sell their produce. It would imply that bigger farmers are better informed about prices in the market than smaller ones, the latter being more vulnerable to price manipulations by middlemen and other traders who come to the farm. The question remains whether the assortment of the two groups had anything to do with the decision to sell in the market.

Vegetables were a more important source of income to farmers who went to the market than to those who sold all produce at the farm gate (Table 20). The former sold mainly tomatoes and onions, while the latter did not sell onions but Asian vegetables (okra, brinjals, chillies). Onions were only sold by farmers who went to the market because of the absence of specialized onion middlemen who came all the way to the farm, and the presence of the HCDA in Taveta town that acted as a kind of buyer of last resort. The Asian vegetables were grown at the Njukini irrigation scheme and sold directly to an export trader (see section 1.3), which explains why farmers did not bring them to the market.

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[33] In all our cases this marketplace was Taveta, the most important trading centre in the division.
[34] See Appendix 12.

Table 20. Average net cash revenues out of selling of horticultural commodities in Taveta by research group, 1991

	hh's selling hort at the farm gate only (n=18)		*hh's selling at least part in a local market (n=20)*	
	income (KSh)	*%*	*income (KSh)*	*%*
Vegetables				
Tomatoes	451	14	1,816	20
Onions	0	0	1,417	16
Okra	80	2	207	2
Cucumber	70	2	0	0
Kale	56	2	146	2
Brinjals	55	2	0	0
Other vegetables*	41	1	133	1
All vegetables	756	23	3,719	41
Fruits and nuts				
Bananas	1,739	54	4,105	46
Mangoes	227	7	400	4
Oranges	355	11	51	1
Lemons	86	3	335	4
Other fruits and nuts**	85	3	289	3
All fruits & nuts	2,492	78	5,180	58
All hort. commodities***	3,248	100	8,899	99

See Appendix 12
* Other vegetables include chillies, cow pea leaves, arrow roots and cassava.
** Other fruits and nuts include pawpaw, avocados, tangerines and coconuts
*** Total gross margin. Net income found after deduction of the fixed costs (see Appendix 12).

Apart from onions and Asian vegetables, the vegetable assortment of both groups did not differ to a large extent. Both groups focused mainly on tomatoes, which is understandable because of good market prospects due to a large demand by middlemen from Mombasa. We will look at the tomato flows from Taveta to Mombasa in the next chapter.

Fruit sales are more important than vegetable sales in Taveta, in contrast with the Taita Hills. Bananas are by far the most important fruit, followed by mangoes and citrus. Farmers who relied on farm-gate sales had considerably smaller cash revenues out of banana sales than those who sold part of their horticultural commodities in Taveta (Table 20). This was first and foremost related to the on average smaller number of banana trees (Table 21). Two other factors of importance were selling opportunities and price levels. Farmers who relied completely on farm-gate sales harvested about the same number of bunches per 100 trees as other farmers (27 compared to 26), but they were able to sell fewer of them (15 compared to 21). While some of the remaining ones were consumed by the household members, the major part went to waste. The deplorable state of the

access roads to the production areas was the main reason for this wastage. Whenever these roads were flooded, farmers who were able to get their bananas to Taveta could sell them while those who had to wait for middlemen at the farm were left without hope.

Table 21. Households with fruit and nut trees and number of trees per owner in Taveta by research group, 1991

	hh's selling hort at the farm gate only (n=18)			*hh's selling at least part in a local market (n=20)*		
	hh's with trees (%)	*av no of trees**	*max no of trees*	*hh's with trees (%)*	*av no of trees**	*max no of trees*
Bananas	89	386	1150	85	570	1550
Mangoes	50	6	24	50	6	12
Lemons	50	2	6	55	3	10
Oranges	39	3	5	15	4	6
Avocados	11	3	4	40	2	3
Pawpaw	6	2	2	15	2	3
Tangerine	6	1	1	0	-	-
Coconut	0	-	-	5	1	1

Source: farm survey
* averages refer to households with the type of fruit tree.

The second factor that explains the smaller cash revenues of farmers who rely on farm-gate sales is the lower prices at the farm gate than in Taveta market. The off-farm price at the time of the survey was on average KSh 31 per bunch, while farmers who sold them in Taveta market received on average KSh 41.[35] Possible carrying costs from the farm to the road were up to KSh 3 per bunch, while the subsequent transport costs and market fees were KSh 3 and Ksh 1 per bunch, leaving a considerable additional profit for farmers who were able and willing to make the trip.

Although half of the horticultural farmers in Taveta have mango trees, the revenues out of mango sales were relatively small compared to bananas (Tables 20 and 21). This is partly related to the limited number of trees per household and partly to seasonality of supply. The Kenyan market is flooded with mangoes at the beginning of each year, affecting prices in the urban markets. Taveta mangoes have two handicaps compared to mangoes from the Coast. First, they are small whereas urban consumers prefer big mangoes. It also makes the fruits unsuitable for the export market, which otherwise could be an attractive alternative. The only solution is to plant trees of the appropriate variety. The second handicap is the isolated location of Taveta compared to production areas in Kwale and Kilifi. The latter two districts are near to Mombasa from where most mangoes are distributed to coastal retail markets and upcountry wholesale markets. The isolated

[35] The averages were significantly different: t=-2.780; p=0.01.

location of Taveta also affects other coastal tropical fruits like citrus. The only way to diminish the isolation of Taveta is by improving the Taveta-Mwatate road.

Chapter 5. Tomato and banana trade

After analyzing horticultural production in the previous chapters, the coming chapters will focus on horticultural marketing. The structure of horticultural marketing channels and the conduct of horticultural traders will be analyzed in order to judge the market performance. Both structure and conduct vary with the type of commodity traded. Therefore, two commodities will be taken as an example in the present chapter, namely tomatoes and bananas. They are the two most important horticultural commodities in Taita Taveta District, both in terms of cash crop production and trade.[36] Each section starts with an explanation of the tomato trade, followed by a discussion about the differences with banana trade.

5.1. Introduction

Tomatoes are an important horticultural cash crop in Taita Taveta, produced by farmers in the Taita Hills and around the springs in Taveta Division. The fruits are sold to local consumers and carried to urban centres outside the district, Mombasa being the main one. Local marketplaces play a major part in the marketing process, as a large part of the traded tomatoes pass one of them before reaching their destination. Two out of the three major market centres in the district (Wundanyi and Taveta) are situated near tomato producing areas. Voi, the third one, receives it tomatoes from the same sources.[37]

The biggest concentration of bananas are found at Mboghoni and Kimorigo Sub-Locations in Kimorigo Location, Taveta Division, where the trees line up as far as the

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[36] For cash crop production see sections 4.1 and 4.2. In 1988, the total estimated production in the district was 25,400 tonnes of bananas, and 2,200 tonnes of tomatoes, compared to for instance 900 tonnes of cabbages, 1000 tonnes of kale, 500 tonnes of onions and 100 tonnes of lettuce (MPND, 1989).

[37] Voi is about 50 km from the tomato production areas in Taita Hills and 120 km from those in Taveta Division.

eye can see, suggesting a banana forest. The fruits are carried as far as Mombasa and Nairobi. Within the district they reach Voi, which, however, also gets supplies from the lower slopes of the Taita Hills in Mwatate Division. Commercial banana production in Mwatate is, however, on a much smaller scale than in Taveta. Higher up the slopes, in Wundanyi Division, commercial production is even more limited due to climatic conditions. Bananas from this area hardly reach Voi or other parts of the district, as they are mainly consumed within the household or sold to local consumers. Wundanyi town, like Voi, receives some bananas from Mwatate.

Almost all horticultural traders in the local markets are women. The majority of them handled two to four types of horticultural produce at the same time. The composition of the assortment is related to supply and demand conditions in the markets concerned. Combinations of tomatoes, brassicas and onions are most common in the marketplaces of Voi and Wundanyi, while an assortment of tomatoes and onions together with either bananas, mangoes or oranges prevails in Taveta market.[38] The present chapter focuses on tomatoes and bananas only, leaving out the additional commodities.

5.2. Commodity flows and the markets involved

Collecting functions of local markets

Taveta is situated near production areas of tomatoes while Wundanyi is surrounded by them. Usually, local traders in these market centres get their produce directly from the production sites without mediation of other marketplaces. They are familiar with current demand and supply conditions at the farm level, in contrast with traders from elsewhere who do not always have such information and may therefore prefer to buy in a local marketplace in the production area instead of going all the way to the farms. This was confirmed by our research. At the time of the survey, about 80% of the tomatoes in Taveta market, and 90% of the tomatoes in Wundanyi market came directly from the farms.[39] In contrast, only about half of the traded tomatoes in Voi market came directly from the farms, the other half coming from local markets in the production areas.[40]

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[38] The recurrent combination of tomatoes and onions is related to their major role as ingredients of the soup that is eaten together with rice and *ugali*.
[39] See Appendices 14 and 15. The produce that comes directly from the farms includes both tomatoes bought at the farm gate and produce from the own farm. We will come back to this in the next section.
[40] See Appendix 13.

Markets that are used by traders from elsewhere to buy local produce have a so-called collecting function and are therefore called collecting markets.[41] What makes a local marketplace a collecting market? Comparing Taveta and Wundanyi may give an answer to this question, as both markets are situated near production areas while the former has a much more distinct collecting function than the latter. The major part of the tomatoes from Taveta Division which were destined for urban centres like Voi and Mombasa passed through Taveta market at the time of the survey.[42] In contrast, almost none of the tomatoes from Taita Hills destined for Mombasa flew through Wundanyi market and only part of the tomatoes destined for Voi. If traders from the coast came to Taita Hills, they went directly to the farms.[43] Besides, one marketing cooperative (the Taita HPC) and several informal marketing associations brought farmers' tomatoes to Mombasa. The Taita HPC was by far the most important organization in this respect, with its own collecting centres, grading station, truck, and permanent stall in the Mombasa wholesale market (see section 1.4).

In addition to traders from Mombasa, part of the traders from Voi and Mwatate travelled uphill to buy tomatoes directly at the farm gates. Similarly, farmers from Taita took tomatoes downhill to Voi and Mwatate, often taking produce from other farmers with them. Traders from Voi and Mwatate who did purchase tomatoes at a local market in the hills did not only go to Wundanyi but also to smaller markets in the area, of which Mgambonyi was the most important one. Thus, two factors affected the collecting function of Wundanyi market: direct links between local farms and urban centres outside the hills, and competition with other local markets. Consequently, Wundanyi focused mainly on sales to local consumers, in contrast with Taveta market.

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[41] See for instance Wilson (1973) and Kohls & Uhl (1990) Other authors call them assembly markets, see for instance Durr & Lorenz (1980), and Tilburg et al. (1989).

[42] At the time of the survey, only a small percentage (approximately 5%) went directly from the farms to these towns (see Appendix 14). They were either bought by interregional traders at the farm-gate, or brought by farmers to Mombasa themselves. The latter possibility was even more rare than the former. During the survey, only one farmer was found in Taveta Division who reported hiring a truck together with other farmers to bring tomatoes to Mombasa. In general, such an initiative was beyond the scope of most farmers because of the travelling distances involved and the sophisticated character of the Mombasa wholesale market where they could be cheated easily.

[43] At the time of the survey, traders from Mombasa were hardly found in the area, which might partly be related to the fact that the harvesting peak for tomatoes was still to come (most tomatoes in the market were grown under irrigation). However, traders in Wundanyi market reported no selling to traders from Mombasa during any part of the year.

Primary and secondary collecting markets

Taveta does not have to compete with other marketplaces in the area as a collecting market. Smaller marketplaces in the division, of which Chumvini and Mukuyuni are the most important ones, serve as secondary collecting centres, supplying produce to Taveta market. Several reasons can be mentioned that determine the crucial role of Taveta. First, most interregional traders who want to buy tomatoes come to the area by one of the long-distance buses that have Taveta as their final destination and do not call at other marketplaces in the area or pass the actual production sites.[44] Passengers of these buses come to Taveta not only for fruits and vegetables, but also for all kinds of commodities from Tanzania, including cloth, shoes, radios, batteries, watches, etc. The importance of Taveta as a border market has led to direct bus connections with towns as far as Kisumu and to a special train service from Mombasa on market days.[45]

A second reason for the leading role of Taveta within the area is its higher degree of accessibility in comparison to other collecting markets in the division. Most of the time, Taveta can be reached by large trucks and buses, while the other markets can only be served by smaller trucks and pick-ups due to the condition of the access roads. The smaller vehicles are less economical for long-distance transport. Therefore, traders need a place to transfer the commodities to larger vehicles, causing the differentiation into secondary and primary collecting centres.

A central collecting centre where all tomatoes from the area come together has the additional advantage of demand and supply concentration. This is of special importance to large traders from Mombasa who then have the possibility to negotiate a lower price and to get tomatoes of a better and more homogeneous quality. The latter is necessary in order to make sure that the tomatoes do not go bad during the 300 km trip on top of a bus or loaded in a truck.

To obtain a more homogeneous quality the tomatoes are sorted before going on long-distance transport. Local traders who buy the tomatoes at the farms or in the secondary collecting markets, bring them to Taveta market in gunny bags or reed baskets. During the trip tomatoes at the bottom are often mashed and many others bruised. The traders from Mombasa who come to Taveta therefore employ boys in the market to remove the

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[44] The tomato production areas were situated to the north and south of Taveta while the Mombasa-Voi-Taveta road comes in from the east.

[45] This train used to go from Mombasa to Moshi and was the primary reason why Taveta developed into a town.

bad tomatoes and to re-pack the remaining ones in wooden boxes. The boxes are more appropriate for the long trip to the coast, and are also a kind of standardised selling unit in the Mombasa wholesale market, from where most tomatoes are distributed to retail markets and shops along the coast. The use of boxes is further facilitated by carpenters who stay in Taveta market to fix old ones and supply new ones whenever necessary.

Thus, its location along the border, its accessibility by road and railway, and the advantages of supply and demand concentration in combination with availability of sorting and repackaging facilities have given Taveta its crucial role as primary collecting market, receiving tomatoes directly from the farms and through secondary collecting markets in the area.

Market sequence in the case of tomato trade

It can be concluded that tomatoes pass a varying number of markets before they reach the final consumer, dependent on origin and destination of the produce. Tomatoes meant for local consumers in production areas pass one market, e.g. Wundanyi. Tomatoes meant for consumers in a smaller urban centre outside the production area (e.g. Voi), pass up to two different collecting markets and the town market. Finally, tomatoes meant for consumers in large urban centres outside the district (e.g. Mombasa), pass two to four markets, including up to two collecting markets, an urban wholesale market and an urban retail market.[46] The sequence of the various markets and their interactions is visualized in Figure 2.

Market sequence of tomato and banana trade compared

Figure 3 shows the market interactions in the case of banana trade. Taveta market functions as a primary collecting centre for bananas, as it does for tomatoes. The bananas either pass a secondary collecting market (Mukuyuni) or come directly from the farms. Unlike for tomatoes, the Wundanyi and Mgambonyi markets do not function as collecting

[46] For that matter, the HPC uses the same number of collecting levels as in the tomato trade from Taveta to Mombasa. The farmers bring their tomatoes to special cooperative collecting centres, from where they are transported to a central grading and repackaging station near Wundanyi. Finally the tomatoes are carried to the HPC stall in the wholesale market in Mombasa, after which they find their way to retail markets, institutions and consumers.

Figure 2. Market interactions in the case of tomato trade

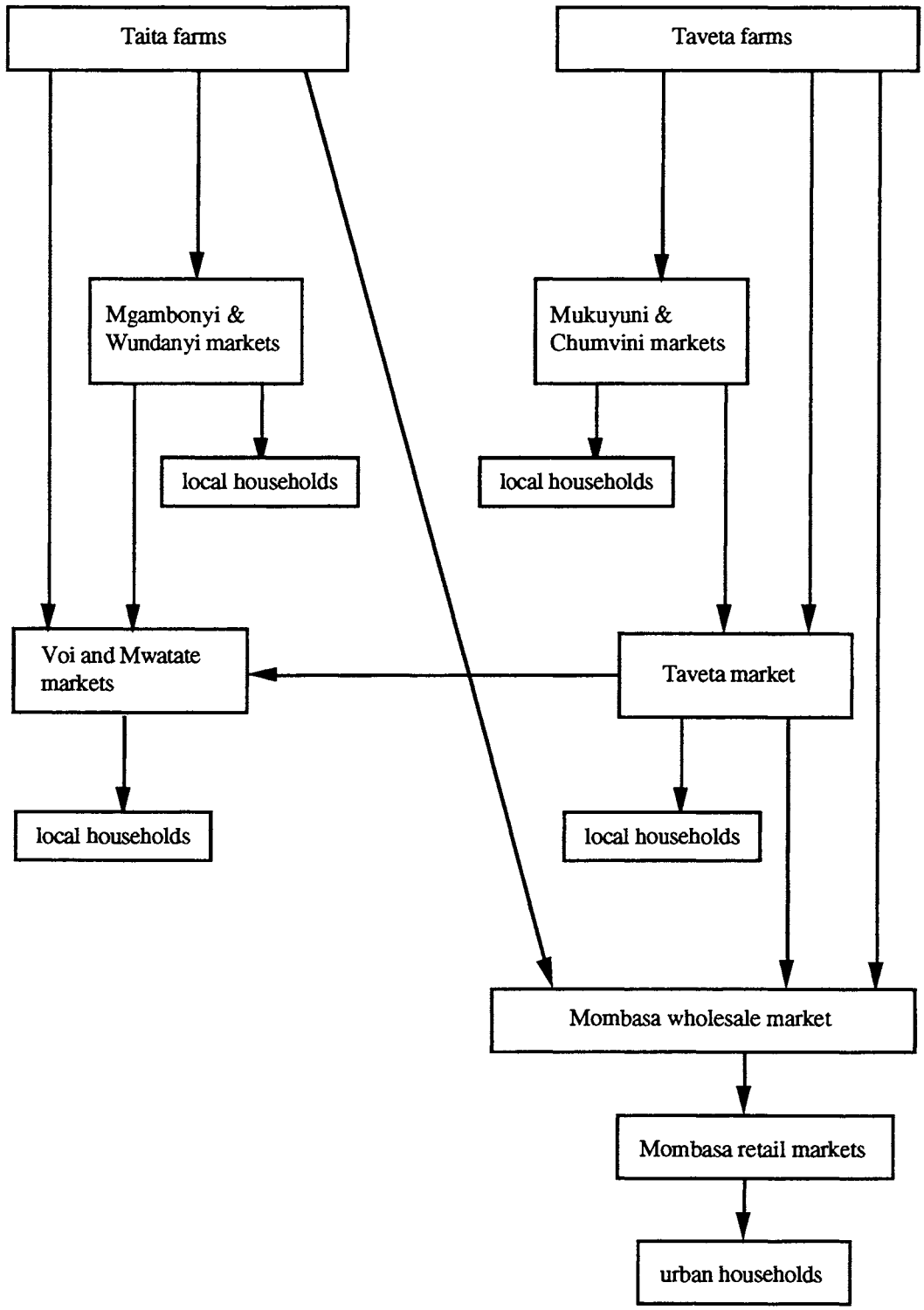
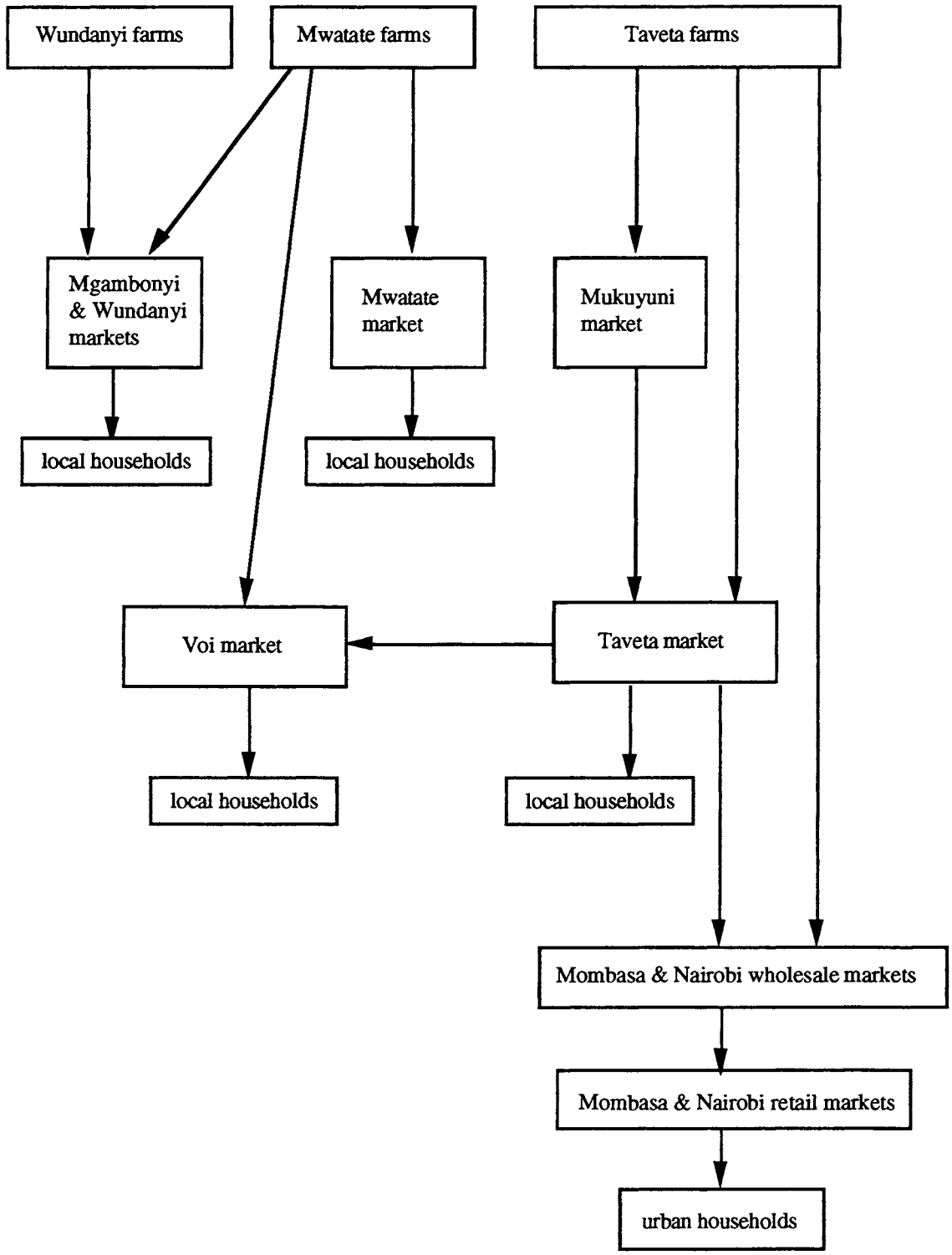


Figure 3. Market interactions in the case of banana trade



centres for bananas in the Taita Hills due to limited surplus production in the area. As stated, the bananas mainly stay in the hills to be sold to local consumers. Mwatate market, which was found to receive its tomatoes from Wundanyi and Taveta, gets its bananas from local producers. One might expect Mwatate to be a collecting centre for local bananas destined for Voi and Wundanyi, but this is not the case as the bananas go directly from the farms to their final destination. The traders do not have to rely on supplies from Mwatate market as they live in the division and know the farmers, which enables them to buy at the farm gate. Most of them are actually farmer-traders who sell bananas at least partly originating from their own farms in Wundanyi and Voi. Relatively short travelling distances and newly tarred roads make travelling to these markets more tempting than selling at the farm gate.

5.3. Traders in the local markets

So far, the origin and destination of tomatoes and bananas in the various production areas and markets have been discussed, distinguishing sellers on the farms and in the marketplaces on the one hand, and local consumers and non-local traders on the other. However, within markets different types of traders operate, who can be distinguished by their degree of mobility. They will discussed in the present section, focusing on tomato trade first.

Mobile versus resident tomato traders

Mobility is a better criterion for an understanding of the structure of commodity flows than the well-known distinction between wholesalers and retailers. Usually, fruit and vegetable traders with smaller quantities for sale sell to consumers, while those with larger expected turnovers focus on traders. The latter may include middlemen and/or wholesalers and retailers from the same or other markets, depending on the size and the function of the market. However, during periods of large supply and small demand bigger traders will also sell to consumers to get rid of their tomatoes before they perish. On the other hand, visiting and resident traders will buy produce from smaller traders during periods of small supply and large demand to reach the required quantities. As a consequence, a considerable group of tomato traders in our sample (48%) reported selling both to consumers and traders, making the distinction between wholesalers and retailers

less appropriate.[47] Only a very small group of traders (9%) reported selling to other traders only, and could therefore be considered as real wholesalers. It has to be noted that all of them were found in Taveta, which appeared to be the only market in the district that was large enough to show such a degree of differentiation.

Based on mobility, two trader groups in the local markets can be distinguished. The first go out to buy the commodity either at the farm gate or in a collecting market, while the second buy from farmers and traders who come to their market. In theory, a third group exists, consisting of farmer-traders who bring tomatoes to the market that originate from their own farm. However, the majority of these farmer-traders also handle tomatoes bought from other producers, which makes their activities quite similar to those of mobile professional traders.[48] Farmer-traders and mobile professional traders will therefore be regarded as one group for the moment, the so-called "mobile traders". In contrast, professional traders who stay in the market and do not go out to buy produce will be called "resident traders". For that matter, Taveta has relatively many resident tomato traders compared to the other markets.[49] This is related to the size of the market[50], the importance of Taveta as a collecting market, and the related allocation of tasks among mobile and resident traders as we will see later on.

Mobility of the tomato traders in relation to their type of customers

Statistical analysis reveals a relation between the mobility of the traders and the type of customers, i.e. other traders or consumers. A significantly larger proportion of the resident traders focused only on consumers, while a larger proportion of the mobile traders dealt (also) with other traders (Table 22). This has everything to do with the selling price of the traders involved. Resident traders are almost by definition obliged to ask higher prices, because they buy from mobile traders in the market and have to account for their own costs. The lower price of mobile traders attracts traders from elsewhere who come to the market to look for produce. They buy in larger quantities than consumers, consequently increasing the daily turnover of the mobile traders. A larger turnover is

[47] See Appendix 16.
[48] See Appendix 17.
[49] 56% of the tomato traders in Taveta market are "resident traders", compared to 23% in Voi market and 16% in Wundanyi market (see Appendix 17).
[50] At the time of the survey about 180 tomato traders operated in Taveta market, compared to 100 in Voi and 70 in Wundanyi (see Appendix 17).

advantageous to them because of economies of scale during transport.[51] Therefore, mobile traders will prefer to sell to traders whenever they are able to generate enough supply while traders prefer to buy from them. So, mobility leads to lower prices and larger turnovers. The latter can also be shown by statistical analysis as the mobile traders in our sample sold significantly larger quantities of tomatoes per market day than resident traders.[52]

Table 22. Types of customers by mobility of the tomato traders*

	selling to traders and consumers or to traders only	*selling to consumers only*	*total*
mobile traders	66	28	94
resident traders	16	35	51
all traders	82	63	145

See Appendix 16
* X^2=18.7, p<0.001

Relative importance of mobile and resident tomato traders

The fact that resident traders were to a larger extent pure retailers does not have to mean that local consumers bought most of their tomatoes from resident traders. A clear distinction occurs between Taveta on the one hand and Wundanyi and Voi on the other. Survey results show that consumers who came to Taveta market indeed bought most of their tomatoes from resident traders, while traders from elsewhere bought the major part from mobile traders.[53] This is understandable in the light of price differences and the preference of mobile traders to sell in larger quantities, as explained earlier. In the markets of Voi and Wundanyi, however, not only traders from elsewhere but also local

[51] The bigger the quantities carried the lower the transport costs per kilogramme, in the case of both public transport and a trucks or pick-ups hired at a lump sum.

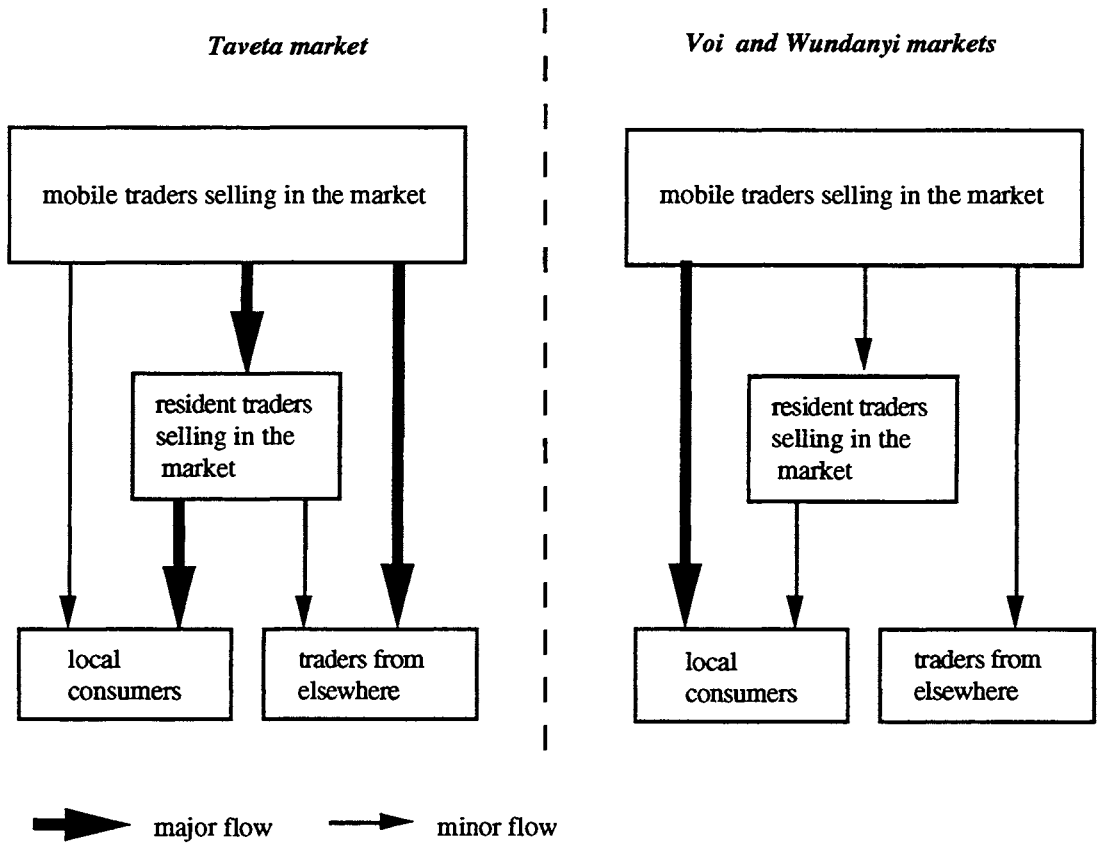
[52] Analysis of variance shows that sales levels were determined by two factors. First the place where the tomatoes were bought, that is at the farm gate or in a collecting market (mobile traders) versus the market where the trader sold the produce (resident trader). Second, the fact whether the trader was a pure wholesaler or not (only found in Taveta market). To carry out the analysis the daily sales of all 145 tomato traders were calculated per kilogramme. Thereafter, they were converted into natural logarithms and eleven extreme values were deleted to get a normal distribution. The variable names were: type of trader (mobile/resident trader) and wholesaler (yes/no). The results of the analysis were as follows:

source	*sum-of-squares*	*Df*	*mean-square*	*F-ratio*	*P*
wholesaler (1)	92.2	1	92.2	69.7	0.000
type of trader (2)	7.4	1	7.4	5.6	0.020
(1)*(2)	0.007	1	0.007	0.005	0.942
error	173.3	131	1.3		

[53] See Appendix 14.

consumers bought most of their tomatoes from mobile traders.[54] The reason is the limited number of traders from elsewhere that frequented those markets and the subsequent forced focus of mobile traders on consumers. The differing attitude of the mobile traders affected the possibilities of resident traders to sell tomatoes. Therefore, the relative number of resident tomato traders was much smaller in Voi and Wundanyi market than in Taveta market, as shown earlier on.

Figure 4. Major and minor tomato flows within the surveyed markets



See Appendices 13 to 15.

Figure 4 visualizes the interactions between mobile traders, resident traders and customers in Taveta on the one hand, and Voi and Wundanyi on the other. The differentiation into major and minor flows is based on a level-wise comparison. The flows are presented in more detail in Appendices 13 to 15.[55]

[54] See Appendices 13 and 15.

[55] When looking at the magnitude of the flows, one has to remember that the figures in the appendices are indications at a given moment in time. The quantities will be different at other times of the year, which makes calculations of annual throughputs impossible. The relative importance of mobile and resident trader involvement will, however, remain roughly the same.

Banana versus tomato trade: the importance of collecting traders

When comparing tomato and banana trade in the local markets, the biggest difference occurs in Taveta Division. As we saw, mobile tomato traders buy at the farms and in secondary collecting centres, to sell to consumers, resident traders and traders from elsewhere. The latter can be retailers from Voi and, more important, middlemen from Mombasa and Nairobi.[56] Mobile traders who sell to them are usually called collecting traders.[57] A comparison shows that collecting traders are considerably less important in the case of bananas than tomatoes because a larger share of the bananas is bought by middlemen at the farms. About 70% of the tomatoes destined for urban centres outside the district go through the hands of collecting traders, compared to 20% of the bananas (Figure 5). The primary reason for this is the location of the most important banana production area, at Mboghoni Sub-Location, along a branch of the Taveta-Voi road (see Map 2, section 1.1). Middlemen from Mombasa go to this area to buy their bananas directly from the farmers. The branch road is in a bad state, especially after heavy showers, but the farmers carry the bunches on their head to a meeting point that can be reached by truck. Alternatively, the middlemen hire labourers or rent a pick-up to do the job. There is no need for the middlemen to bring the bananas all the way to Taveta market before transferring them to a truck, as this would only increase the mileage. The concentration of supplies assures fully loaded trucks, without the need to add produce from other parts of Taveta.

The farmers in Mboghoni also produce tomatoes for sale. Some of the tomatoes are taken to Mombasa by the middlemen who come for the bananas, others are brought to Taveta by collecting traders, including farmer-traders and professional ones. Middlemen who come for tomatoes in the first place do not go to the area but proceed to Taveta market. This can be explained by the difference in concentration of production. A middleman

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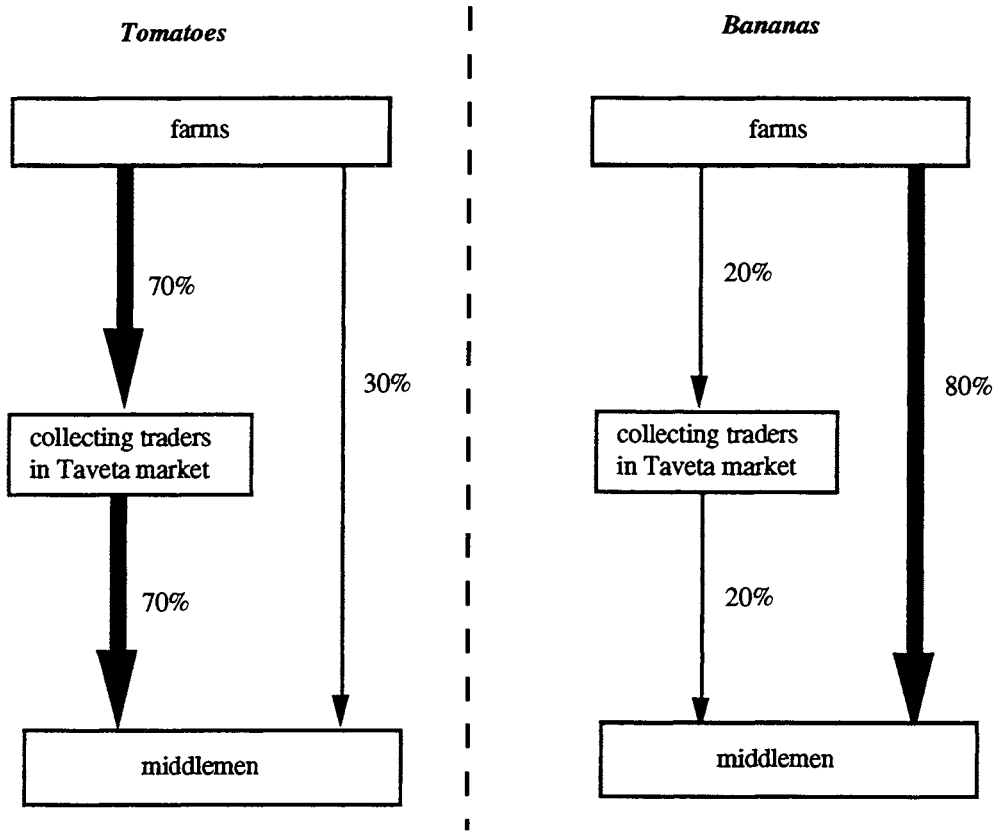
[56] Theoritically, middlemen transport their commodities to urban centres where they sell them to wholesalers. Part of the traders who come to Taveta, however, do not sell their produce to wholesalers but to retailers or consumers, which classifies them as mobile wholesalers or mobile retailers instead of middlemen. Mobile retailers can be distinguished from actual middlemen because of their smaller scale of operation. They usually come from Voi and buy their commodities from collecting traders in Taveta market. Wholesalers from Mombasa and Nairobi are, however, difficult to distinguish from middlemen when encountered in the production area or collecting market as they act in a similar way and have the same scale of operation. For the sake of the argument, both of them are therefore referred to as middlemen in the present chapter and Chapter 6.

[57] Both farmer-traders and professional traders can act as collecting traders.

Figure 5. Collecting traders versus middlemen in the tomato and banana trade, Taveta Division



See Appendices 14 and 19

whose primary interest is bananas, has to deal with a couple of farmers who live relatively close together as almost all farmers grow considerable quantities of bananas. A middleman who wants to buy primarily tomatoes has to rely on more farmers who live further apart from each other, as only part of the farmers in the area grow tomatoes and most of them in relatively small quantities. Therefore, a middleman needs more time to get sufficient tomatoes than bananas in the production area, which makes buying from collecting traders in Taveta market more attractive. After all, the sooner a middleman is back in Mombasa, the bigger his chance of getting a fair price in the wholesale market.

Buying in Taveta market also offers the opportunity to choose the best quality tomatoes, whereas sorting and repackaging is easier because of the presence of box suppliers and experienced sorting boys. In theory, a middlemen can buy the tomatoes at the farm and have them sorted and repackaged in Taveta market, but then excessive losses due to bad quality could not be recovered from the seller as the latter would no longer be around. In contrast with tomatoes, the reflections on quality do not apply for bananas. They are not

packed but transported while being unripe and connected to the stem, in which condition they can stand a lot of hardships. The quality of the bananas can be checked by the middleman while the bunches are loaded.[58]

Summarizing, the high concentration of banana supplies combined with the location near the road to Mombasa and the possibility to transport the bananas by bunch, leaving out the need for sorting and packing facilities, makes buying bananas at the farms more attractive to middlemen than buying in the collecting market.

Apart from Mboghoni Sub-Location, many bananas can be found in Kimorigo Sub-Location, although in smaller quantities. Tomatoes and mangoes are at least as important in this area as bananas. The larger diversity of fruits and lower concentration of bananas increases the role of collecting traders. Middlemen who want to go to the area have to pass Taveta anyway because of the location of the town, which makes it more attractive to buy from the collecting traders in the market (see Map 2, section 1.1). Although the homesteads of the farmers in Kimorigo are situated near a primary road to Taveta, the farms are located further away and can only be reached by a muddy branch road that only suits small trucks and pick-ups.[59] Middlemen who have bought produce in the area, therefore, have to transfer their commodities to a bigger truck before starting the long trip to Mombasa. The most obvious place is Taveta because of the presence of a large number of trucks for hire, the more so because one middleman usually does not fill a whole truck and truck-sharing is easier when more traders are present. All loading of trucks takes place in front of the official marketplace, where also most of the wholesale trade by collecting traders is concentrated because of lack of space within the walls. It makes reliance on collecting traders all the more attractive. The findings for Kimorigo show once more the importance of both the location and accessibility of a production area for the role of collecting traders in the marketing channel - in addition to the type of commodity handled and the concentration of supply at the farm level.

Banana versus tomato trade: the importance of farmer-traders

The fact that the bulk of the bananas bypasses Taveta market does not mean that the marketplace does not harbour a lot of traders who sell bananas. Many of them sell heaps

[58] An odd middleman was found packing bananas in bags after removing the stems in Taveta market. This was, however, not to avoid spoilage during transport but to save space.
[59] The farms of the households in Mboghoni and Kimorigo are actually situated not far from each other, but they are separated by a swampy river.

of bananas to local consumers, fewer sell by hand and bunch to retailers, wholesalers and middlemen from elsewhere. In comparison to tomatoes, the relative involvement of farmer-traders is, however, higher at the expense of resident professional traders (Table 23). This is probably related to the larger number of farmers who grow bananas in sub-locations near the town.[60] Not only bigger banana farmers from Kimorigo come to the market to sell by bunch to middlemen, but also smaller ones to sell by heap to consumers. Because selling to consumers is also the main activity of the professional resident traders, the latter are to a smaller extent involved in banana than in tomato trade.

Table 23. Types of traders selling tomatoes and bananas by market (November, 1991) (%)

	Voi market		*Taveta market*		*Wundanyi market*	
	tomatoes	*bananas*	*tomatoes*	*bananas*	*tomatoes*	*bananas*
farmer-traders	25	13	12	24	46	90
mobile prof. traders	51	83	33	32	38	10
resident prof. traders	23	4	56	45	16	0
	99	100	101	101	100	100

See Appendices 17 and 21
Abbreviation: prof = professional

A similar situation occurs in Wundanyi market. Resident banana traders were not found at all, whereas most of the mobile traders were farmer-traders. The total number of traders selling bananas in the market was less than half of those selling tomatoes.[61] The difference can be explained by (1) a lower level of surplus production in the area which makes the market unimportant as collecting centre, and (2) banana self-sufficiency of most local households which decreases the demand for bananas in the market. The farmer-traders in the market are able to cover the demand by local consumers, which induces professional traders to look for other commodities (like tomatoes) with a higher demand and sales possibilities to traders from elsewhere.

In Voi market, farmer-traders of bananas are less important than those of tomatoes. This is probably related to the origin of the produce. Most tomatoes come from the Taita Hills while most bananas come from Taveta. Farmers from the hills can use the excellent tarmac road between Wundanyi and Voi, while farmers from Taveta are subject to the

[60] As stated, banana production is concentrated in Mboghoni and Kimorigo Sub-Locations, Kimorigo Location, while part of the tomatoes come from Njukini, Chala Location, which is further away from Taveta (see Map 2, section 1.1). Some of the farmer-traders actually live in Taveta town.
[61] See Appendices 17 and 21.

hardships of the long and sandy road from Taveta to Mwatate before they reach the tarmac. This discourages Taveta farmers from travelling to Voi with their bananas. They sell them in Taveta market to mobile professional traders who come from Voi to buy the fruits.

Resident banana traders are also less important than resident tomatoes traders in Voi market. This is probably related to the relatively low turnover of most mobile banana traders. Almost all of them sell bananas by heap to consumers, often in combination with onions which they both buy in Taveta market. Their focus on consumers pushes potential resident traders out of the banana trade.[62] A much larger proportion of the mobile tomato traders focus on both wholesale and retail, leaving room for resident traders to do part of the retailing.[63]

5.4. Trade costs, margins and revenues

Now that the composition of flows through the local markets is known, the profitability of the tomato and banana trade in the local markets should be estimated to get a first idea of the performance of the marketing system. Traders' profits are determined by two factors, namely trade margins and sales quantities, trade margins being the difference between the selling price on the one hand and the sum of the buying price and marketing costs on the other. We will start with the latter exercise, focusing on tomatoes.

Types of marketing costs

Marketing costs include various components dependent on the trade level. In order to get the tomatoes to the market, transport is needed. This implies transport costs. When travelling by public transport (mini-bus called *matatu*), the trader has to buy a ticket to and from the market, while paying an extra transport fee for each bag or basket of produce carried. When using a pick-up or small truck, which are usually rented and shared with other traders, the trader pays an amount per bag, basket or kilogramme. The transporter carries the commodities to the market and the trader follows by *matatu* or in the back of

[62] Only two mobile banana traders out of the sampled 23 sold large quantities of bananas by bunch (20 and 30 bunches per day), one of them being a farmer-trader from Mwatate. Nine mobile traders sold up to one bunch per day, the others less than eight.
[63] Fourteen out of the sampled 37 mobile traders sold more than 40 kg per day. Only nine sold less than 10 kg a day (the average of the resident traders was 7 kg a day).

the truck. Apart from vehicles, produce may also be carried by bicycle, hand cart or on the head while walking. The latter two possibilities only apply when the production sites are within walking distance of the marketplace, which was only the case for part of the tomatoes traded in Wundanyi market.

Once the produce has arrived in the market, traders have to deal with another expense, namely market fees. The rules with regard to market fees differ from one marketplace to another. In the Taveta and Voi markets, a mixed system was used, with a fixed daily fee for small traders and a fee per bag or basket for bigger traders. In Taveta the fee per bag did not depend on the type of produce, while in Voi a further distinction was made between cabbages on the ones hand and all other horticultural commodities on the other.[64] Cabbages where handled as a special case in Voi because of the use of extended bags.[65] Unlike the other markets, all traders in Wundanyi market were charged a fixed amount per market day, regardless of the quantities traded.[66] This was related to the almost complete absence of large horticultural traders handling more than one or a few bags of commodities per market day.

The market authorities in Voi also charged a market fee on unofficial market days. Although the town had two official market days, like the other ones, trade in the marketplace continued at a lower level during the rest of the week. Traders involved were then charged a lower fee.[67] Market activities in Taveta and Wundanyi were negligible outside the official market days, except for some horticultural traders with permanent stalls. They had to pay a monthly or annual rent on top of the fee charged during official market days.[68] For that matter, traders with permanent stalls in Voi market were also subject to rent. It has to be noted, that traders with permanent stalls in Taveta market were sometimes found selling produce on the ground during official market days. According to them, they got more customers when selling on the ground due to a pre-conceived opinion of potential buyers about prices in stalls.

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[64] Market fees in Taveta market were KSh 3 per small trader and KSh 12 per bag of produce, and in Taveta market KSh 5 per small traders, KSh 10 per bag of cabbages and KSh 5 per bag of other produce.
[65] Cabbages were less common in Taveta market. The topping up of cabbage bags originates from Central Province where it is stimulated by the market fee system in the Nairobi wholesale market (see Dijkstra & Magori, 1992b). Extended bags were not common for commodities like tomatoes because of the bigger chance for bruises and mashed produce.
[66] The fee was KSh 3 per day.
[67] During unofficial days the market fee was KSh 4 per small trader.
[68] Traders with permanent stalls incurred one extra cost, namely employment of a watchman to look after the produce during the night. Those costs were, however, normally low, as watchman services are shared by groups of traders in the market.

Trade margins for tomatoes

Trade margins are not only related to marketing costs, but also to buying and selling prices, the latter two being dependent on the source of supply and the type of customers. The source of supply is related to the mobility of the trader, as discussed earlier. Table 24 compares mobile and resident traders in the surveyed markets. The former buy at producer or collecting market prices, have to cope with transport costs and a market fee, and finally sell at wholesale or retail prices. The latter buy at wholesale prices in the market, have to pay a market fee, and sell at retail prices.[69] The remaining margins to mobile traders include a wholesale component in all cases, and a retail component when selling to consumers. The remaining margin of resident traders only includes a retail component.

Table 24. Prices, costs and trade margins of tomatoes by market and type of trader (November, 1991) (KSh/kg)

	Voi market		*Taveta market*		*Wundanyi market*	
	mobile traders (n=36)	*resident traders (n=11)*	*mobile traders (n=27)*	*resident traders (n=34)*	*mobile traders (n=31)*	*resident traders (n=6)*
buying price at farm gate/ in collecting market	6.30		2.31		4.63	
transport costs	0.94		0.37		0.45	
market fees	0.08		0.11		0.08	
margin	1.59		0.59		1.60	
wholesale price	8.91	8.91	3.38	3.38	6.76	6.76
market fees	-	0.16	-	0.11	-	0.08
margin	2.86	2.70	3.16	3.05	3.08	3.00
retail price	11.77	11.77	6.54	6.54	9.84	9.84

See Appendix 22.

If we want to compare the prevailing margins in the three markets, we have to keep the importance of the various flows in mind. At the wholesale level all markets operate similarly: mobile traders take care of all or most sales to other traders. Inter-market differences, however, occur at the retail level. In Taveta market, resident traders take care of the major part of the sales to consumers, while in the other two markets retail trade is dominated by mobile traders again (see section 5.3). This affects the prevailing margins in retail trade. In Taveta market the margin consists of the difference between the retail

[69] Part of the resident traders in Taveta market buy at wholesale prices from mobile traders to sell not only at retail prices to consumers but also at slightly inflated wholesale prices to traders from elsewhere (see Appendix 22). The latter alternative is not mentioned in Table 24 to avoid confusion.

price on the one hand and the sum of the wholesale price and market fees on the other, while in the other two markets it consists of the difference between the retail price on the one hand and the sum of the producer or collecting market price, transport costs and market fees on the other. The results are shown in Table 25, together with the margins in relation to wholesale trade.

Table 25. Prevailing margins of tomato wholesale and retail trade by market (November, 1991) (KSh)

	Voi market (n=47)	*Taveta market (n=61)*	*Wundanyi market (n=37)*
wholesale trade	1.59	0.59	1.60
retail trade	4.45	3.05	4.68

Based on Table 24.

The table shows that both the prevailing wholesale and retail margins are considerably smaller in Taveta market than in the Voi and Wundanyi markets. This can be explained by the magnitude of the respective tomato flows and number of traders involved. Eight to twelve times as many tomatoes flowed through Taveta than Voi and Wundanyi, involving 0.8 to 1.6 times as many traders.[70] This led to a higher level of competition in Taveta market, presumably affecting the trade margins. According to theory, trade margins are one of the variables determining market performance (see Dijkstra & Magori, 1991). The data therefore suggest that Taveta's role as collecting market for produce destined for Mombasa has led to a better performance compared to other markets in the district. We will come back to market performance in section 7.4.

Factors determining the daily income out of tomato trade

Trade margins can be used to calculate daily incomes (revenues, profits) out of tomato trade by way of multiplication by the quantities traded. The thus found incomes or profits appear to fluctuate considerably from one trader to another, with a minimum of less than KSh 10 and a maximum of over KSh 2,000 per day. Analysis of variance shows two explanatory factors, namely the market in which the trader operates and the mobility of the trader (mobile versus resident traders).[71] Incomes out of the tomato trade were most

[70] See Appendices 13 to 15 for the quantified flows. The number of tomato traders in the markets were 101 (Voi), 179 (Taveta) and 69 (Wundanyi).

[71] Out of the sample of 145 tomato traders, 6 cases were deleted because of a higher buying price than selling price, and two cases because of a negligible tomato turnover (less than 1 %). The incomes out of

substantial among mobile traders in Taveta market (Table 26), even while they had the smallest margins. The reason is the relatively large quantities handled in comparison to mobile traders in the other markets and resident traders in general.[72] Daily incomes out of tomato trade were lowest among resident traders in Voi, which was related to both small margins and limited sales quantities.

Table 26. Average daily income out of tomato trade by market and type of trader (November, 1991) (KSh)

	Voi market (n=44)	*Taveta market (n=55)*	*Wundanyi market (n=35)*	*all markets*
mobile traders (n=86)	72	159	38	76
resident traders (n=48)	19	34	29	27
all traders	37	74	33	54

Source: trade survey
Note: for calculation method see Appendix 23.

Daily income out of tomato versus banana trade

Banana traders make less money by selling their bananas than tomato traders by selling their tomatoes, especially in the Voi and Wundanyi markets (Table 27). In both markets the lowest income group is significantly bigger in the case of bananas. This is not so much related to cost factors as it is to turnovers, because tomato traders in both markets also have higher gross incomes, that is incomes before deduction of transport and marketing costs.[73]

In Taveta market, incomes out of tomato and banana trade do not differ very much among mobile traders. Differences do, however, occur among resident traders, especially with regard to the higher incomes (Table 28).[74] This is related to the selling of tomatoes

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tomatoes of the remaining traders were converted into natural logarithms and three extreme values were deleted to get a normal distribution. The results of the analysis were as follows:

source	*sum-of-squares*	*Df*	*mean-square*	*F-ratio*	*P*
trader type	22.72	1	22.72	13.34	0.00
market	13.69	2	6.84	4.02	0.02
trader type*market	5.12	2	2.56	1.50	0.23
error	217.94	128	1.70		

[72] See Appendix 24.
[73] The gross incomes out of tomato sales were on average KSh 162 per tomato trader in Voi market and KSh 78 per tomato trader in Wundanyi market. The gross incomes out of banana sales were on average KSh 121 per banana trader in Voi market and KSh 43 per banana trader in Wundanyi market.
[74] Since resident banana traders were almost or completely absent in Voi and Wundanyi markets (see Appendix 21), a division according mobility was not useful.

by part of the resident traders to traders from elsewhere, a practice that is almost completely absent in the case of bananas.[75] The sales to other traders allow for bigger selling quantities resulting in higher incomes of the resident tomato traders involved.[76]

When comparing the total incomes of tomato and banana traders, the complete assortment of both groups of traders has to be taken into account. The calculated total incomes lead to analogous income distributions for both groups, which is at least partly related to the fact that most banana traders also sell tomatoes and are therefore a member of both groups.[77] This shows that commodity-wise comparison of total trader incomes is not

Table 27. Distribution of daily incomes out of tomato and banana sales in Voi and Wundanyi markets (November, 1991) (%)

	Voi market		*Wundanyi market*	
	tomato traders (n=45)	*banana traders (n=24)*	*tomato traders (n=35)*	*banana traders (n=10)*
KSh 0-24	38	54	37	60
KSh 25-99	33	25	43	40
KSh 100-249	16	13	14	0
KSh 250-499	7	4	6	0
KSh >= 500	7	4	0	0
	101	100	100	100

Source: trade survey

Table 28. Distributions of daily incomes out of tomato and banana sales in Taveta market by mobility of the trader (November, 1991) (%)

	mobile traders		*resident traders*	
	of tomato (n=45)	*of bananas (n=24)*	*of tomatoes (n=35)*	*of bananas (n=10)*
KSh 0-24	8	14	55	59
KSh 25-99	17	14	24	41
KSh 100-249	25	29	3	0
KSh 250-499	29	24	15	0
KSh >= 500	21	19	3	0
	100	100	100	100

Source: trade survey

[75] See Appendices 14 and 19.

[76] The gross incomes out of tomatoes were on average KSh 101 in the case of resident tomato traders, and KSh 30 in the case of resident banana traders. In the case of mobile traders the average gross incomes were less divergent: KSh 570 for tomatoes and KSh 516 for bananas.

[77] Appendices 25 and 26 show the income distributions for tomato and banana traders, respectively. Appendix 27 shows how many traders in the samples trade tomatoes only, bananas only, or both tomatoes and bananas. Appendix 28 shows the average number of commodities handled by the tomato traders and Appendix 29 by the banana traders.

fruitful. We will, therefore, focus on a market-wise comparison of total daily incomes in the next chapter, including all questioned horticultural traders in the surveyed markets of Taita Taveta.

Chapter 6. Trader incomes

In the previous chapter horticultural marketing channels in Taita Taveta were investigated by looking at two important commodities, namely tomatoes and bananas. In the present chapter, the incomes generated by horticultural traders will be further analyzed. As we saw in section 5.4, a commodity-wise comparison of total trader incomes is not fruitful, because most horticultural traders deal with more than one vegetable or fruit. A comparison by mobility of the traders is not fruitful either because a trader may buy one commodity at the farm gate or in a collecting market and another in her own market. This is especially common among traders with permanent stalls in Voi market who have a large assortment and get their commodities from various sources. They may for instance travel to Taveta market to buy bananas and onions, while purchasing cabbages and kale from Taita farmers who come to Voi market.[78] Therefore, income differences between markets will be investigated, taking into account all horticultural traders. Subsequently, the incomes of traders in the local markets will also be compared with those of horticultural middlemen.

6.1. Trader incomes in the local markets

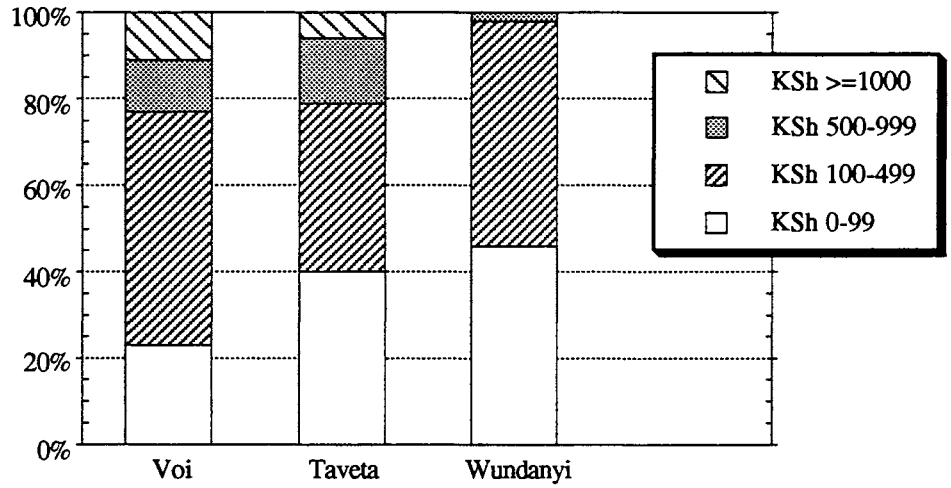
Daily incomes of horticultural traders in the local markets

Figure 6 shows the daily income distributions for horticultural traders per market.[79] In Voi the lowest income group is clearly smaller than in the other markets, while the highest income group is bigger. In Wundanyi market the lowest income group includes almost half of the horticultural traders, while the highest income group is completely

[78] Some traders travel all the way to Nairobi to buy potatoes, carrots and cabbages, while buying tomatoes, brinjals, okra and other highly perishable commodities from Taita farmers in Voi market.
[79] Figure 6 is based on more detailed income distributions per market that can be found in Appendix 30.

absent. The income distributions of Taveta and Wundanyi markets are somewhat similar, with the exception of the highest income categories where bigger traders who deal with commodities for collection are found.[80]

Figure 6. Daily income distribution of horticultural traders by market



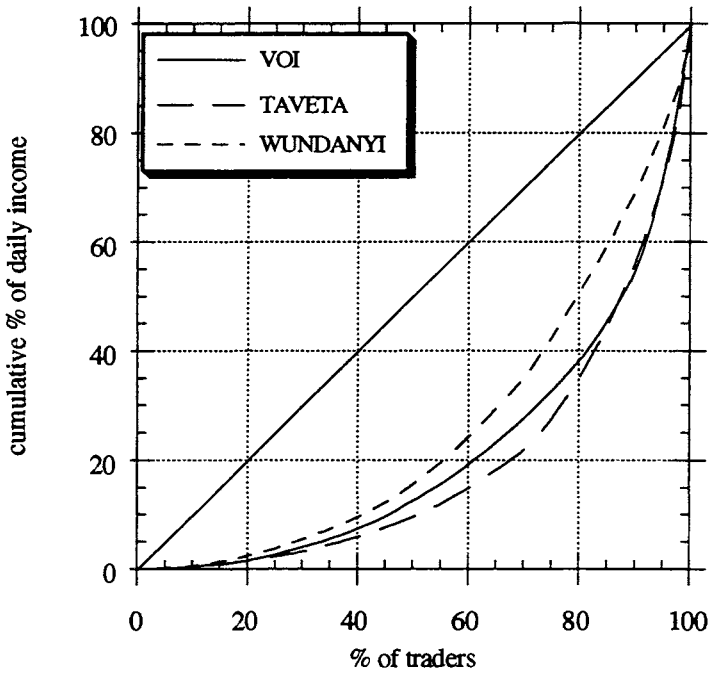
Apart from analyzing income distributions, the level of income inequality in the three markets can be investigated by means of so-called Pareto curves. A Pareto curve is a generally accepted way to show income inequalities within groups of people. The curve shows which percentage of the population earns which part of the total cash revenues accumulated in the market. In our sample, 80% of the traders received for instance 40% of the total profits accumulated in the Taveta and Voi markets, compared to 50% of the total profits accumulated in Wundanyi market (Figure 7). The closer the curve to the diagonal, the more equal the income distribution, which means that the income distribution is more equal in Wundanyi than Voi and Taveta.

In conclusion, Taveta market looks more like Wundanyi when comparing income groups, and more like Voi when comparing income inequalities. The first is probably related to the urban (Voi) versus rural (Taveta, Wundanyi) character of the markets, while the second could be related to the total turnover in the markets concerned. After all, the market with the lowest total turnover (Wundanyi) has the smallest income inequality,

[80] Analysis of variance and box plots confirm that Taveta has a closer resemblance to Wundanyi than Voi. We will come back to this in section 7.3.

and the market with the highest turnover (Taveta) the biggest income inequality.[81] The Taveta and Voi markets have a higher turnover than Wundanyi market because of their collecting function and urban setting respectively .

Figure 7. Pareto curves of daily trader incomes by market



Monthly incomes of horticultural traders in the local markets

The daily incomes of horticultural traders can be used to calculate monthly incomes by multiplication by the number of days per month that the traders are selling their commodities. All surveyed markets have two official market days a week, during which most traders are active. Part of the traders have permanent stalls, especially in Voi market, and sell throughout the week, but the sales quantities are much smaller than during official market days.[82] Other traders sell mainly produce from their own farms and come to the market only once a week, once every fortnight or even less frequently. The

[81] The turnover in the marketplaces on market days at the time of the survey was estimated at: Wundanyi between KSh 70,000 and KSh 85,000; Voi between KSh 200,000 and KSh 240,000; and Taveta between KSh 350,000 and KSh 395,000.

[82] Appendix 31 shows the number of days per week traders are in business, specifying traders by market and use of a stall.

majority of the professional traders and farmer-traders, however, sell produce in the market twice a week.

Table 29 gives an estimation of the monthly income distribution of horticultural traders in the surveyed markets.[83] About one-third of the traders make little money out of the horticultural trade (less than KSh 1,000), over one-third earn small to moderate incomes (KSh 1,000 to KSh 3,000), one-fourth get moderate to high rewards (KSh 3,000 to KSh 10,000) and a very small group really make a lot of money out of selling horticultural commodities in a local market (over KSh 10,000).[84] It can therefore be concluded that profits of traders who sell horticultural commodities in the local markets are not excessive. Only a minority of the traders could be characterized as fairly well-off on the basis of their estimated monthly income out of horticultural trade at the time of the survey.

Table 29. Distribution of monthly incomes of horticultural traders by market (November, 1991) (%)

monthly income	*% of the traders*
KSh <1,000	34
KSh 1,000-2,999	36
KSh 3,000-4,999	11
KSh 5,000-7,499	8
KSh 7,500-9.999	6
KSh >=10,000	6

See Appendix 32

6.2. Middlemen incomes

A type of traders that often has the stigma of being very rich are the horticultural middlemen who buy produce in the production areas to transport it to Mombasa, Nairobi or elsewhere. The middlemen are relatively few in number compared to retailers and consumers, and part of them go to the farms instead of buying in the market. Our sample

[83] The traders were asked how many days per week they sold in the surveyed market (see Appendix 31). Traders with stalls were usually present 6 or 7 days a week, the others one or two. The traders were also asked whether they traded in other marketplaces, but this was not the case for any of them. If traders sold commodities in the market outside the official market days, it was supposed that the income during those days was one-third of the income during official market days. The weekly income was calculated on the basis of the weighed daily incomes and the number of days in business. The monthly income was calculated by multiplying the weekly incomes by 4.3, which is the average number of weeks per month.

[84] To compare: in 1991 a casual farm labourer earned about KSh 900 per month, an office cleaner KSh 1,500, a driver KSh 2,000, an office clerk and a teacher KSh 2,500, a technician KSh 5,000, a manager and a doctor KSh 9,000, and a bus operator more than KSh 15,000.

consists of 15 respondents who were buying either in Taveta market or at the farms in Kimorigo and Mboghoni Sub-Locations.[85] The middlemen bought bananas, tomatoes, mangoes, onions, avocados, and citrus fruits. Only a minority specialized in one commodity, which makes commodity-wise comparison of middlemen not fruitful.

The income distribution of the horticultural middlemen differs to a large extent from that of traders selling in the local markets. While 6% of the latter group earned more than KSh 1,000 per market day, all middlemen did so.[86] Three-fifths earned between KSh 1,000 and KSh 5,000, and two-fifths more than KSh 5,000 (Table 30). Interestingly, the sampled middleman with the highest income made more money out of onion trade than tomato and banana trade. Onions have a big margin due to their high demand and limited number of production areas in the coastal region, Taveta being the main one.[87]

Table 30. Distribution of daily incomes of horticultural middlemen buying in Taveta Division (November, 1991) (%)

daily income	*% of the traders (n=15)*
KSh 1,000-3,000	27
KSh 3,000-5,000	33
KSh 5,000-10,000	20
KSh >10,000	20

See Appendix 33

In general, margins fluctuated largely from one middleman to another, depending on the place of buying (market versus farm), variety (e.g. small versus large mangoes), transport costs in relation to transport means and destination of the produce (by truck to Mombasa, by truck or train to Nairobi), and the buyers of the commodities (wholesalers or retailers).[88]

The substantial incomes of the middlemen resulted from large quantities of produce handled and big margins. The latter are influenced by the trade risks that the middlemen have to face. The risks are high because of the condition of the road from Taveta to

[85] Our 1991 sample, which is used to calculate middlemen incomes, does not cover middlemen buying in Taita Hills. See section 1.6.
[86] Almost all middlemen came to Taveta twice a week, buying their produce the day before or the same day as the official market day, also when they bought the commodities at the farms. This was related to the availability of trucks for hire during the market days, which was important to the middlemen as none of them owned a truck.
[87] Appendix 33 shows the assortment of the middlemen. The Coast receives also onions from Loitokitok, and some from Naivasha and Meru. Appendix 33 can be used to compare the costs and benefits of onion trade with other commodities (one bag of onions contains seven nets; one bag of bananas contains 10 to 12.5 bunches).
[88] See Appendix 33 for the specifications per middleman.

Mwatate, which is not tarmaced. After a heavy downpour it can be flooded for a day or more, forcing the middlemen to stay in Taveta with their bought commodities that are highly perishable.[89] Even when the road is passable, the trip remains rough and the losses can be quite high especially if commodities are ripe.

Due to the condition of the road the number of transporters who come to Taveta is also limited, which confronts the middlemen with another risk as hardly any of them owns a truck. If they are not able to secure space in the back of one of the trucks to Mombasa or Nairobi on the day of the market, they may as well throw away their produce as it will get spoilt before new trucks are available on the next market day. Local transport is also a problem, because the access roads to the production sites at Kimorigo and Mboghoni are in a most deplorable state. This means that middlemen have to rely on locally available pick-ups and small trucks to get their produce to the main road or to Taveta market. These pick-ups and trucks are, however, scarce, too, and the chances of getting stuck are big.

The poor condition of the road affects the trade margins in one more way, namely through the number of middlemen present. If trade risks were smaller, more middlemen would come to Taveta Division, which would increase competition and thus make buying prices rise. For now, farmers in the less accessible parts of the production areas may depend on one or two middlemen, especially after a shower, which leaves them with no choice but to accept the prices these middlemen are willing to offer.

[89] Even the railway is regularly washed away by the rain or buried under mud.

Chapter 7. Destination Mombasa

The large majority of vegetables and fruits leaving Taita Taveta are destined for Mombasa. Out of the 15 middlemen interviewed in Taveta in 1991, 9 went to Mombasa, and 1 to Mombasa and Malindi.[90] Out of the 31 middlemen interviewed in Taita during a follow-up in 1993, 28 went to Mombasa, 1 to Mombasa and Malindi, and 2 to Malindi only. All the produce marketed by the Taita HPC on behalf of its members is sold in the cooperative stall in Kongowea market, Mombasa. The importance of Mombasa as outlet for produce from Taita Taveta calls for analysis of the marketing flows from the moment the commodities enter the town to the time the vegetables and fruits reach their final destination. This will give more insight into the structure of the whole marketing structure, from farm gate to consumers' dish.

7.1. The horticultural commodity flows

The large majority of the produce that enters Mombasa passes the Kongowea wholesale market. All the interviewed middlemen who brought fruits and vegetables from Taveta to Mombasa went to Kongowea, as did 90% of the middlemen who brought horticultural commodities from Taita.[91] Two-thirds of the middlemen from Taita went to look for customers in Marikiti or Mwembe Tayari retail markets in addition to Kongowea market, but according to them Kongowea was their main market outlet. The size of the wholesale market guarantees a large number of potential customers, which increases chances of quick selling against a fair price. The mentioned retail markets could be attractive when carrying less common vegetables like leeks, baby marrow, and lettuce. Retailers in these markets focus on wealthier customers.

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[90] See Appendix 33.

[91] Only three out of the 28 middlemen from Taita did not go to Kongowea, but focused exclusively on the Marikiti retail market in the old town of Mombasa.

When arriving at Kongowea, the middlemen sell their produce in wholesale quantities, like bags, boxes and bunches, to wholesalers and retailers in the market (Figure 8). A special type of customers are traders who have specialized in supplying tourist hotels. They often develop long-term relations with specific middlemen who deliver vegetables like lettuce, cucumber, baby marrow, beetroot, and carrots to them on order.[92] Hotels and other institutions like hospitals and boarding schools may send their own personnel to buy in Kongowea instead of relying on intermediaries, but this is less common.

The Taita HPC, which has taken over part of the activities of the middlemen in the Taita Hills, has its own stall in the Kongowea wholesale market. It acts like a wholesaler, selling vegetables to retailers, and to the earlier mentioned suppliers of institutions, especially those dealing with tourist hotels. The latter like the commodities of the Taita HPC because of their high quality in comparison to most other produce in the market. The cooperative's large assortment which includes also less common vegetables like leeks, lettuce, cauliflower, baby marrow and French beans, is another aspect of importance. It is also a reason for consumers to try their luck at the Taita HPC stall.

Some fruits that arrive in Kongowea market are sold by middlemen through auctioning by professional auctioneers. The practice is most common for bananas, which usually come from Taveta, but oranges, mangoes and papayas are also auctioned, especially during peak periods of supply. Under such circumstances, the system guarantees quick selling of all supplies in the market. Bananas do not have a peak period but are auctioned throughout the year. The auctioneer responsible for bananas has developed a way of ensuring more even market supplies throughout the week. In consultation with the banana middlemen, the first two or three truck loads to enter the market are auctioned the same day, while middlemen arriving later have to wait until the next day. To avoid premature ripening of these fruits, the bananas are off-loaded and stored under a tree in the marketplace. The system avoids over-supply during one day and under-supply during the next, which was a problem in the past because most trucks arrive in Mombasa the day after the market day in Taveta town.

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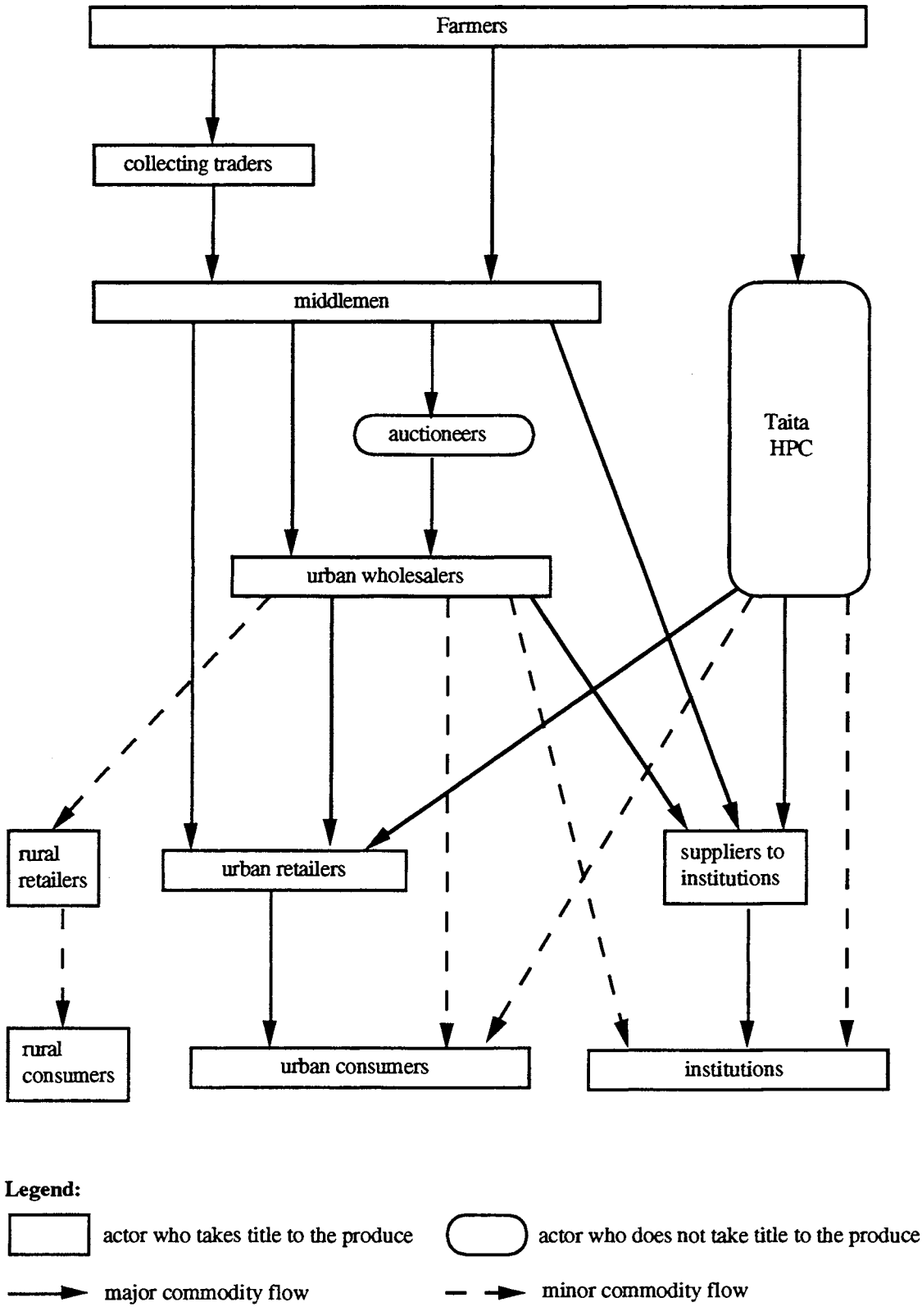
[92] Some of these hotel suppliers come to Marikiti instead of Kongowea market, which is another reason for Taita middlemen to go there in addition to Kongowea.

Figure 8. Horticultural commodity flows from Taita Taveta to Mombasa and beyond



Buying from auctioneers requires knowledge of the auction system and bidding skills. This is beyond the scope of many retailers. Therefore, some fruit wholesalers specialize in buying fruits at the auction to sell to retailers. Sometimes they also sell in smaller quantities to consumers, although retailing is officially forbidden in the wholesale market. At the time of the survey, one group of wholesalers was especially known for secret retail activities, namely those dealing with tomatoes. While wholesalers are supposed to sell their tomatoes per wooden box of 25 to 80 kg depending on the size, a considerable group of wholesalers sold their tomatoes in boxes of about 2 to 5 kg. Their customers were not only smaller retailers, but also consumers.

The retailers who buy in Kongowea come from retail markets, kiosks and roadside stalls in Mombasa, other official and unofficial marketplaces along the Coast, and from the retail market at Kongowea itself.[93] They usually do not go to the production areas themselves because of the travelling distances involved which make carrying of small quantities of produce uneconomical. Our surveys among traders of tomato, onions, bananas, cabbages, kale and mangoes, which were the main commodities from Taita Taveta at that time, indeed showed that all the traders in the Majengo and Kongowea retail markets bought their commodities in Kongowea wholesale market. A similar survey among the traders in Kongowea wholesale market showed that two-thirds bought the commodities from traders who came to the market, while one-third went to the production area themselves to buy at the farms or in a collecting centre.[94]

The traders who go out could be characterized as mobile wholesalers because they sell in wholesale quantities in Kongowea while collecting the commodities in the production areas, in contrast with resident wholesalers who buy from traders who come to them. The criterion of mobility does, however, not differentiate mobile wholesalers from middlemen as both buy in the production areas to sell in wholesale quantities in Kongowea market. To come to a distinction between those two groups the type of

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[93] Before opening the new marketplace at Kongowea in June 1989, wholesaling took place in an old market in the centre of Mombasa town. The market, which originally was meant for retailing, was, however, much too small. It lacked sufficient stalls and parking space. Most of the produce was actually displayed on the ground outside the market building without protection against sun and rain. When the horticultural wholesalers moved to Kongowea, the area was turned into a charcoal market and horticultural retailers in and around the market were also forced to leave. Therefore, they came to Kongowea together with the wholesalers. While the wholesalers settled in large concrete halls and permanent stalls, retailers started to trade on the ground, blocking the pass-ways with their small heaps of vegetables and fruits. To solve the problem, extra halls were built in a separate section of the market for the purpose of retailing. They were not yet ready at the time of the survey.

[94] In most cases, the production areas and collecting markets were in Taita Taveta, but a few traders went all the way to the wholesale market in Nairobi (Wakulima) or to the market in Karatina (see Appendix 33).

customers has to be considered. Middlemen sell mainly to wholesalers, and to a lesser extent to retailers, while mobile wholesalers sell mainly to retailers and to a lesser extent to other buyers, which may include resident wholesalers.

The relative importance of middlemen and mobile wholesalers can be shown when looking at the precise buying sources of retailers and resident wholesalers in the Kongowea and Majengo markets. Only one-fifth of the retailers in Majengo and Kongowea relied on middlemen. This was to be expected as middlemen prefer to sell to wholesalers who buy larger quantities than retailers. Selling ten bags to one wholesaler takes less time than selling ten retailers one bag. Middlemen and wholesalers also develop customer relations, which include a right of first buying for the wholesaler and a guaranteed market outlet for the middlemen.

Interestingly, over half the resident wholesalers bought from mobile wholesalers instead of middlemen.[95] Especially those with relatively low turnovers relied on mobile wholesalers, as can be shown by statistical analysis.[96] The traders involved were not pure wholesalers although they called themselves such. A group of tomato traders with secret retail activities has already been mentioned earlier on. Also a group of onion and banana wholesalers were involved in both wholesale and retail trade. The onion traders often bought their supplies from the Horticultural Crops Development Authority (HCDA) which has a stall in the Kongowea wholesale market. The parastatal is one of the major onion suppliers to Mombasa, buying the onions in Taveta market and selling them to wholesalers and retailers in town.[97] The banana traders bought their supplies from a few large mobile wholesalers with their own stalls. Most probably they preferred buying from them because lack of knowledge of the auctioning system prevented buying from middlemen.

It can be concluded that the source of supply is related to the turnover of the trader involved: retailers and smaller resident wholesalers buy mainly from (mobile) wholesalers, while bigger resident wholesalers buy mainly from middlemen. The correlation between source of supply and turnover can be shown once again when comparing resident wholesalers and mobile wholesalers. The mobile ones have a

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[95] See Appendix 34.

[96] A t-test shows the significance of the correlation between the source of supply of resident wholesalers (middlemen or mobile wholesalers) and their turnover (selling quantities multiplied by selling prices). In order to obtain a normal distribution the turnovers of the traders were converted into natural logarithms. The results of the analysis are: N=25; Df=23; t=2.39; p=0.03

[97] During the analysis, the HCDA was characterized as a mobile wholesaler instead of middleman because of its stall and selling to retailers.

significantly bigger turnover than the resident ones.[98] In general, the biggest traders go out to buy the commodities in Taita Taveta, while the smaller ones rely on middlemen and mobile wholesalers who bring them from the production areas.[99]

7.2. Price determination

Prior to each transaction in the urban markets, individual sellers and buyers negotiate the price, thus giving the impression of a high degree of competition. The question is, however, whether groups of traders might curtail competition by means of mutual price agreements (a so-called price cartel). Such trader tactics would be prejudicial to other actors in the marketing chain, including farmers, other traders and consumers. It is, therefore, important to look into the determinants of buying and selling prices in the urban markets.

During the survey, traders were asked how they determined their buying and selling prices. Table 31 shows the results for wholesalers and retailers in Kongowea market and retailers in Majengo market. For the sake of comparison, the table also includes the answers of the interviewed horticultural middlemen and traders in the markets of Taita Taveta. The figures show two things. First, traders relate buying prices to selling prices and vice versa, which is understandable as the difference between these two prices determines the trade profit to a large extent. Second, traders try to maximize their profit within a competitive environment, as is shown by their reference to market demand and supply in the case of selling prices. This indicates that they are primarily price takers instead of prices setters.

Few urban traders said they related their buying and selling prices to those of other traders. Effective price cartels, therefore, seemed to be absent. In comparison, a relatively large proportion of the traders in the Taita Taveta markets referred to selling prices of other traders. This can be explained by the unimportance of standardized units in the those markets. While selling units with an unspecified weight, like heap, bundle, bunch, piece and bag are more common in rural markets, selling units with a specified

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[98] Statistical analysis by means of t-test. In order to obtain a normal distribution the gross incomes of the traders were converted into natural logarithms. The results of the analysis are: N=39; Df=37; t=-3.38; p=0.02

[99] When comparing the turnover of resident wholesalers who buy from middlemen and mobile wholesalers who go to the production areas, the latter again had on average a bigger turnover. The differences between these two groups were, however, not significant because of the small sizes of the groups and relatively large variation in turnovers within each group (N=23; Df=21; t=-1.99; p=0.06).

weight like kilogramme, 50kg box (tomatoes) and 14kg net (onions), are more common in urban markets.[100] As a consequence, traders in the urban markets compete to a larger extent by means of price, while traders in the rural markets use quantity and quality variables to distinguish themselves from competitors. Many tomato traders in Wundanyi, for instance, sold a heap for KSh 5, but the heap contained 3 tomatoes in one case and 4 in another, or 2 big and 3 small tomatoes in one case and 5 small ones in another, or 5 unripe tomatoes in one case and 4 ripe ones in another. Thus, price competition is less important, and traders were more geared to the same price per selling unit than in urban markets.

Table 31. Price determinants by type of trader (%)

	wholesalers Kongowea (n=39)	*retailers Kong. (n=15)*	*retailers Majengo (n=59)*	*middle-men (n=46)*	*traders Taita Taveta markets (n=208)*
buying price:					
- related to expected/ previous selling price	92	87	90	85	87
- related to buying price other traders	13	0	8	9	13
- determined by sellers produce	26	13	5	24	29
selling price:					
- related to the buying price	92	100	93	100	86
- related to selling price other traders	7	7	7	6	30
- determined by buyers produce	0	0	0	9	3
- depends on supply and demand in the market	64	73	25	80	32

Source: trade survey
Notes: - Traders were allowed to give more than one answer.
- The fourth column includes the interviewed middlemen in Taveta (1991) and Taita (1993). The fifth column includes the traders from the surveyed markets in Voi, Taveta, Wundanyi (1991). Appendix 35 specifies the percentages for each sub-group.

It can be concluded that horticultural trade by middlemen and traders in urban and rural markets is characterized by a high degree of competition. Traders compete either by price or by quantity and quality variables. Effective price cartels that would curtail competition were not found during the survey.

[100] The percentages of selling price units with an unspecified weight per market were: Kongowea wholesalers 40%; Kongowea retailers 44%; Majengo retailers 29%; Taita middlemen 21%; Taveta middlemen 68%; Voi traders 47%; Taveta traders 92%; Wundanyi traders 67%. The differences between the two groups of middlemen, and between the traders in the markets of Taita Taveta, were related to the types of commodities handled. Bananas, which were important among the Taveta middlemen and traders in the Taveta market, are always traded by bunch, hand or piece, never by kilogramme or other standardized unit.

7.3. Trader incomes

When comparing incomes of traders in the urban markets of Mombasa, one may expect the average *wholesale* trader to have a significantly higher income than the average *retail* trader. This is indeed the case: retailers in the Majengo and Kongowea markets earn generally less than wholesalers in Kongowea market, in terms of both *daily* and *monthly* income (Figure 9, trader 1 to 3).[101] The bigger wholesale incomes are related to higher turnovers.

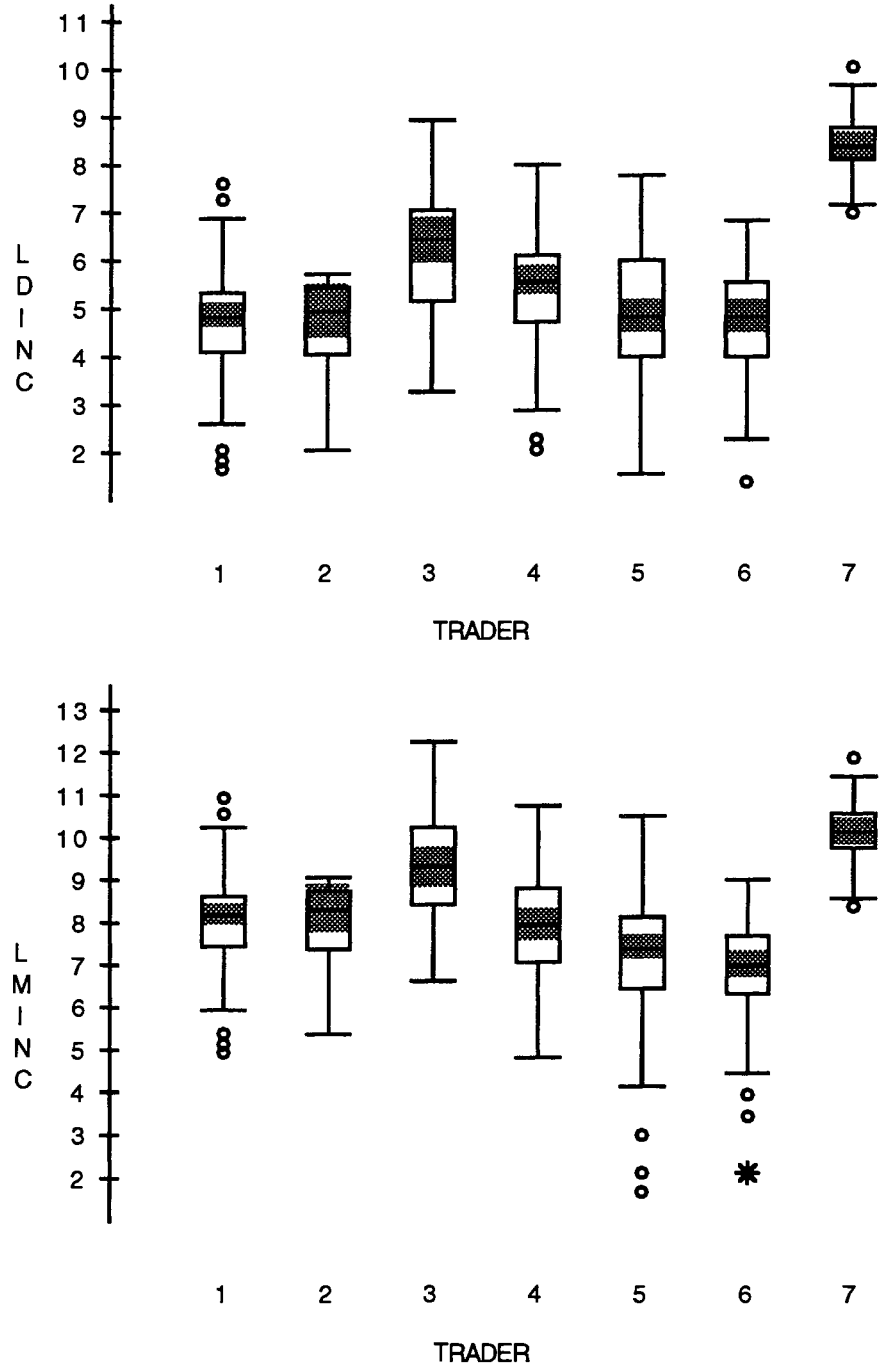
A *daily* income comparison between *wholesalers* in Mombasa and *traders* in the marketplaces of Taita Taveta reveals that Mombasa wholesalers earn significantly more than traders in the Taveta and Wundanyi markets, while traders in Voi market find themselves somewhere in between Mombasa wholesalers and traders in the other Taita Taveta markets (Figure 9, trader 4 to 6). The traders in the Taveta and Wundanyi markets earn on average about the same as retailers in Mombasa, while Voi traders earn somewhat more. The picture changes, however, when comparing *monthly* averages because most of the Mombasa retailers are selling commodities seven days a week compared to Taita Taveta traders two days a week. The monthly incomes of the Voi traders and Mombasa retailers are on average about the same while the monthly incomes of the Taveta and Wundanyi traders are significantly smaller.

One more type of horticultural traders has to be drawn into the comparison, namely the middlemen (Figure 9, trader 7). The box plots are quite clear about their income position: they are the biggest income earners of all horticultural traders, including Mombasa wholesalers. Differences between Mombasa wholesalers and middlemen are smaller when looking at monthly incomes because middlemen generally have two selling days a week, while wholesalers usually sell throughout the week.

In conclusion, an income hierarchy of horticultural traders starts with middlemen at the top, followed by (1) wholesalers in the wholesale market of a major town (Mombasa), (2) retailers in retail markets of the same town (Majengo, Kongowea), and traders in a the town market of a smaller town (Voi), and finally at the bottom (3) traders in rural

[101] Analysis of variance shows the significance of the differences (see Appendix 36). Analyzing either daily or monthly incomes does not make much difference because most of the traders are selling seven days a week (see Appendix 37). Appendix 38 and 39 give the daily and monthly income distributions for the Mombasa traders.

Figure 9. Box plots of daily and monthly income by type of trader



ldinc = daily trade income (log converted); lminc = monthly trade income (log converted)
Trader classification: 1 = traders Majengo market; 2 = retailers Kongowea market; 3 = wholesalers Kongowea market; 4 = traders Voi market; 5 = traders Taveta market; 6 = traders Wundanyi market; 7 = middlemen.
Notes:

1. The incomes have been log converted to get normal distributions per type of trader.
2. The boxes in the box plots contain 50% of the distribution. Within the range of the whiskers 75% of the distribution is depicted. The horizontal bar in each box is the median of the distribution. Extreme data points are plotted as circles and star bursts. For more detailed information see Appendix 36.
3. Appendix 36 also shows the analyses of variance that was used to test daily and monthly incomes differences per trader type.

markets (Taveta, Wundanyi). This does of course not mean that an individual trader in Taveta can never earn more than one in Mombasa, but it means that on average income differences are significant.[102]

7.4. Market performance

Now that the structure of the marketing chain has been investigated from farmer to consumer, and the conduct of its traders explained, the overall market performance can be judged. Four performance criteria will be discussed, namely product suitability, rates of profit, level of output, and price integration between markets.[103] Starting with the first, product suitability is related to the price-quality ratio of the traded horticultural commodities. Although prices are largely determined by market forces, as shown in section 7.2, the price-quality ratio is not optimal because of a generally low quality level in the surveyed markets. This is largely the result of factors that are outside the sphere of influence of individual traders. One of these factors concerns the physical conditions in the marketplaces. Lack of sheds, concrete floors and proper drainage affect the quality of the fruits and vegetables sold in the market. The commodities, which are generally highly perishable, are displayed on the ground without protection against sun and rain. After a shower, the marketplace turns into a mud pool and fruit and vegetables become as dirty as their surroundings.

Besides the market conditions also the conditions of the roads affect the quality of the commodities. The rough roads in the Taita Hills and Taveta Division cause losses of fruits and vegetables destined for Mombasa. Losses increase because of improper sorting and packing. Collecting traders and farmers for instance carry tomatoes in large gunny bags from the farms to Taveta market. By the time they reach the market the ripest tomatoes have turned into pulp. Middlemen usually repackage lots in boxes but again tomatoes of varying ripeness are often intermixed and most boxes are too big to prevent squeezing of the tomatoes at the bottom.[104] The use of gunny bags and large boxes does

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[102] In theory, income inequalities between urban and rural markets might also differ. The Pareto curves do, however, not differ much (see Appendix 40). The curves of wholesalers in Kongowea market and retailers in Majengo market look the same as those of traders in the Voi and Taveta markets. Only the curves of middlemen and retailers in Kongowea market show a smaller income inequality but this might be related to the relatively small sample sizes of both groups.

[103] These performance criteria are part of the so-called structure, conduct, performance analysis. See Dijkstra & Magori (1991) for a more elaborate explanation.

[104] A box may contain for instance as much as 80 kilograms of tomatoes, while boxes with a maximum weight of 20 to 40 kilograms would be best. The Taita HPC uses 20kg boxes for its tomatoes, and the authorities at the irrigation scheme in Loitokitok 40kg boxes.

not arise from ignorance of the farmers and traders. Wooden boxes are very expensive in Taita Taveta as timber has to come from far.

A positive exception when it comes to sorting, grading and packing is the Taita HPC, which has introduced standard boxes and proper sorting and grading among its members. The high prices Taita HPC commodities fetch in the Mombasa market show that these activities pay for themselves, that is as long as they are combined with market-oriented production to avoid flooding of the market.

Profit rates, the second performance criterion, are generally moderate, as shown in Chapter 5 with respect to tomato and banana trade, and in Chapter 6 with respect to trader incomes. An important exception is formed by a small group of horticultural middlemen. Their substantial profits are, however, at least partly related to the risks they have to bear because of poor infrastructure at the collecting stage.

Horticultural middlemen do not deliberately restrict output levels or trade flows towards Mombasa, nor do they operate some kind of buying cartel: the level of competition is determined by the number of middlemen who come to the production areas and the availability of transporters to carry the produce to Mombasa. Both factors are again related to the accessibility of the areas. Improvement of the infrastructure will, therefore, not only allow smaller margins because of smaller trade risks and lower transport costs, but also force middlemen to decrease these margins because of rising competition.

The final performance criterion concerns price integration between markets. Under normal circumstances market prices in production areas may be expected to be lower than prices in the urban market, especially when the urban market is over 100 kilometres a way. This, however, is not always the case in Wundanyi. Selling prices of, for instance, tomatoes in Wundanyi market are often higher than in Mombasa. This can be explained by the relatively isolated position of Wundanyi market. Most middlemen go directly to the farms instead of the market to collect horticultural commodities, while few vegetables and fruits from elsewhere reach the market because of high costs of transport uphill and the limited purchasing power of the rural population. Thus, prices in Wundanyi are almost completely determined by local supply and demand conditions. In contrast, Mombasa receives its vegetables and fruits from various destinations, including Wundanyi, Taveta, Loitokitok and Central Province. It may have large supplies at times of scarcity in the Taita Hills, leading to diverging prices.

Prices in Voi and Taveta markets on the one hand and the Mombasa markets on the other are much more integrated. Voi is located on the highway from upcountry to the coast and therefore a target market for horticultural commodities from Taita Taveta, the coast and Central Province. Although the urban population is not very big, its purchasing power is relatively high because many inhabitants have jobs at the railways, in the local safari lodge, at the local hospital, or at the sisal plantation.

Price integration between Taveta and Mombasa is high because of Taveta's major function as collecting centre of commodities destined for Mombasa. Local buyers will always have to compete with middlemen from Mombasa who are well informed about price developments in coastal urban markets. Only when the Taveta-Mwatate road is impassable because of floods after a shower, the communication with Mombasa is nil. Commodities are then offered in Taveta market against a throw-away price, while prices in Mombasa market rise because of decreasing supplies.

In conclusion, the performance of the horticultural market system is satisfactory within the constraints imposed by the market environment. The environment is characterized by a poor market and road infrastructure in the production areas that hampers competition, and lack of timber to build boxes for proper produce packaging. The market performance in Taveta can be further improved by organizing farmers in farmer-groups and introducing quality control and planned market-oriented production, as practised by the Taita HPC in the Taita Hills.

Chapter 8. Conclusions and recommendations

8.1. Horticultural production

Taita

Horticulture has great potential in the Taita Hills, because of both favourable agro-ecological circumstances and good selling prospects in Mombasa. Over 60% of the farmers in the Taita Hills sold vegetables and, to a lesser extent, fruits in 1991. Horticulture was the most important source of cash revenues on the farms, followed by livestock. Although coffee prices have improved lately, coffee revenues hardly counted at the time of the survey. Staple crops like maize and beans were mainly for home consumption. In addition to farm revenues, off-farm employment generated extra income to the rural households. The latter source of cash is, however, less certain because of structural adjustment policies that affect government jobs. In contrast, the demand for vegetables and fruits in Kenya is still on the rise due to ongoing urbanization. Therefore, the horticultural sub-sector deserves to be given top priority by the district authorities.

Horticultural commodities do not only generate cash revenues but are also important as food to the rural households. They provide vitamins and iron, while some can serve as staple food, namely bananas, Irish and sweet potatoes. Farmers can eat the latter instead of *ugali*, the more so because many of them are not able to produce enough maize due to the small size of their holdings and the general belief that maize does not do well during the long rains. This belief hampers the food self-sufficiency of rural households and forces them to buy maize. It leaves less money to invest in commercial horticulture and other money generating activities. Extension workers will therefore have to convince farmers that it is possible to obtain a successful maize harvest during the long rains as long as the proper chemicals and fertilizers are used.

Extension messages have to be combined with improved credit facilities to tackle lack of capital among potential horticultural farmers. Although a financial institution like the Agricultural Finance Corporation (AFC) issues so-called small-scale development loans, its services reach few farmers. An important bottleneck is the requirement of collaterals because many farmers lack title deeds. Group lending is often mentioned as an alternative, but also group loans require a collateral. In the past, the Ministry of Cooperatives used to initialize cooperative societies, but most of these groups have ceased to function because of mismanagement and lack of training and support from higher quarters. Local groups, also called associations, are now being established under the umbrella of the Ministry of Culture and Social Services, to apply for group loans at the Cooperative Bank. The grass roots level officers of this ministry, however, lack sufficient technical knowledge of agriculture, and extension workers of the Ministry of Agriculture should therefore be involved to ensure successful horticultural projects. The establishment of a security fund out of membership contributions and the application of group responsibility in the case of loan defaulting by individual members may increase the chances of success.

Rising costs of inputs during recent years have not only reinforced the need for input loans but also for the economic use of fertilisers and chemicals. In addition to inorganic fertilisers, the role of manure has to be stressed in improving the quality of the soil. Both manure and fertilizers have to play a role, the more so because of the more intensified methods of agricultural production that are required in the Taita Hills to overcome scarcity of land. Intensification includes for instance closer spacing of cabbage plants, which not only saves space but also accords with the demand for smaller heads by urban consumers nowadays.

The produce package of horticultural farmers in the Taita Hills is based on tradition, more than on knowledge of demand and supply in the various markets. Extension workers should advise the farmers about which horticultural crops are in high demand in Mombasa. They could use the knowledge of the Taita HPC, which, for the moment, has recognized a rising demand for tomatoes, cabbages and onions from Taita Taveta because of rising prices of similar commodities from Central Province due to increasing transport costs to the coast. The Taita HPC has shown the feasibility of combined market-oriented production, production planning, improved grading and packaging, and cooperative marketing by farmer groups.

Taveta

As in Taita, horticulture is a major source of cash to the farmers in Taveta, especially at the Kimorigo and Mboghoni Sub-Locations (Kimorigo Location) and the Njukini irrigation scheme (Chala Location). The most important production constraint to households without horticulture is lack of irrigation facilities. Without irrigation, horticulture is not possible in Taveta because of the semi-arid nature of the area. A problem among households with irrigation facilities is the increasing salinity of the soil, due to lack of proper drainage systems. Development and improvement of irrigation systems is, therefore, of primary importance in Taveta. This could be carried out by groups of local farmers with technical support from relevant ministries and projects like the Coast-ASAL development programme.

The horticultural farmers in Taveta focus mainly on bananas, tomatoes and onions. Because of the dominance of banana production at Kimorigo and lack of rotation with other crops, pests and diseases are an increasing problem. Extension messages in Taveta should therefore stress the need for some kind of crop rotation, especially in the banana growing areas. As bananas are a perennial crop, introduction of a kind of relay cropping might be part of the solution. Moreover, agricultural research should focus on selection of disease resistant varieties (e.g. Dwarf Cavendish which is resistant to the Panama disease). Farmers have to be informed about the economic life time of bananas (10 years), as too many trees are far beyond that age. It will be worthwhile investigating whether an organization like the Taita HPC could be set up in Taveta to improve the production and marketing of vegetables and fruits in the area.

8.2. Horticultural marketing

Local markets are important to rural households wishing to sell vegetables and fruits. Trading conditions in most of the markets are, however, far from ideal, as they are too small and lack permanent stalls, proper drainage systems and toilets. This affects the quality of the commodities traded and hence the revenues to the farmers and local traders. Upgrading of marketplaces is an important condition for further development of horticultural production and marketing in the Taita Hills and in Taveta Division.

Once marketplaces have been improved and sufficient stalls are available, traders should be forbidden to sell produce outside stalls. Parallel trading in stalls and on the ground, as

happens in Voi market at the moment, should be avoided because, if they have the choice, consumers prefer to buy from traders on the ground, to whom they expect to pay less. As a consequence, traders refuse to occupy stalls if selling on the ground is allowed.

Taveta has in the past been mentioned as one of the centres that would benefit from the so-called Rural Trade and Production Centres (RTPC) programme that is meant to up-grade important market centres all over Kenya. The present study shows that Taveta deserves to be given top priority because of its major collecting function with regard to horticultural commodities destined for Mombasa and elsewhere. When improving the marketplace, all of its functions should be taken into account to avoid such problems as occurred in the newly established Kongowea wholesale market, Mombasa, where wholesaling was initially hampered by the large number of retailers settling in the marketplace.

Apart from marketplace conditions, the state of the major district roads and the access roads to the production areas determine the performance of the marketing system. Accessibility is especially important to middlemen who come from Mombasa and elsewhere to buy horticultural commodities, like cabbages and tomatoes in the Taita Hills and bananas, tomatoes, onions and mangoes in Taveta. The better the roads, the more traders will come to the markets and farms. Lower transport costs and increasing competition among traders both lead to higher farm-gate and lower consumer prices. Up-grading of marketplaces should, therefore, be combined with improvement of the access roads to these centres. The major road from Mwatate to Taveta deserves special attention. Improvement of this road is a primary condition for further development of horticultural production in Taveta Division. Other roads requiring attention are those from the Sagala Hills to Voi. Although the area has potential for horticulture and is located close to Voi town, the access roads are in a terrible state and impassable during the rainy season.

Given the conditions of the roads and marketplaces, the performance of the horticultural marketing system in Taita Taveta District is fairly satisfactory. The incomes of the traders in the local markets are moderate to low, due to a high level of price competition. The only traders with relatively high incomes are specialized middlemen who take truckloads of produce to Mombasa and elsewhere. Their substantial profits are related to the large quantities handled and to the prices paid to the farmers. They justify their margins by pointing to the high risks arising from perishability of the commodities, conditions of the roads and scarcity of trucks for hire.

Improved availability of trucks would increase competition among middlemen and therefore lead to better prices for the farmers. It would also give informal farmer groups the opportunity to go into long-distance trade and take their share of the profit. The main bottleneck to starting transporters is usually the fact that they need a collateral to buy a truck on credit, like the farmer groups discussed in the previous section. Credit schemes that solve the collateral problem should, therefore, not only include farmers and farmer groups, but also individual businessmen who want to go into transport. While trucks are needed for the transport to Mombasa, tractors seem to be the most appropriate solution for the moment to get the produce from the farms to the nearest accessible collecting point.

Produce losses during transport are usually high due to poor post-harvest handling and improper packing. Sorting and grading is unknown among farmers except for Taita HPC members, and many farmers in Taveta pack highly perishable commodities like tomatoes in gunny bags instead of boxes. Farmers should be taught about the advantages of proper sorting, grading and packing. When determining the optimal means of packing, not only technical aspects but also financial aspects and availability of material like timber have be taken into account. Again, Taita HPC experience can be used.

Cooling of produce is absent, both in the production areas and at their final destination in the urban centres. Cooling is, however, not by definition a solution to produce losses. It will only be profitable if (i) higher prices cater for the cooling costs, (ii) the technology is appropriate, (iii) the commodities can be sold immediately after cooling, (iv) the commodities are properly sorted, graded and packed, and (v) the cooling device is fully utilized. If not really necessary, cooling should be avoided because of the costs and risks involved. Planned production is usually a cheaper and easier solution.

Processing of vegetables and fruits can sometimes be an alternative if there is no fresh market. This is, however, not the case in Taita Taveta as Mombasa and Nairobi offer good selling opportunities. It has to be stressed that processing is only profitable if the final product can be sold. To make up for the processing costs, consumers must not only be willing to buy but also to pay more than for the fresh equivalent. As long as fresh vegetables and fruits can find a market in Mombasa or elsewhere, processing is not a major issue in Taita Taveta. Planned production is again an easier way to avoid flooding of the market than processing.

Planned production requires knowledge about prices in Mombasa market, which farmers in Taita Taveta generally lack. The Taita HPC has so far been successful in providing daily market information to its members and surrounding farmers through notice boards at the collecting centres. The Ministry of Agriculture by means of its Marketing Officer is supposed to disseminate prices to farmers on the one hand and to keep in touch with the price information centre in Nairobi on the other. However, lack of logistical support hampers its efforts. Farmers should be informed about the broadcasting of Mombasa wholesale prices on the radio. Besides, the display of prices on notice boards should be extended to local market centres in the area. This should be the responsibility of the Ministry of Agriculture, which could use existing Taita HPC information systems. Marketing officers of the ministry should also be provided with the necessary logistical support to facilitate their functioning.

In conclusion, Taita Taveta District has great potential as far as horticulture is concerned. The rising demand for vegetables and fruits in Mombasa provides a basis for further expansion of the sub-sector, bringing prosperity to the local farmers. Developments are, however, hampered by various production and marketing constraints, including rising costs of inputs and lack of credit, poor drainage systems in the irrigated areas, spreading pests and diseases, poor infrastructure and high transport losses, scarcity of transport means and packaging material, and lack of market information. All these constraints require attention by the responsible government authorities, either at the local, district or national level. After all, the horticultural sub-sector in Taita Taveta, as elsewhere in Kenya, is a major supplier of income, employment and food to the people. It therefore deserves to be given top priority.

Appendices

Appendix 1. Group sizes by cluster according to the household listing

CBS cluster name (number)	*Taita hh's without hort sales*	*Taita HPC farmers*	*other hort farmers*	*Taveta hh's without hort sales*	*hh's with hort sales*
Werugha (108)	32	13	104		
Mlondo (109)	39	8	62		
Mgambonyi (111)	42	1	43		
Wundanyi (112)	69	3	62		
Mgange (120)	27	9	47		
Kimorigo (97)				24	83
Mboghoni (98)				40	65
Chala (99)				149	17
total	209	34	318	213	165

Abbreviations: CBS = Central Bureau of Statistics; hh's = households; hort = horticultural.

Appendix 2. Number of analyzed farm households by research group and cluster

CBS cluster name (number)	*Taita hh's without hort sales*	*Taita HPC farmers*	*other hort farmers*	*Taveta hh's without hort sales*	*hh's with hort sales*
Werugha (108)	2	8	15		
Mlondo (109)	5	7	7		
Mgambonyi (111)	3	1	9		
Wundanyi (112)	7	5	15		
Mgange (120)	3	6	6		
Kimorigo (97)				3	15
Mboghoni (98)				1	19
Chala (99)				12	4
total	20	27	52	16	38

Abbreviations: CBS = Central Bureau of Statistics; hh's = households; hort = horticultural.
Note: A few sampled households were left out during the analysis because the respondents appeared to have given conflicting answers. The given group sizes in the present table exclude those households.

Appendix 3. Sold commodities by market according to the trader listing

	Voi	*Taveta*	*Wundanyi*	*Majengo*	*Kongowea retail*	*Kongowea wholesale*
Amaranthus	2	6	6	6	4	4
Arrow root	4	9	3	-	3	-
Avocado	15	43	9	3	4	7
Baby marrow	1	-	3	-	1	1
Bananas	59	131	31	35	2	19
Baobab seeds	-	-	-	2	-	-
Bitter leaves	8	1	7	-	1	-
Black nightshade	1	10	2	-	4	-
Brinjal	7	8	-	7	2	-
Cabbages	71	21	39	15	17	31
Cardamom (spice)	2	-	-	-	-	-
Carrots	21	1	12	19	10	1
Cassava	3	1	-	-	-	-
Cauliflower	-	-	-	1	-	-
Celery	-	-	-	-	1	-
Coconut	-	4	-	4	-	-
Cow pea leaves	9	9	4	-	5	-
Cucumber	1	-	-	2	-	-
Custard apple	-	1	1	-	-	-
Dhania	4	3	1	17	8	-
French beans	2	-	-	1	-	1
Garden peas	7	-	1	16	8	1
Garlic	12	2	12	25	14	3
Ginger	1	1	-	-	1	-
Grapefruits	-	-	-	1	1	4
Green maize	11	5	1	4	9	-
Guava	-	-	1	-	-	-
Hot pepper	11	14	-	11	13	-
Irish potatoes	26	10	14	39	71	14
Kale	64	25	54	2	1	26
Leeks	3	-	1	-	-	1
Lemon	17	25	8	16	38	9
Lettuce	3	-	5	2	1	-
Lime	6	1	-	4	3	2
Mangoes	3	59	2	5	10	11
Melon	1	-	-	-	-	-
Okra	6	5	-	7	2	-
Onions	103	121	42	65	64	48
Oranges	20	52	3	-	20	24
Passion fruits	9	4	11	9	7	2
Pawpaw	26	11	15	6	1	5
Pineapples	4	1	-	9	6	14
Plums	-	-	-	-	-	1
Pumpkin	-	-	-	2	-	-
Pumpkin leaves	2	-	2	-	1	-
Radish	-	-	-	1	-	-
Red cabbage	-	-	1	-	-	-
Spider flower	-	-	-	-	2	-
Spinach	24	5	34	3	-	-
Spring onions	-	-	3	-	1	-
Sugarcane	2	1	-	-	-	-
Sweet pepper	18	7	2	7	10	1
Sweet potatoes	3	26	7	-	-	-

Continued on next page

Appendix 3 continued

Tamarind (wild fruit)	-	1	6	11	4	-
Tangerine	-	7	-	-	10	15
Tomatoes	101	179	69	39	37	115*
Tree tomatoes	6	2	10	-	-	-
Turmeric (spice)	1	-	-	2	-	-
Total no. of traders	184	452	199	106	234	343

Note: The trader listings in Voi, Taveta and Wundanyi were carried out on official market days in November 1991. The trader listings in Majengo and Kongowea were carried out in December 1991.
* The number of wholesale tomato traders was very large because many of them were actually a kind of large retailers, selling tomatoes in boxes of a few kilogrammes (see section 7.1 of the main text).

Appendix 4. General characteristics of households by research group, 1991

	Taita hh's without hort sales (n=20)	*Taita HPC farmers (n=27)*	*other hort farmers (n=52)*	*Taveta hh's without hort sales (n=16)*	*hh's with hort sales (n=38)*
size holding (acres)	1.9	4.6	3.3	3.0	2.9
no. of residents	4.9	7.2	6.2	7.2	5.4
- 0 to 15 years	1.9	3.2	3.0	3.6	2.5
- 16 to 59 years	2.5	3.7	3.0	3.5	2.8
- 60+ years	0.5	0.3	0.2	0.1	0.1
no. of part res	1.3	1.0	1.2	0.3	0.3
- 0 to 15 years	0.0	0.1	0.0	0.0	0.0
- 16 to 59 years	1.3	0.9	1.2	0.3	0.3
- 60+ years	0.0	0.0	0.0	0.0	0.0
total res+part res	6.2	8.2	7.4	7.5	5.7
polygamous hh (%)	15	30	35	25	26
female-headed hh (%)	25	7	19	25	26
level of education (%)					
- no formal education	50	30	35	38	32
- adult classes only	0	0	2	0	0
- primary level 1-4	10	22	19	38	32
- primary level 5-8	15	30	35	25	26
- beyond primary	25	19	10	0	11

Source: farm survey
Abbreviations: ; hh's = households; hort = horticultural; part res = part-time residents; res = residents

Appendix 5. Livestock by research group, 1991

	Taita hh's without hort sales (n=20)	*Taita HPC farmers (n=27)*	*other hort farmers (n=52)*	*Taveta hh's without hort sales (n=16)*	*hh's with hort sales (n=38)*
hh's with cows (%)	50	96	73	31	32
hh's with (up)graded cows (%)	45	89	65	0	0
no. of mature (up)graded cows per (up)graded cow owner	1.6	1.4	1.2	-	-
hh's with traditional cows (%)	5	26	13	31	32
no. of mature trad. cows per trad. cow owner	2.0	16.4	5.7	3.0	2.5
hh's with cows selling milk (%)	40	38	47	0	0
hh's with cows selling milk locally (%)	40	38	47	-	-
hh's with cows selling milk to the KCC (%)	0	0	3	-	-
av. daily sales by hh's selling milk (litres)	2.9	3.1	2.6	-	-
hh's with goats (%)	0	19	6	69	58
no. of mature goats per goat owner	0.0	5.6	14.3	5.6	4.2
hh's with sheep (%)	15	19	21	19	26
no. of mature sheep per sheep owner	1.7	2.4	2.7	1.7	4.0

Source: farm survey
Abbreviations: hh = household; hort = horticultural; av = average; trad = traditional

Appendix 6. Off-farm employment by research group, 1991

	Taita hh's without hort sales (n=20)	*Taita HPC farmers (n=27)*	*other hort farmers (n=52)*	*Taveta hh's without hort sales (n=16)*	*hh's with hort sales (n=38)*
hh's with off-farm employment (%)	75	70	73	56	42
av no. of off-farm jobs of these hh's	1.5	1.6	1.6	1.0	1.1
av no. of months employed per year	11.2	10.9	10.6	12.0	11.1
type of empl. (%):					
- agricultural	20	23	20	22	44
- resource extraction	0	0	2	0	0
- manufacturing	0	13	16	0	6
- construction	5	8	8	0	0
- trading	5	4	2	33	13
- repairing	10	4	2	11	0
- services	20	12	27	22	19
- office/clerical	20	23	18	0	13
- professional/ managerial	20	15	6	11	6
place of work (%):					
- neighbourhood	40	42	37	56	75
- elsewhere					
(a) commuting daily	7	0	3	0	6
(b) commuting weekly	7	0	5	0	0
(c) less frequent visits with:					
(c1) monthly cash contr.	20	0	13	11	13
(c2) quarterly cash contr.	0	16	11	33	0
(c3) less frequent cash contr.	27	42	32	0	6

Source: farm survey
Abbreviations: hh = household; hort = horticultural; av = average; empl = employment; contr = contributions
Notes: The various types of employment add up to approximately 100% per group. The employment categories mentioned here are also used by the Central Bureau of Statistics in Nairobi. Agriculture includes all types of paid casual and permanent farm work; manufacturing includes self-employed producers of food, beverages, tobacco products, plant and animal fibre products, clothing, wood, pottery and metal products; construction includes building, manufacturing of bricks and other building blocks; trading includes all wholesale and retail trade; repairing includes all types of self-employed repair work (bicycles, clothing, machinery, etc.); services include transport operators, cooks, waiters, shoeshiners, watchmen, etc.; office and clerical works include secretaries, cleaners, administrators, etc.; professional and managerial work includes doctors, police, priests, engineers, etc.
All alternatives mentioned under place of work (neighbourhood to less frequent visits with less frequent cash contributions) add up to approximately 100% per group.

Appendix 7. Reasons for not selling horticultural commodities

	Taita (n=20)		*Taveta (n=16)*	
	no of resp.	%	*no of resp.*	%
land shortage	3	15	2	13
labour shortage	3	15	1	6
water shortage	3	15	10	63
poor soil	3	15	0	0
no time because of off-farm job	3	15	0	0
too old	2	10	1	6
wild animals destroy the crop	1	5	1	6
farm inputs too expensive	3	15	0	0
fodder crops for livestock planted	1	5	0	0

Source: farm survey
Abbreviation: resp = respondents
Note: respondents were allowed to express more than one alternative.

Appendix 8. Calculation method for various types of household income

1. **net household income** = net farm income + net off-farm income + net land income[105]

2. **net farm income** = net horticultural income + net industrial crops income + net staples income + net livestock income
net horticultural income = net vegetable income + net fruit income
net industrial crops income = net coffee income + net tea income + net pyrethrum income + net cotton income + net sugarcane income
net staples income = net maize income + net beans income + net sorghum income + net finger millet income

3. **net vegetable income**
In order to estimate the total net vegetable income, the harvested quantity per plot per crop per growth cycle was asked (FORM 2), to be multiplied by the average value, whereafter the variable costs (FORM 6) and annual rent in case of hired plots (FORM 3) were deducted.[106]

The average *value* was based on the average annual selling price, which resulted from the inquired lowest and highest selling price in 1991 and the price at the time of the interview (FORM 5). In case of missing prices, as in households which did not sell vegetables, estimated averages were used based on the households which sold vegetables.

Per interview the *variable costs* of one vegetable were asked. They included cultivation costs (seed, hired tractor and ox services for ploughing and harrowing, fertilizer, chemicals, bought manure, and hired casual labour for ploughing, planting, weeding, harvesting) (FORM 6). When the farmer sold the produce in the market, marketing costs were involved including various transport costs and market fees (FORM 7). All costs were added up to estimate the variable costs as percentage of the gross income for the missing cases. The percentages were:
In Taita: kale 26%, cabbages 32%, tomatoes 28%, other vegetables 29%
In Taveta : tomatoes 41%, cow pea leaves 5%, other vegetables 41%

Fixed costs with regard to farming were asked in all cases. They could include (1) permanently employed labour, (2) maintenance costs of irrigation furrows and other irrigation costs, (3) depreciation of a spraying pump, irrigation equipment, and other farm tools (FORM 6). The depreciation period was set at 5 years. The total fixed costs of irrigation were deducted from the vegetable and fruit incomes in accordance with their relative importance. The total fixed costs of a spraying pump and permanent labour were deducted from the vegetable, fruit, industrial crops and livestock incomes in accordance with their relative importance.

4. **net fruit income**
The net fruit income was calculated by multiplying the annual sales per fruit type (FORM 3) by the average value, after which the costs as percentage of the gross income were deducted. The value was again based on selling prices (FORM 5). The costs were estimated at 1% for all fruits (FORM 6).

5. **net coffee/cotton income**
The net income out of *coffee* was calculated by the following formula:
Net annual income = annual harvest * selling price - cultivation costs + annual bonus
- The annual harvest for *coffee* was based on the average 3-monthly sales (FORM 2) which was multiplied by 5/3 to get the total harvest per year (5 months of harvesting in Taita). The selling price was KSh 3.19 per kg of cherries (Background Survey).
- The annual yields per ha for *coffee* were 2100 kg of cherries in Taita (MPND, 1989). The cultivation costs per ha were KSh 4980, consisting of KSh 1620 of fertilizer (200 kg CAN, KSh 405 per 50kg bag), KSh 3360 fungicides (8 times 1 kg of fungicides, on average KSh 420 per kg).

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[105] Net income = gross income minus costs
[106] FORM refers to a specific page of the farm questionnaire. The questionnaire can be found in the research outline (Dijkstra & Magori, 1991). Background Survey refers to a small survey that was carried out prior to the farm survey, comprising open interviews with district officials and horticultural farmers. The results were used to develop the farm questionnaire and to estimate key figures not obtained through the farm survey.

- All labour for small-scale coffee production was usually provided by the family.
- The annual bonus for the previous year for coffee was asked (FORM 2).

The net incomes out of *cotton* and *sugarcane* were calculated as percentage of the multiplication of annual harvest and selling price; as follows:
- *cotton* (Taveta only):
net cotton income = 0.24 * harvested cotton * KSh 9.20 per kg
The harvested cotton and expected further harvest were asked (FORM 2) (at the time of the survey the harvest was not yet finished).
The selling price is an average of the price for first quality cotton (AR, 80% of the harvest, KSh 10.00) and second quality cotton (BR, 20% of the harvest, KSh 6.00).
The percentage net income of the gross income (0.24) is based on the average annual yield of 850 kg per ha (MPND, 1989), and the costs of inputs which only consist of insecticides worth KSh 6000 (15 kg of on average KSh 400). Fertilizers and pesticides are not applied, while all labour is family labour.
- *sugarcane (Taita only)*:
net income = 1.00 * harvested sugarcane * KSh 1.50 per piece
The annual harvest was asked (FORM 2). According to the survey the harvested quantities were on average negligible. Therefore, the net income was nil.

6. net staples income (cereals and beans)
The net incomes out of *maize, beans, sorghum* and *finger millet* were calculated as percentages of the multiplied annual harvest and selling price, as follows:

Maize and beans:
Maize: net income = 0.90 * harvested maize * KSh 630 per 90kg bag
Beans: net income = 0.78 * harvested beans * KSh 810 per 90kg bag
The harvested quantities were asked per plot for both the long and the short rains (FORM 3).
In Taita Taveta maize and beans are usually pure stand. The yield for maize was 20 bags per ha (MPND, 1989). The input costs were: hybrid seed KSh 450, and insecticides KSh 840 (2 kg, on average KSh 420 per kg). The yield for beans was 8 bags per ha (MPND,1989),and the input costs: beans seed KSh 900 (100 kg per ha), fertilizer KSh 105 (9 kg of DAP, KSh 585 per 50kg bag),pesticides KSh 420 (1 kg, on average KSh 420 per kg).
Labour for planting ,weeding and harvesting is usually provided by family members, including informal rotating labour groups consisting of people from the same extended family. They do not pay each other., or only in kind.
The prices for maize refer to the local markets, instead of the (lower) official price offered by the NCPB, as small-scale farmers prefer to sell in the market.

Sorghum and finger millet:
Sorghum: net income = harvested sorghum * KSh 585 per bag
Finger millet: net income = harvested finger millet * KSh 518 per bag
fertilizer and chemicals are unusual in small-scale sorghum and finger millet cultivation. The only costs are seed costs but they are smaller than 1% of the revenues. The prices refer to the local market.

7. **net livestock income**
The net livestock income was sub-divided into income out of livestock products (including milk and meat), and income through value increase of the herd.

7.1. **milk**
The income out of milk comprised milk sales, own consumption by household members and feeding to calves (FORM 1). The quantity sold included both selling to the KCC and local sales (FORM 1). The average lactating period of the cows was 305 days and the inter-calf period 14 months.

7.2. **meat**
The income out of meat comprised sales of cattle, including (up)graded and traditional cows, goat, sheep, and other animals. Bought cattle was left out of the calculations because they were regarded as part-finished output (see FAO, 1980; Dijkstra & Magori, 1992a). The number of animals and selling price per animal were asked (FORM 1).

7.3. **value increase herd**
The calculation of the annual value increase of herd was based on figures of the DDP (see also Leegwater, et al., 1991). The percentage-wise increase per annum was multiplied by the actual value per type of animal. The figures were:

type of animal	*value increase (%)*	*value (KSh)*
(up)graded cow	12	3500
traditional cow	12	1900
sheep	25	250
goats	25	225

The value increase of cows includes the value of bull calves.

7.4. **other animals**
Donkeys and chickens and other animals might be present at farms. Donkeys were however kept as means of transport and therefore not included in the income calculations. Chickens, rabbits, etc. were only included when they were kept in large quantities for commercial purposes.

8. **net land income**
The net land income was calculated by adding up the annual rent received for each plot rented out. The gross and net land incomes were considered to be equal because of assumed absence of costs.

9. **net off-farm income**
The net off-farm income was calculated by asking the monthly income and number of months employed for each member of the household engaged in off-farm employment (FORM 1). The incomes were attributed to the household budget in relation to the distance to the place of work and frequency of visits to the household by the members concerned (FORM 1). The ratios were as follows:

place of work	*visits to the household*	*ratio*
in the neighbourhood	no travelling	1
elsewhere	commuting daily	0.90
elsewhere	commuting weekly	0.25

When visiting less frequently, the frequency of cash contributions to the household was asked . In case of monthly or quarterly cash contributions, the ratio was set at 0.10 and 0.05 respectively. Less frequent cash contributions were not considered. It has to be remembered that the persons concerned are part of the household and do not yet have their own household.

10. **Differences between income and cash income calculations**

10.1. **net vegetable cash income, net fruit cash income, net staples cash income**
Only the sold quantities of produce were included (FORM 2).

10.2. **net coffee/cotton income**
The net total and cash incomes out of coffee and cotton were equal because of the sale of the entire harvest.

10.3. **net livestock cash income**
Only milk sales and income out of cattle selling were included (FORM 1).

10.4. **net off-farm cash income**
The net off-farm income and net off-farm cash income were about equal as off-farm employment was normally rewarded in cash.

10.5. **net land cash income**
The net land income and net land cash income were about equal, as payments in kind were rather rare.

Appendix 9. Extreme cases and analyses of variance regarding household incomes

For the sake of analysis the total household incomes were converted into natural logarithms and some extreme cases were omitted to get normal distributions. The extreme cases will be mentioned and the results of the analyses shown. The extreme cases were not included in the tables mentioned in the main text and appendices.

Taita

Two cases in the group of households not selling horticulture were omitted. One had a household income of KSh 73,000 while all other household incomes were below KSh 52,500. The other one had a household income of KSh 300, while all other households had households incomes of over KSh 1,300, not only in this group but also in all other groups.
Three cases in the group of households selling to the HPC were omitted. Two had household incomes of KSh 105,000 and KSh 148,000, while all other household incomes were below KSh 75,000. One had a substantial negative horticultural cash income (KSh 5,800) while none of the other households in any of the groups had a negative horticultural cash income.
Six cases in the group of households selling horticulture otherwise were omitted. They differed from the other households in this group because they did not sell their commodities at the farm gate or in a local market but carried their produce to markets outside the area, including Mombasa (2 cases), Voi (3 cases) and Mwatate (1 case). Their household income and cash income out of horticulture was on average much higher than that of the other households in this group (household inc. KSh 34,000 versus KSh 15,600 for the others; net horticultural cash inc. KSh 13,590 versus KSh 2,200 for the others). The sample group was, however, too small to be treated separately within the analysis. They were also relatively unimportant in absolute numbers. According to the household listing they were made up less than 5% of the households selling horticulture in the surveyed Taita clusters.

Analyses of variance show significant differences between *household incomes* of households without horticultural sales, households selling horticulture to the HPC and households selling horticulture otherwise, as follows (probability<0.05):

- Households without hort. sales versus households selling hort. to the HPC:

Source	*df*	*Sum of Squares*	*Mean Square*	*F-ratio*	*Probability*
group	1	20.815	20.815	28.469	0.000
error	45	32.901	0.731		
total	46	53.716			

- Households without hort. sales versus households selling hort. otherwise:

Source	*df*	*Sum of Squares*	*Mean Square*	*F-ratio*	*Probability*
group	1	5.251	5.251	7.674	0.007
error	70	47.898	0.684		
total	71	53.149			

- Households selling hort. to the HPC versus households selling hort. otherwise:

Source	*df*	*Sum of Squares*	*Mean Square*	*F-ratio*	*Probability*
group	1	9.813	9.813	23.753	0.000
error	77	31.810	0.413		
total	78	41,623			

The latter two groups also had significantly different *horticultural cash incomes* (probability<0.05). To carry out the analysis the values were converted into natural logarithms, and the same extreme cases were omitted as for the analyses regarding household income. The results of the analysis of variance are:

Source	*df*	*Sum of Squares*	*Mean Square*	*F-ratio*	*Probability*
group	1	37.593	37.593	25.868	0.000
error	77	111.900	1.453		
total	78	149.493			

Taveta

One cases in the group of households not selling horticulture was omitted. It had a household income of over KSh 69,000 while all the other households had households incomes under KSh 35,000.

Five cases were omitted from the group of households which did sell horticulture. Three of them had household incomes of KSh 52,000, KSh 55,000 and KSh 84,000 respectively, while all other household incomes were below KSh 37,500. Two households had calculated negative household incomes of KSh -70 and KSh -313 respectively.

The analysis shows no significant differences between *household incomes* of households with horticultural sales and without horticultural sales (probability>0.05):

Source	*df*	*Sum of Squares*	*Mean Square*	*F-ratio*	*Probability*
group	1	0.375	0.375	0.484	0.490
error	52	40.229	0.774		
total	53	40.603			

Within the group of households selling horticulture, two sub-groups of households exist with significantly different *horticultural cash incomes* (probability<0.05). They are households which only sold produce at the farm gate and households which sold at least part of their horticultural produce in a market. To carry out the analysis, net horticultural cash incomes were converted into natural logarithms, and the same extreme cases were omitted as for the analyses regarding household income. The results of the analysis of variance are:

Source	*df*	*Sum of Squares*	*Mean Square*	*F-ratio*	*Probability*
group	1	13.287	13.287	10.503	0.003
error	36	45.541	1.265		
total	37	58.828			

Appendix 10. Income and cash income out of horticulture in Taita by research group, 1991 (KSh)

	hh's without hort sales (n=20)		*Taita HPC farmers (n=27)*		*other horticultural farmers (n=52)*	
	total	*cash*	*total*	*cash*	*total*	*cash*
Banana	215	0	656	90	398	52
Brassicas:						
Kale	9	0	703	453	667	406
Cabbage	7	0	2,962	1,727	631	452
Cauliflower	0	0	611	356	0	0
Lettuce	0	0	566	476	61	46
Spinach	0	0	2,138	935	10	8
Sub total	16	0	6,980	3,947	1,369	912
Pot herbs & spices:						
Chillies	0	0	0	0	0	0
Sweet pepper	0	0	628	428	31	28
Okra	0	0	0	0	0	0
Onion	0	0	52	35	25	16
Parsley	0	0	0	0	1	1
Leek	0	0	121	98	84	72
Sub total	0	0	801	561	141	117
Other vegetables:						
Green peas	0	0	158	130	0	0
French beans	0	0	659	575	22	22
Cucumber	0	0	257	257	18	18
Brinjals	0	0	0	0	0	0
Carrots	0	0	841	521	42	36
Tomatoes	0	0	3,632	2,124	974	767
Baby marrow	0	0	339	198	26	22
Cape tomatoes	0	0	73	44	5	3
Sub total	0	0	5,959	3,849	1,087	868
Other Fruits:						
Avocados	0	0	0	0	0	0
Mangoes	60	0	139	47	223	107
Tangerines	15	0	0	0	0	0
Lemons	0	0	222	7	6	0
Guava	12	0	0	0	0	0
Pawpaw	0	0	3	0	0	0
Passion Fruit	25	0	67	43	182	111
Apricots	0	0	7	0	0	0
Sub total	112	0	438	97	405	218
Roots & Tubers:						
Irish potatoes	0	0	1,423	1,193	243	119

continued on next page

Nuts:						
Macadamia nuts	0	0	580	541	9	9
Total Gross Margin	343	0	16,834	10,271	3,652	2,295
Less Fixed Cost	1	0	709	498	65	63
Net (cash) income	342	0	16,125	9,773	3,587	2,232

Source: Farm Survey.
Abbreviations: hh = household; hort = horticultural

Appendix 11. Vegetable cash income of Taita HPC farmers by market outlet, 1991 (KSh)

	vegetables sold to the Taita HPC	*vegetables sold otherwise*	*all sales*
Brassicas:			
Kale	0	453	453
Cabbage	1,392	335	1,727
Cauliflower	344	12	356
Lettuce	464	12	476
Spinach	931	4	935
Sub total	3,131	816	3,947
Pot herbs & spices:			
Chillies	0	0	0
Sweet pepper	304	124	428
Okra	0	0	0
Onion	0	35	35
Parsley	0	0	0
Leek	42	56	98
Sub total	346	215	561
Other vegetables:			
Green peas	0	130	130
French beans	492	83	575
Cucumber	184	73	257
Brinjals	0	0	0
Carrots	476	45	521
Tomatoes	1,393	731	2,124
Baby marrow	124	74	198
Cape tomatoes	0	44	44
Sub total	2,669	1,180	3,849
Roots & Tubers:			
Irish potatoes	0	1,193	1,193
Total Gross Margin	6,146	3,404	9,550

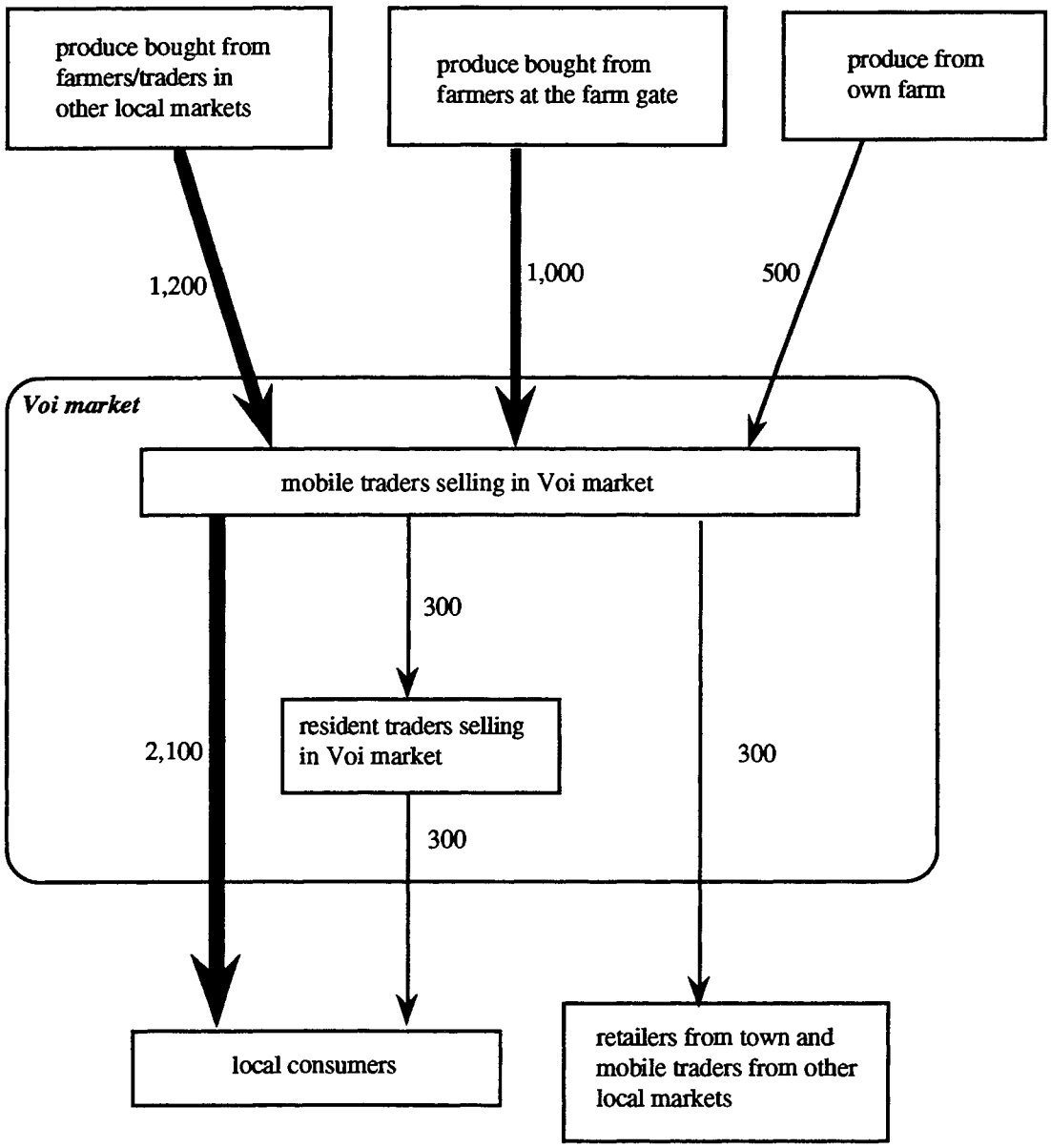
Source: Farm Survey.

Appendix 12. Income and cash income out of horticulture in Taveta by research group, 1991 (KSh)

	hh's without hort sales (n=16)		*hh's selling hort at the farm gate only (a) (n=18)*		*hh's selling hort otherwise (b) (n=20)*		*hh's with hort sales (a)+(b) (n=36)*	
	total	*cash*	*total*	*cash*	*total*	*cash*	*total*	*cash*
Bananas	189	0	3,006	1,739	5,085	4,105	4,101	2,958
Brassicas:								
Kale	61	0	118	56	245	146	185	103
Local vegetables:								
Cow pea leaves	21	0	25	5	148	0	90	3
Other vegetables:								
Chillies	0	0	39	39	0	0	19	19
Okra	0	0	103	80	240	207	175	147
Onion	0	0	0	0	1,473	1,417	775	746
Cucumber	0	0	78	70	0	0	37	33
Brinjals	0	0	55	55	0	0	26	26
Tomatoes	14	0	598	451	2,181	1,816	1,431	1,169
Sub total	14	0	873	695	3,894	3,440	2,463	2,140
Other Fruits:								
Avocados	0	0	116	82	203	94	162	88
Mangoes	0	0	306	227	468	400	392	318
Tangerines	0	0	3	3	0	0	1	1
Lemons	0	0	108	86	357	335	239	217
Oranges	0	0	421	355	58	51	230	195
Pawpaw	0	0	36	0	462	191	260	100
Sub total	0	0	990	753	1,548	1,071	1,284	919
Roots & Tubers:								
Arrow root	0	0	0	0	71	31	37	16
Cassava	0	0	0	0	0	102	76	54
Sub total	0	0	0	0	215	133	113	70
Nuts:								
Coconuts	0	0	0	0	7	4	4	2
Total Gross Margin	285	0	5,012	3,248	11,142	8,899	8,240	6,195
Less Fixed Cost	0	0	689	639	1,168	1,088	943	848
Net (cash) income	285	0	4,323	4,175	9,974	7,811	7,297	5,347

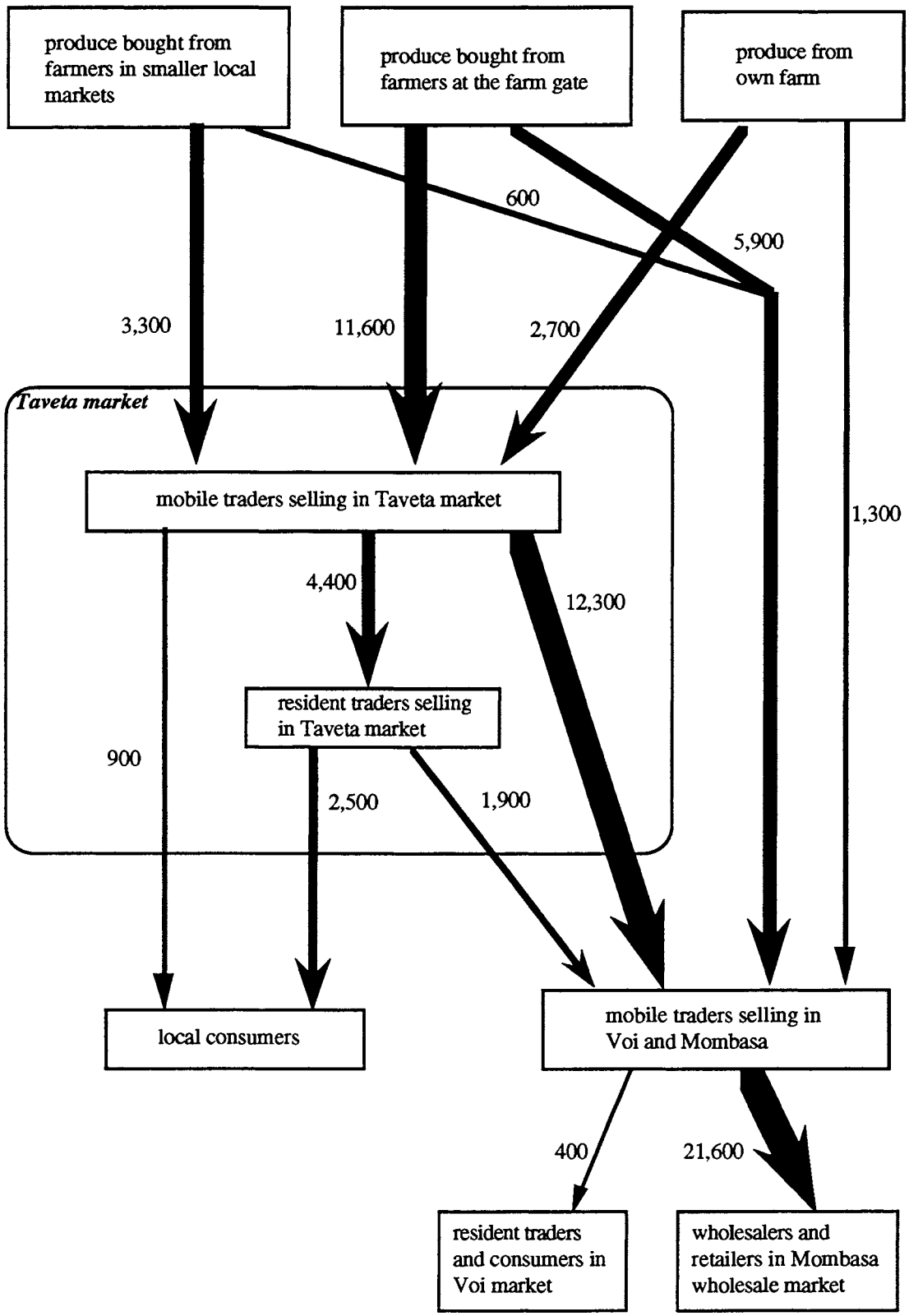
Source: Farm Survey

Appendix 13. The daily flow of tomatoes through Voi market (November, 1991) (kg)



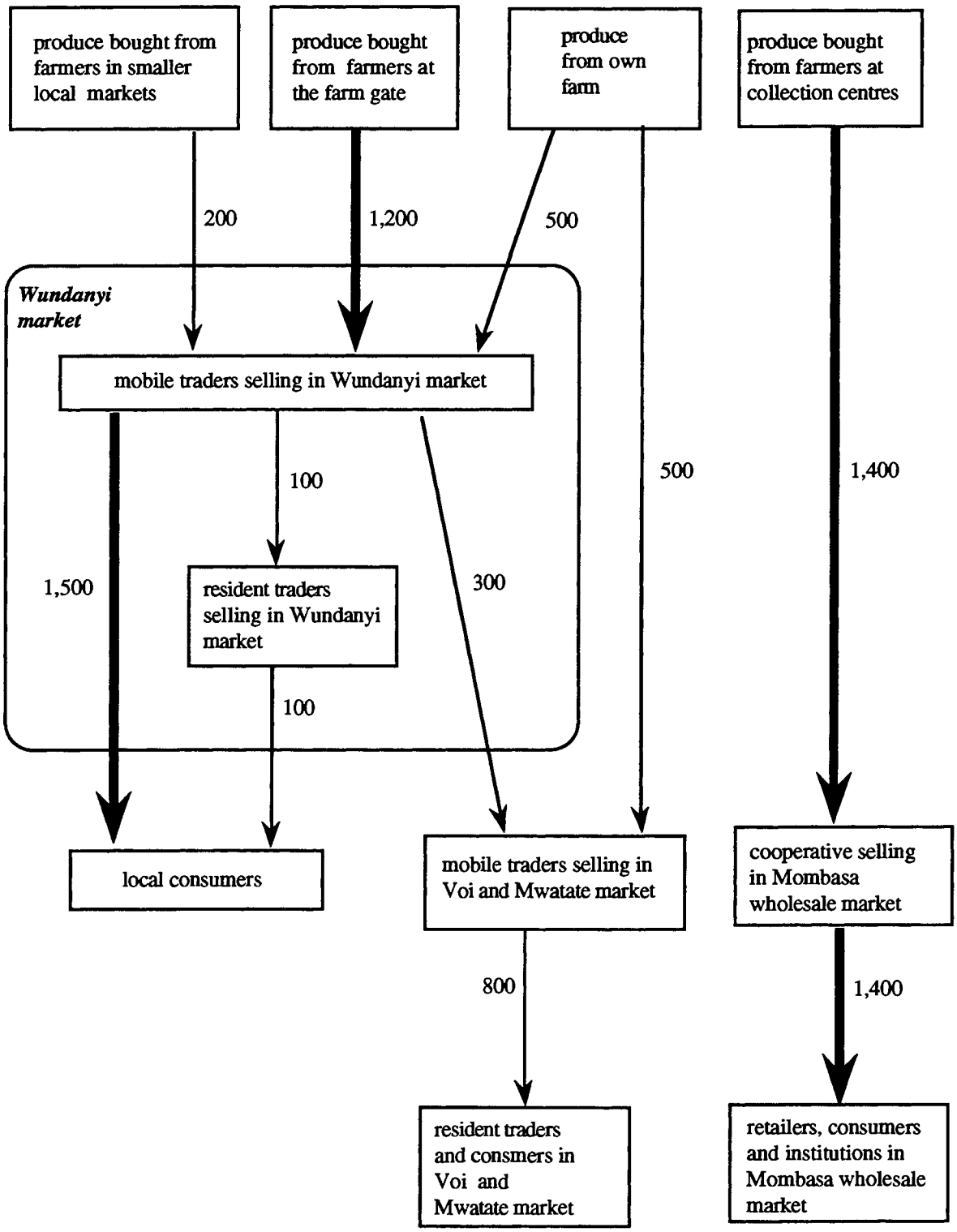
Source: trade survey

Appendix 14. The daily flow of tomatoes through Taveta market (November, 1991) (kg)



Source: farm survey, trade survey

Appendix 15. The daily flow of tomatoes through Wundanyi market (November, 1991) (kg)



Source: farm survey, trade survey

Appendix 16. Types of customers by type of tomato trader and market (November, 1991)

	mobile traders selling to:			*resident traders selling to:*			*all traders selling to:*		
	other traders	*con-sumers*	*both*	*other traders*	*con-sumers*	*both*	*other traders*	*con-sumers*	*both*
Voi	0	15	21	0	7	4	0	22	25
Taveta	12	4	11	1	23	10	13	27	21
Wundanyi	0	9	22	0	5	1	0	14	23
all markets	12	28	54	1	35	15	13	63	69

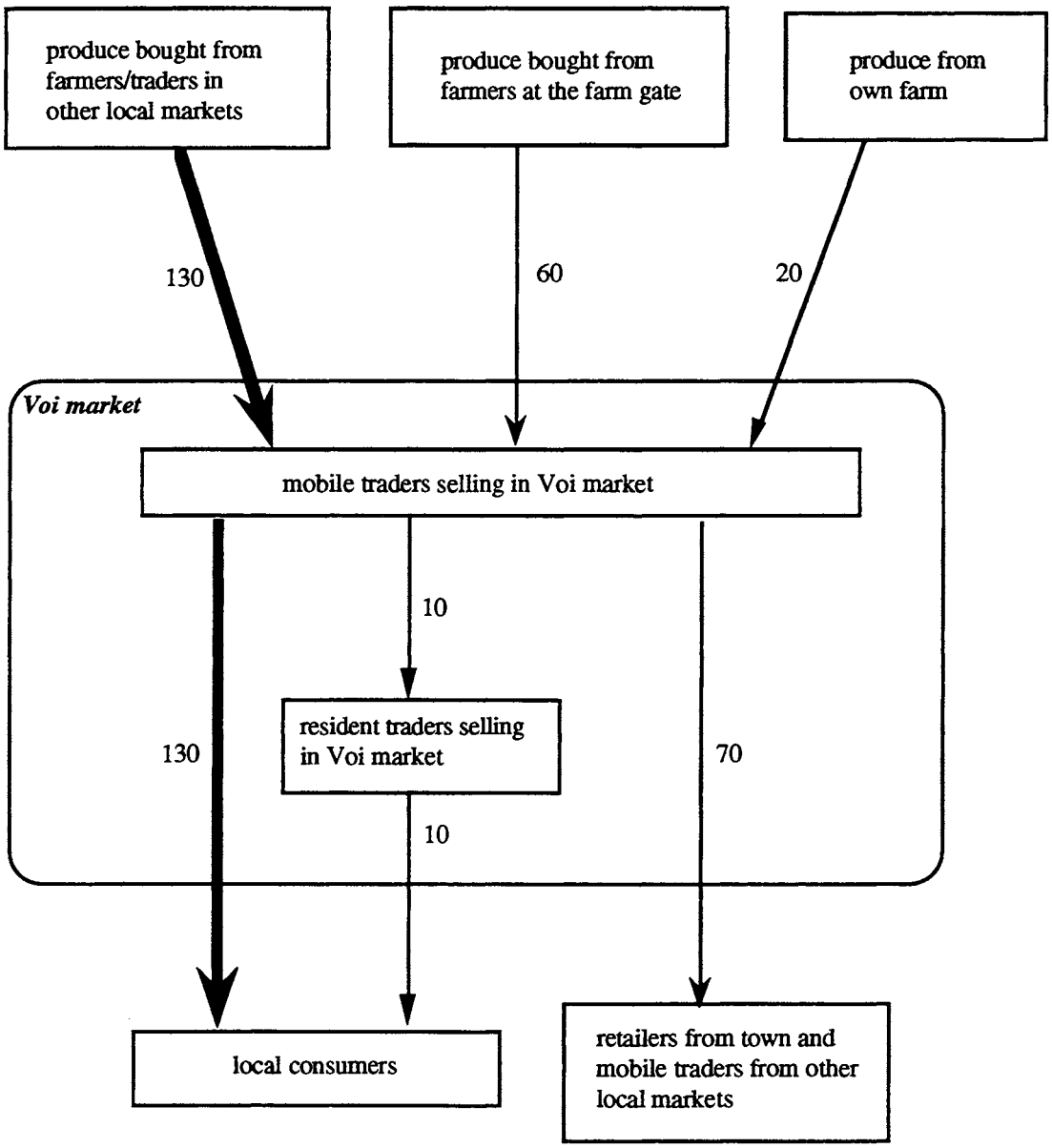
Source: trade survey

Appendix 17. Types of traders selling tomatoes by market (November, 1991)

	Voi market	*Taveta market*	*Wundanyi market*
farmer-traders selling:			
- only own tomatoes	1	4	3
- also tomatoes of other farmers	11	3	14
mobile professional traders	24	20	14
resident professional traders	11	34	6
total no. of tomato traders sampled	47	61	37
total no. of tomato traders in the market	101	179	69

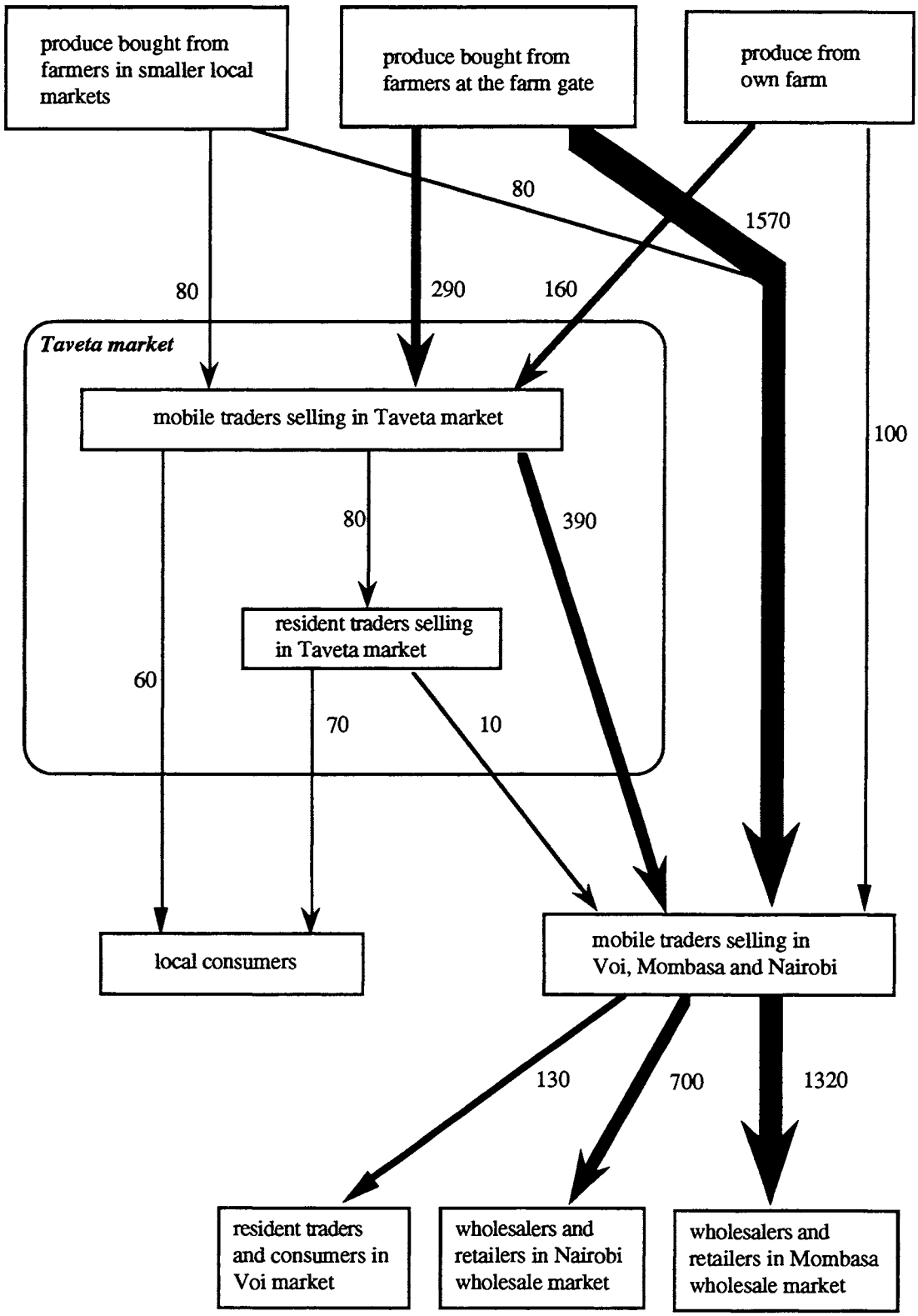
Source: trade survey

Appendix 18. The daily flow of bananas through Voi market (November, 1991) (bunches)



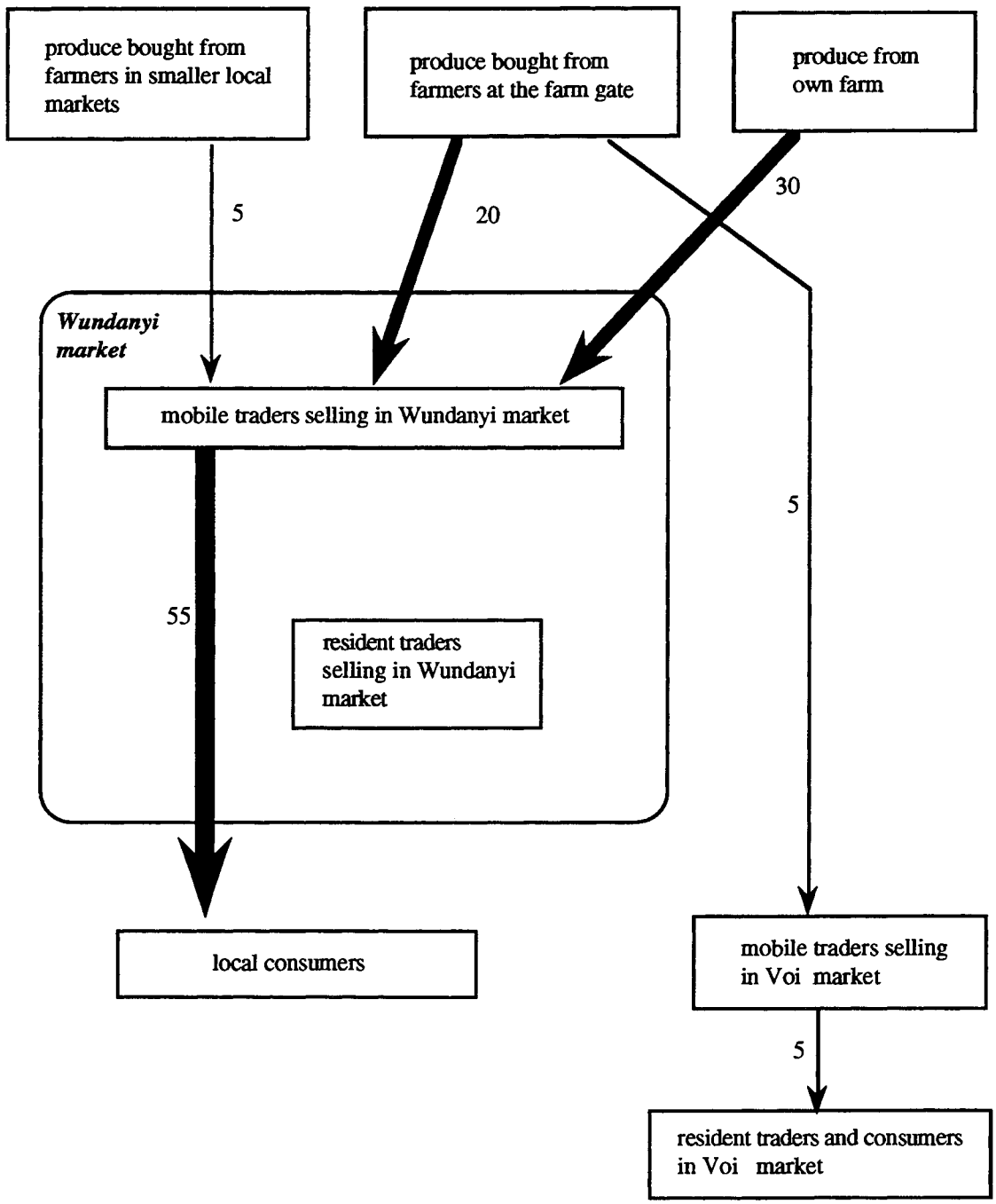
Source: trade survey

Appendix 19. The daily flow of bananas through Taveta market (November, 1991) (bunches)



Source: farm survey, trade survey

Appendix 20. The daily flow of bananas through Wundanyi market (November, 1991) (bunches)



Source: farm survey, trade survey

Appendix 21. Types of traders selling bananas by market (November, 1991)

	farmer-traders selling: *only own* ban.	*also ban. of other* farmers	*mobile prof. traders*	*resident prof. traders*	*total no of ban traders* sampled	*total no. of ban traders in* the market
Voi	0	3	20	1	24	59
Taveta	3	6	12	17	38	131
Wundanyi	2	7	1	0	10	31

Source: trade survey
Abbreviations: ban = banana; prof = professional

Appendix 22. Prices and marketing costs of tomato trade by market and type of trader (November, 1991)

market	*type of trader (n)*	*buying price*	*transport costs*	*market fees*	*selling price wholesale*	*selling price retail*
Voi	mobile (36)	6.30	0.94	0.08	8.91	11.77
		(2.50)	(0.38)	(0.05)	(1.22)	(3.02)
	resident (11)	8.91	-	0.16	-	11.77
		(1.22)		(0.09)		(3.02)
Taveta	mobile (27)	2.31	0.37	0.11	3.38	6.54
		(0.79)	(0.19)	(0.09)	(0.88)	(1.91)
	resident (34)	3.38	-	0.11	4.43	6.54
		(0.88)		(0.09)	(1.09)	(1.91)
Wundanyi	mobile (31)	4.63	0.45	0.08	6.76	9.84
		(1.08)	(0.40)	(0.08)	(1.27)	(2.20)
	resident (6)	6.76	-	0.08	-	9.84
		(1.27)		(0.08)		(2.20)

Source: trade survey

Notes:

- Farmer-traders who only sold own produce (eight cases) did not have a buying price, and were therefore excluded from the buying price calculations. They were included in the selling price calculations.
- The figures represent averages per category. The figures in parentheses are standard deviations of the mean.
- The average buying prices for mobile traders were based on both farm-gate prices and prices in (secondary) collecting markets. The first prevailed in the case of mobile traders from Taveta and Wundanyi markets, the second in the case of mobile traders from Voi market. The suppliers in (secondary) collecting markets were mainly farmers (as at the farm gate).
- The wholesale selling prices for mobile traders and buying prices for resident traders were combined for each market to get a single average, because differences were not significant (analysis of variance). The same applies for:
  -- retail selling prices of mobile and resident traders in each market
  -- market fees of mobile and resident traders in Taveta market and in Wundanyi market.
- Market fees of mobile and resident traders differed significantly in Voi market. The same applied for:
  -- buying prices of mobile and resident traders in each market
  -- wholesale selling prices of mobile and resident traders in Taveta market.

Appendix 23. Calculation method for daily incomes of horticultural traders

The net daily income or daily profit was calculated by deducting the various costs of the gross daily income or gross daily margin. The gross daily margin equalled the selling price minus the buying price times the turnover on the day of the survey. Cost categories might include costs of packing material, transport costs, and marketing fees.

Traders used *packing material* like boxes, bags, baskets, etc. Smaller traders, however, sold their produce loose, so that the packing material could be used for a number of trade cycles until it had worn out. The traders therefore had to cope with depreciation costs, which, however, were too small to be of significance as part of the total costs. Small traders might wrap vegetables or fruits in a piece of old newspaper, but they were able to get hold of those without costs. Some traders supplied plastic bags to their customers who then had to pay for them, which meant that the trader did not incur the costs. Large traders who sold their produce per bag or box might include the packing material in the deal, but they then charged for it.

Various types of *transport costs* were distinguished during the survey, including:
- hired labour for carrying to road
- hired transport to road
- hired labour for loading
- if hired vehicle: rent
- if own vehicle: running costs
- bus/*matatu* fees
- bus/*matatu* ticket (to and fro)
- hired labour for unloading/carrying
- hired handcart
- other transport costs (to be specified by the trader)

Apart from transport costs, the main other marketing costs were *market fees*. Less frequent costs were rent of a store and wage of a shared watchman. If they occurred, they were added to the market fees.

Appendix 24. Median quantities of tomatoes sold per day by type of tomato trader and market (November, 1991) (Kg)

	Voi market (n=47)	*Taveta market (n=61)*	*Wundanyi market (n=37)*	*all markets*
mobile traders (n=94)	17	240	22	30
resident traders (n=51)	5	9	7	8
all traders	10	40	20	18

Source: trade survey
Note:
- The median is presented instead of the average because of a non-normal distribution (positively skewed).

Appendix 25. Daily income distribution of tomato traders by market (November, 1991) (%)

daily income	*Voi market (n=45)*	*Taveta market (n=57)*	*Wundanyi market (n=35)*	*all markets*
KSh <100	24	31	48	34
KSh 100-299	31	37	34	34
KSh 300-499	20	9	14	14
KSh 500-999	13	18	3	12
KSh >=1000	11	5	0	6

Source: trade survey
Note: Out of the sample of 145 tomato traders, 6 cases were deleted because of a higher buying price than selling price, and two cases because of a negligible tomato turnover (less than 1 %).

Appendix 26. Daily income distribution of banana traders by market (November, 1991) (%)

daily income	*Voi market (n=24)*	*Taveta market (n=38)*	*Wundanyi market (n=10)*	*all markets*
KSh <100	25	24	60	29
KSh 100-299	29	37	20	32
KSh 100-499	29	13	20	19
KSh 500-999	4	18	0	11
KSh >=1000	13	8	0	8

Source: trade survey

Appendix 27. Traders in the sample selling tomatoes, bananas, or both

	Voi market	*Taveta market*	*Wundanyi market*
tomatoes only	28	34	30
bananas only	7	15	5
tomatoes and bananas	17	23	5
total	52	72	40

Source: trade survey

Appendix 28. Distribution of tomato traders by number of horticultural commodities and market (November, 1991) (%)

no. of commodities	*Voi market (n=45)*	*Taveta market (n=57)*	*Wundanyi market (n=35)*
1 (tomatoes only)	0	23	6
2	11	26	23
3	13	16	34
4	38	12	17
5	20	7	20
6	11	7	0
7 or more	7	9	0
	100	100	100
average no. of com.	4.3	3.2	3.2

Source: trade survey

Appendix 29. Distribution of banana traders by number of horticultural commodities and market (November, 1991) (%)

no. of commodities	*Voi market (n=24)*	*Taveta market (n=38)*	*Wundanyi market (n=10)*
1 (bananas only)	0	29	0
2	8	21	30
3	13	5	50
4	29	13	0
5	25	11	20
6	17	8	0
7 or more	8	13	0
	100	100	100
average no. of com.	4.6	3.4	3.1

Source: trade survey

Appendix 30. Daily income distribution of all horticultural traders by market (November, 1991) (%)

daily income	*Voi market (n=57)*	*Taveta market (n=95)*	*Wundanyi market (n=56)*	*all markets*
KSh <100	23	40	46	37
KSh 100-299	33	32	36	33
KSh 100-499	21	7	16	13
KSh 500-999	12	15	2	11
KSh >=1000	11	6	0	6
	100	100	100	100

Source: trade survey

Appendix 31. Number of business days per week by market and use of a stall (%)

days week	*Voi market*			*Taveta market*			*Wundanyi market*			*all markets*
	no stall (n=17)	*stall (n=40)*	*all*	*no stall (n=67)*	*stall (n=28)*	*all*	*no stall (n=50)*	*stall (n=6)*	*all*	
one	18	0	5	3	4	3	16	0	14	7
two	76	5	26	67	7	49	68	17	63	47
three	0	0	0	0	0	0	0	0	0	0
four	0	0	0	9	0	6	0	0	0	3
five	0	3	2	0	4	1	0	0	0	1
six	0	23	16	10	11	11	8	50	13	13
seven	6	70	51	10	75	29	8	33	11	30
			100			99			101	101

Source: trade survey

Appendix 32. Monthly income distribution of all horticultural traders by market (November, 1991) (%)

monthly income	*Voi market (n=57)*	*Taveta market (n=95)*	*Wundanyi market (n=56)*	*all markets*
KSh <500	14.0	21.1	23.2	19.7
KSh 500-999	3.5	14.7	25.0	14.4
KSh 1000-1999	17.5	23.2	23.2	21.6
KSh 2000-2999	15.8	12.6	14.3	13.9
KSh 3000-3999	5.3	5.3	7.1	5.8
KSh 4000-4999	5.3	5.3	3.6	4.8
KSh 5000-7499	19.3	5.3	1.8	8.2
KSh 7500-9999	8.8	6.3	1.8	5.8
KSh >=10,000	10.5	6.3	0.0	5.8
	100.0	100.1	100.0	100.0

Source: trade survey

Appendix 33. Middlemen incomes				
respondent no.	1	2	3	4
place of residence	Taveta Division	Mombasa	Mombasa	Taveta Division
place of buying	Taveta market	Taveta market	Taveta market	Taveta market
means of transport	shared truck	shared truck	shared truck	shared truck
destination	Mombasa	Mombasa	Mombasa	Malindi
customers	whol, retailers	ret, institutions	retailers	ret, consumers
bananas (bunches)				
buying price	50	60	40	
costs	25	26	6	
selling price	130	130	60	
margin	55	44	14	
quantity	70	100	100	
net income	3850	4400	1400	
tomatoes (large boxes, bags)				
buying price	380	350	400	400
costs	79	104	85	165
selling price	600	500	600	1400
margin	141	46	115	835
quantity	5	35	50	5
net income	705	1610	5750	4175
mangoes (bags)				
buying price		100	200	120
costs		104	71	111
selling price		250	300	400
margin		46	29	169
quantity		10	20	3
net income		460	580	507
onions (nets)				
buying price		50		
costs		12		
selling price		90		
margin		28		
quantity		20		
net income		560		
other fruits 1 (bags)		avocadoes	avocadoes	
buying price		200	80	
costs		104	78	
selling price		350	400	
margin		46	242	
quantity		15	10	
net income		690	2420	
other fruits 2 (bags)		oranges		
buying price		300		
costs		104		
selling price		450		
margin		46		
quantity		10		
net income		460		
total income	4555	8180	10150	4682

Appendix 33 continued				
respondent no.	5	6	7	8
place of residence	Mombasa	Taveta Division	Taveta Division	Mombasa
place of buying	farms	Taveta market	Taveta market	Taveta market
means of transport	shared truck (2x)	shared truck	shared truck	shared truck
destination	Momb, Malindi	Mombasa	Mombasa	Mombasa
customers	retailers	whol, retailers	whol ,retailers	whol, ret, inst
bananas (bunches)				
buying price	30	40		
costs	22	39		
selling price	70	130		
margin	18	51		
quantity	350	85		
net income	6300	4335		
tomatoes (large boxes, bags)				
buying price	200		350	
costs	97		78	
selling price	400		650	
margin	103		222	
quantity	50		20	
net income	5150		4440	
mangoes (bags)				
buying price	600			
costs	96			
selling price	800			
margin	104			
quantity	10			
net income	1040			
onions (nets)				
buying price	36			50
costs	15			29
selling price	90			90
margin	39			11
quantity	300			500
net income	11700			5500
other fruits 2 (bags)				
buying price				
costs				
selling price				
margin				
quantity				
net income				
other fruits 1 (bags)				
buying price				
costs				
selling price				
margin				
quantity				
net income				
total income	24190	4335	4440	5500

Appendix 33 continued				
respondent no.	9	10	11	12
place of residence	Taveta Division	Mombasa	Taveta Division	Taveta Division
place of buying	farms	Taveta market	farms	farms
means of transport	shared truck (2x)	shared truck	shared truck (2x)	shared truck (2x)
destination	Mombasa	Mombasa	Mombasa	Kibwezi
customers	whol, retailers	whol, retailers	whol, ret, cons	retailers
bananas (bunches)				
buying price	60		60	
costs	24		43	
selling price	110		120	
margin	26		17	
quantity	100		80	
net income	2600		1360	
tomatoes (large boxes, bags)				
buying price		400		400
costs		117		87
selling price		600		1100
margin		83		613
quantity		15		5
net income		1245		3065
mangoes (bags)				
buying price	100	150		
costs	82	81		
selling price	200	250		
margin	18	19		
quantity	10	5		
net income	180	95		
onions (nets)				
buying price				80
costs				22
selling price				280
margin				178
quantity				5
net income				890
other fruits 1 (bags)		avocadoes		
buying price		180		
costs		88		
selling price		350		
margin		82		
quantity		20		
net income		1640		
other fruits 2 (bags)				
buying price				
costs				
selling price				
margin				
quantity				
net income				
total income	2780	2980	1360	3955

Appendix 33 continued				
respondent no.	13	14	15	
place of residence	Taveta Division	Taveta Division	Taveta Division	
place of buying	Taveta market	Taveta market	farms	
means of transport	shared truck	shared truck	pick-up, train	
destination	Nairobi	Nairobi	Nairobi	
customers	retailers	whol, retailers	whol, retailers	
bananas (bunches)				
buying price			35	
costs			21	
selling price			70	
margin			14	
quantity			400	
net income			5600	
tomatoes (large boxes, bags)				
buying price				
costs				
selling price				
margin				
quantity				
net income				
mangoes (bags)				
buying price	110	80		
costs	114	81		
selling price	300	350		
margin	76	189		
quantity	15	60		
net income	1140	11340		
onions (nets)				
buying price				
costs				
selling price				
margin				
quantity				
net income				
other fruits 1 (bags)		oranges		
buying price		400		
costs		86		
selling price		900		
margin		414		
quantity		10		
net income		4140		
other fruits 2 (bags)		lemons		
buying price		150		
costs		76		
selling price		400		
margin		174		
quantity		3		
net income		522		
total income	1140	16002	5600	
Source: trade survey				
Abbreviations: whol = wholesalers; ret = retailers; cons = consumers; inst = institutions				

Appendix 34. Sources of supply of traders in the Mombasa markets

sources of supply	retailers Majengo (n= 59)	retailers Kongowea (n=15)	wholesalers Kongowea (n=39)
Kongowea wholesale market			
- middlemen only	12	3	9
- wholesalers only	43	9	16
- middlemen and wholesalers	4	3	1
- sub-total	59	15	26
Taita Taveta			
- farms			0
- collecting market			5
- farms and collecting market			5
- sub-total	0	0	10
Wakulima wholesale market Nairobi			
- middlemen	0	0	2
Karatina market (Nyeri District)			
- wholesalers	0	0	1

Source: trade survey
Note: some traders have more than one source in Kongowea or Taveta. Therefore the sub-totals are less than the added-up alternatives.

Appendix 35. Price determinants by type of trader (%)

	middlemen Taveta (n=15)	*middlemen Taita (n=31)*	*traders Voi (n=57)*	*traders Taveta (n=95)*	*traders Wundanyi (n=56)*
buying price:					
- related to expected/ previous selling price	93	81	84	88	88
- related to buying price other traders	13	6	19	12	11
- determined by sellers produce	33	19	44	23	25
selling price:					
- related to the buying price	100	100	95	78	91
- related to selling price other traders	20	0	28	29	34
- determined by buyers produce	0	13	7	3	0
- depends on supply and demand in the market	67	87	23	39	31

Source: trade survey
Note: traders were allowed to mention more than one alternative.

Appendix 36. Trader incomes: box plots and analysis of variance

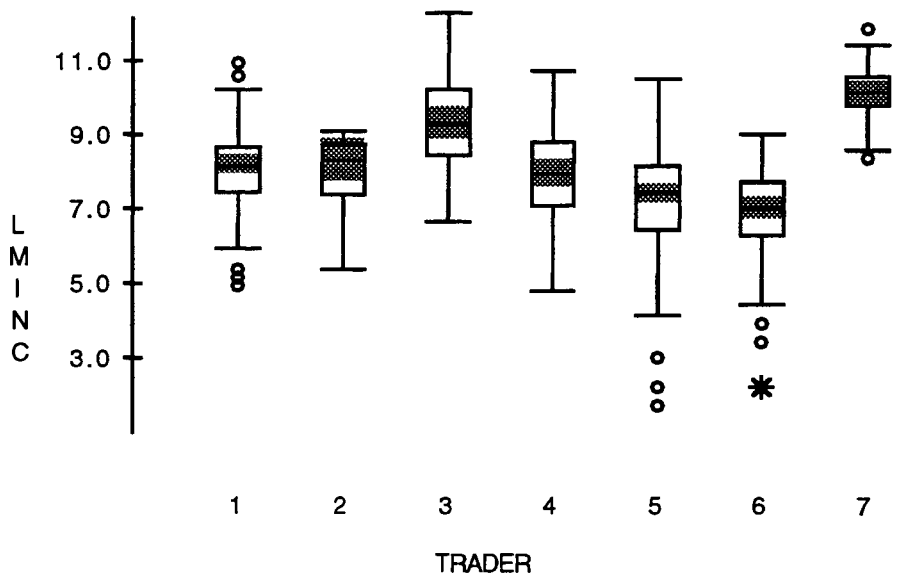
1. Explaining the use of box plots

A box plot is a graphical tool in data analysis, fully equivalent to measures of central tendency, e.g. the mean, standard deviation and so on. By means of box plots however, one can easily compare overall variability and spread around the medians of several variables at the same time (Tukey, 1977). The features of the box plot will be defined below.

The **box** refers to the region between the 25 and 75 percentiles of the distribution, which means that 50% of all observations are found within the box. The horizontal bar in the box is the median. The way the median is depicted in the box gives information of the symmetry of the distribution: whether the data points are equally spread around the median, or not. For example the monthly income distribution of trader types 3 and 6 in the figure below are symmetric around the median while the income distribution of trader type 2 is clearly not symmetric (skewed).

The shaded intervals within the box refer to the 95% confidence interval around the median. If the shaded intervals of separate boxes do not overlap a significant difference between the group medians exists. Clearly there is no statistical difference between trader types 1 and 2 on monthly income, while there is a major difference between trader types 6 and 7 (see figure below).

The upper fence of the box, which is the data point on the 75 percentile of the distribution is called high **hinge**, and the lower fence, on the 25 percentile is called low hinge. The **whiskers** connect the hinges to the other data points still within the central part of the distribution. Out of range values are plotted separately as small circles or star bursts (very extreme points).



Technical notes (Velleman & Hoaglin, 1981):
The length of the whiskers can be computed in the following way:

high hinge + 1.5 * (high hinge - low hinge)	upper whisker
low hinge - 1.5 * (high hinge - low hinge)	lower whisker

Computation of the 95% confidence intervals is as follows:
median ± 1.58 * (high hinge - low hinge)/+n.
Outliers, plotted as a small circle, are values greater than:
high hinge + 1.5 * (high hinge - low hinge) or
low hinge - 1.5 * (high hinge - low hinge)
Extreme outliers, plotted as a star burst, are values greater than:
high hinge + 3 * (high hinge - low hinge) or
low hinge - 3 * (high hinge - low hinge)

2. Explaining Analysis of Variance and the Tukey procedure

To test whether the average daily and monthly incomes per type of traders differed significantly, a one-way analysis of variance (ANOVA) was carried out, including all 7 types of traders. Subsequently a pair-wise comparison of group means was carried out by means of the Tukey HSD (Honestly Significant Difference) procedure.

The Tukey-HSD procedure is a so-called post-hoc test, whose outcomes are only valid if the overall F-test is significant. In our study the F-tests were significant for both the variables daily and monthly income, as will be shown in the next section. The Tukey procedure shows us two matrices. The first is a matrix of pair-wise mean differences calculated by means of the Tukey method.[107] In the second matrix each value of matrix 1 is tested for significance, leading to a matrix of p-values. All values marked with a * denote a pair of means differing significantly from each other at the 0.05 level.

Both the ANOVA and the Tukey HSD-procedure have to obey certain statistical assumptions, like normality and homoscedasticity. Income variables are known to have skewed distributions, which is a serious threat to normality.[108] To normalize the income distributions, a natural logarithmic conversion was applied to the data.

Homoscedasticity means that the variances of the variables to be compared are approximately the same. It is related to normality: when the normality assumption holds, the relationship between the variables is homoscedastic. Heteroscedasticity (the opposite of homoscedasticity) weakens the analysis, but is not fatal. In this study the homoscedasticity assumption was met for monthly income but not for daily income.[109]

The sub samples of the traders in our study are not all of the same size. However, the smallest sample sizes (N=15) are large enough to draw valid conclusions from the tests. The original Tukey HSD-procedure requires equal sample sizes, but the Tukey-Kramer procedure (Kirk, 1982), which has been used in this study, does not require this condition,.

3. Results of the ANOVA and Tukey analyses

3.1. Daily trader income

DEP VAR: **LDINC** (daily income log converted) N: 346

ANALYSIS OF VARIANCE

SOURCE:	SUM-OF-SQUARES	DF	MEAN-SQUARE	F-RATIO	P
TRADER	247.733	6	41.289	22.846	0.000
ERROR	612.667	339	1.807		

LEAST SQUARES MEANS.

	LS MEAN	SE	N
TRADER=1.000 (traders Majengo)	4.808	0.162	69
TRADER=2.000 (retailers Kongowea)	4.667	0.347	15
TRADER=3.000 (wholesalers Kongowea)	6.152	0.215	39
TRADER=4.000 (traders Voi)	5.405	0.178	57
TRADER=5.000 (traders Taveta)	4.858	0.138	95
TRADER=6.000 (traders Wundanyi)	4.579	0.180	56
TRADER=7.000 (middlemen)	8.491	0.347	15

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[107] A detailed explanation of the Tukey HSD-procedure beyond the scope of this appendix. Further information about post-hoc tests can be found in statistical textbooks like Winer (1971) or Kirk (1982).

[108] In the case of an univariate ANOVA without outliers, the F-test is said to be robust against skewed variables if there are at least 20 degrees of freedom for error (Tabachnick & Fidell, 1989).

[109] Bartlett test for homogeneity of group variances. Daily income: $X^2(6)=12.686$, p=0.048. Monthly income: $X^2(6)=6.908$, p=0.329.

POST HOC TEST OF LDINC
MATRIX OF PAIR-WISE MEAN DIFFERENCES:

	1	2	3	4	5	6	7
1	0.000						
2	-0.141	0.000					
3	1.344	1.486	0.000				
4	0.597	0.738	-0.747	0.000			
5	0.050	0.191	-1.294	-0.547	0.000		
6	-0.229	-0.087	-1.573	-0.826	-0.279	0.000	
7	3.683	3.824	2.339	3.086	3.633	3.912	0.000

TUKEY HSD MULTIPLE COMPARISONS.
MATRIX OF PAIR-WISE COMPARISON PROBABILITIES:

	1	2	3	4	5	6	7
1	1.000						
2	1.000	1.000					
3	0.000*	0.005*	1.000				
4	0.166	0.485	0.105	1.000			
5	1.000	0.999	0.000*	0.186	1.000		
6	0.965	1.000	0.000*	0.019*	0.883	1.000	
7	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	1.000

* denotes a statistical significant difference in group means ($p<0.05$).

3.2. Monthly trader income

DEP VAR: **LMINC** (monthly income log converted) N: 346
ANALYSIS OF VARIANCE

SOURCE	SUM-OF-SQUARES	DF	MEAN-SQUARE	F-RATIO	P
TRADER	271.746	6	45.291	25.602	0.000
ERROR	599.711	339	1.769		

LEAST SQUARES MEANS.

	LS MEAN	SE	N
TRADER=1.000 (traders Majengo)	8.127	0.160	69
TRADER=2.000 (retailers Kongowea)	7.997	0.343	15
TRADER=3.000 (wholesalers Kongowea)	9.340	0.213	39
TRADER=4.000 (traders Voi)	7.917	0.176	57
TRADER=5.000 (traders Taveta)	7.243	0.136	95
TRADER=6.000 (traders Wundanyi)	6.761	0.178	56
TRADER=7.000 (middlemen)	10.129	0.348	15

POST HOC TEST OF LMINC
MATRIX OF PAIR-WISE MEAN DIFFERENCES:

	1	2	3	4	5	6	7
1	0.000						
2	-0.129	0.000					
3	1.213	1.343	0.000				
4	-0.210	-0.081	-1.423	0.000			
5	-0.884	-0.754	-2.097	-0.674	0.000		
6	-1.366	-1.236	-2.579	-1.156	-0.482	0.000	
7	2.002	2.131	0.789	2.212	2.886	3.368	0.000

TUKEY HSD MULTIPLE COMPARISONS.
MATRIX OF PAIR-WISE COMPARISON PROBABILITIES:

	1	2	3	4	5	6	7
1	1.000						
2	1.000	1.000					
3	0.000*	0.016*	1.000				
4	0.975	1.000	0.000*	1.000			
5	0.001*	0.389	0.000*	0.040*	1.000		
6	0.000*	0.024*	0.000*	0.000*	0.323	1.000	
7	0.000*	0.000*	0.446	0.000*	0.000*	0.000*	1.000

* denotes a statistically significant difference in group means ($p<0.05$).

Appendix 37. Number of days per week traders are in business by type of trader in Mombasa (%)

number of days per week	*retailers Majengo (n=59)*	*retailers Kongowea (n=15)*	*wholesalers Kongowea (n=39)*	*middlemen (n=15)*
once every fortnight	0	0	0	7
one day a week	0	0	0	20
two days a week	0	0	10	73
three days a week	0	0	3	0
four days a week	0	0	0	0
five days a week	2	0	0	0
six days a week	8	0	3	0
seven days a week	90	100	85	0
	100	100	101	100

Source: trade survey

Appendix 38. Daily income distribution of horticultural traders by type of trader in Mombasa (%)

daily income	*retailers Majengo (n=59)*	*retailers Kongowea (n=15)*	*wholesalers Kongowea (n=39)*	*middlemen (n=15)*
KSh <100	41	33	18	0
KSh 100-299	41	53	18	0
KSh 100-499	12	13	8	0
KSh 500-999	2	0	26	0
KSh >=1000	5	0	31	100
	101	99	101	100

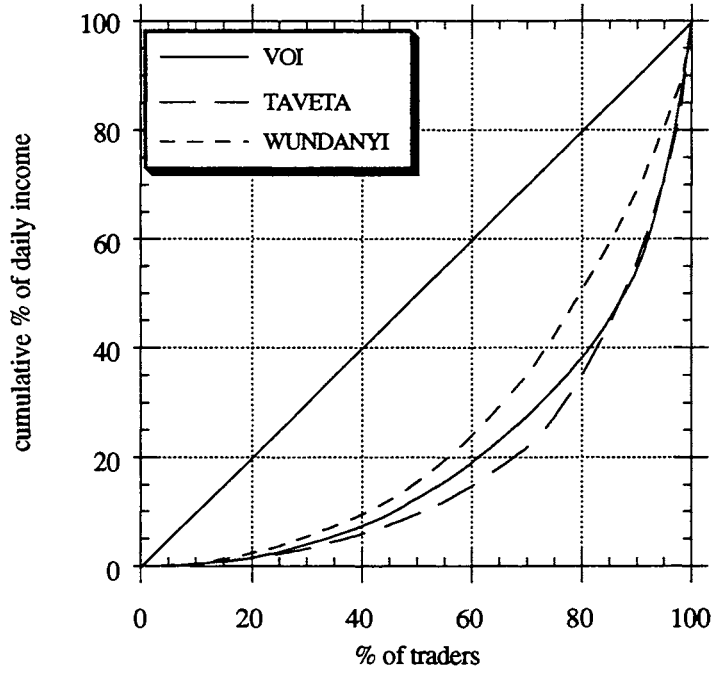
Source: trade survey

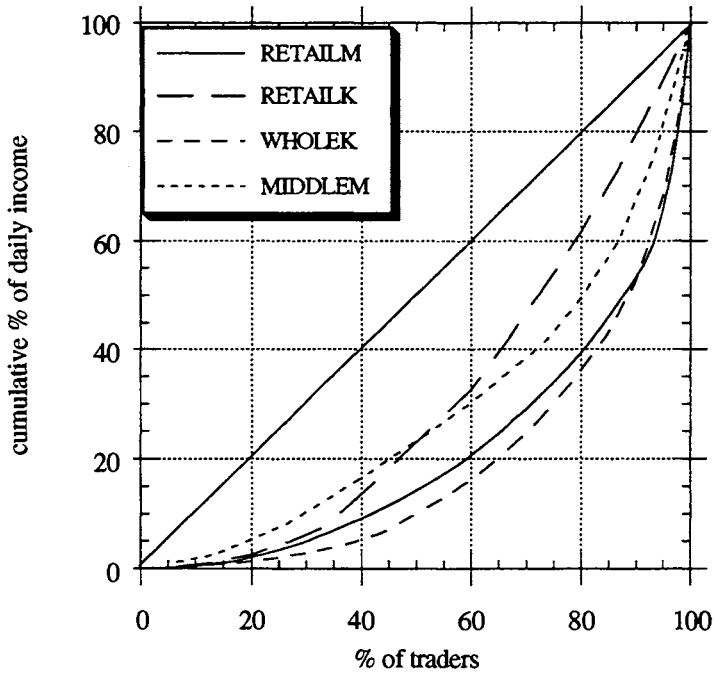
Appendix 39. Monthly income distribution of horticultural traders by type of trader in Mombasa (%)

monthly income	*retailers Majengo (n=59)*	*retailers Kongowea (n=15)*	*wholesalers Kongowea (n=39)*	*middlemen (n=15)*
KSh <500	8	7	0	0
KSh 500-999	8	13	5	0
KSh 1000-1999	10	13	3	0
KSh 2000-2999	15	0	13	0
KSh 3000-3999	15	7	3	0
KSh 4000-4999	7	20	3	7
KSh 5000-7499	17	20	13	7
KSh 7500-9999	8	20	5	7
KSh >=10,000	10	0	56	80
	100	100	101	101

Source: trade survey
Note: in the case of middlemen the monthly income was calculated by multiplying the daily income by a number of days per month, the latter being based on the number of days per week and a factor which is related to the accessibility of the Taveta area. The number of days per month were: 6 in the case of 2 days a week, 4 in the case of 1 day a week, and 2 in the case of 1 day every fortnight (0.5 trips a week).

Appendix 40. Pareto curves of rural and urban traders





retailm = retailers Majengo market
retailk = retailers Kongowea market
wholek = wholesalers Kongowea market
middlem = middlemen

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