

STRUCTURE CONDUCT AND PERFORMANCE OF
TRANSPORT OF FRUIT AND VEGETABLES IN
KENYA

BY

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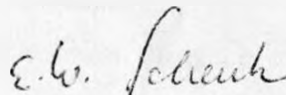
A THESIS SUBMITTED IN PART FULFILMENT OF THE
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SCIENCE IN AGRICULTURAL ECONOMICS IN THE
UNIVERSITY OF NAIROBI 1978.

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ABSTRACT

It is known that provision of fruit and vegetables is of fundamental necessity to human nutrition, and lack of these commodities because of prohibitive high transport charges can have severe consequence in human health, especially in urban centres, where the population depends on imported food from rural areas. Information on the present structure, conduct and performance of transportation system, is somewhat limited. There is therefore a need to get detail information as regards, number of vehicles, type, capacity, of vehicles involved, and prices ruling in the markets, so as to determine what factors affect the market prices, for both transport and commodities.

This report is based on the information collected from deficit and surplus areas. The report gives the result of study conducted in Nyandarua, Kiambu, Taita-Taveta districts and Nairobi and Mombasa markets. A random sample of 114 drawn from all market participants and informed government officials were interviewed. The major objectives of the study are:

- (a) To investigate the mode of transport used by producers and traders,
- (b) To investigate the truckers behaviour,
- (c) To investigate the relationship between distance covered, transport charges, capacity of vehicles, and price paid to farmers,
- (d) To investigate what percentage share transfer charges take of the wholesale prices,
- (e) To investigate the major variables affecting farmgate and wholesale prices.

Arising from the above objectives the following major hypotheses were tested -

- (i) That the farmers and traders near the market use simple transfer methods to ship produce to the market,
- (ii) That there is a relationship between capacity of vehicle and scale of business, type of produce and the length of haulage,

(iv)

- (iii) That the transfer arrangements affect transport costs.
- (iv) That transport charges are directly related to the actual costs and therefore inflexible.
- (v) That transfer costs are charged per unit weight: this means products with high value per unit (for instance tomatoes) are less affected by long distance transport than low valued products such as cabbages.

Many types of vehicles of varying capacities are involved in the transfer of fruit and vegetables. Smaller vehicles ranging from 1 - 2.5 tons operate near the market. But larger vehicles operate further afield.

A large number of participants trade in fruit and vegetables, and hence the market is competitive, as there is no monopoly as regards the business. Calculations based on owned vehicles and hired vehicles indicate that whether one hires a vehicle or owns it, there is no cost advantage.

The testing of hypotheses indicates, that both farmgate and wholesale prices are affected mainly by the distance covered, and the percentage share taken by the transfer charges increases with increasing distance. Also if the produce is of high value, the transfer charges take a smaller percentage of wholesale price. It is therefore important to grow crops of low value near the market and crops of high value further afield, unless this rule is offset by problems of perishability.

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I am of course, responsible for the collection presentation and interpretation of the data. The results presented and the views expressed are my sole responsibility and not necessarily that of University of Nairobi.

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CHAPTER 1.

INTRODUCTION AND OBJECTIVES OF THE STUDY

1.1 Overview

This study focuses on the transportation of fruit and vegetables from rural areas to local fresh urban markets (Nairobi and Mombasa). Transportation structure, conduct and its performance will be studied.

It is known that provision of fruit and vegetables is of fundamental necessity to human nutrition, and lack of these commodities because of prohibitive high transport charges can have severe consequence in human health, especially in urban centres. Thus, fresh fruit and vegetables are necessary. "Horticultural products also contribute towards overcoming malnutrition as many of these products are cheap source of vitamins" says Kenya's, Ministry of Co-operative Development working party report on the Horticultural Co-operative Union (1975, P. 15). The importance of fruit and vegetables can be viewed from two angles, as a source of growth factors known as vitamins (especially A, C, and K): secondly, as a source of energy. These come especially from Irish potatoes and cooking bananas. These foods are infact important among Kikuyu, Meru, Kisii, Luhya and Wataita ethnic groups. The potatoes alone, has become an important competitor of maize (Zea Mais) as staple food crop, according to Mbogoh (1977, Page 1).

The volume of fruit and vegetables traded in, is steadily increasing. The volume handled at Wakulima Wholesale Market, Nairobi, for instance, has been increasing ever since 1969 at about 10 per cent per annum, according to Maritim (1977, P. 57). See table 1.

Table 1: Summary of Various Estimates of Quantities of Produce Traded at Wakulima Wholesale Market.

Year of Study	Estimate 1	Estimate 2	
	<u>1,000 tons</u>		
1969	38.385		
1972	63.741		
1972	82.666		
1973	91.677	67.777	
1974	95.066	71.371	
1975	104.573	70.332	
1975	-	-	50.400 $\frac{1}{2}$
1975	-	-	71.568

Source: Maritim, L.H.K., Analysis of Produce Flow to Wakulima Wholesale Market. (Agricultural Economics Studies No. 3), Nairobi, Department of Agricultural Economics, University of Nairobi. 1977.

1. Figures recorded from Cess Books, City Council of Nairobi 1975, Maritim, L.H.K. (1977, P. 57).
2. Figures adjusted from 1, by taking rainfall figures into account, Maritim, L.H.K., (1977, P. 57).

Maritim (1977, P. 57) used different estimates to obtain volume of produce handled through Wakulima Wholesale market using basic figures obtained by Heinrich F. (1972), Wilson F. (1969 table 2), and Lorenzl, G. and Quick, D. (1975, table 3.5). Maritim (1977) also adjusted figures he obtained from Cess books of Nairobi City Council. Thus, getting a figure slightly higher than the recorded 50,400 tons for 1975. All the figures, showed a rapid development over the years. This growth has continued since 1975. If the adjusted figure of 71,568 tons is compounded at the rate of 10% per annum according to Maritim (1977 page 57), for a total of 3 years (from end of 1975 to 1978), a total of 95,260 tons is obtained showing that a large volume of produce passed through Wakulima Wholesale Market in 1978.

Despite the importance of fruit and vegetables mentioned above, prohibitive retail prices in urban centres put them beyond the reach of lower paid workers.

This may be partly accounted for by high transportation costs which has to be borne by the consumer as high retail prices or by the producer in the form of low farm-gate prices. This double phenomenon discourages both production and consumption, which is fatal to any economic system. If transfer costs are reduced significantly, thus lowering the gap between urban wholesale and farmgate prices, it would make a favourable impact on producers and consumers.

It is therefore, the intention of this study to investigate and review the structure, conduct and performance of the transportation system, supplying the fresh fruit and vegetables to Nairobi and Mombasa markets as the major consumption centres.

1.2 Objectives of the Study

This study will focus on the following specific objectives:

- (a) To investigate the mode of transport used by the producers and traders. The study will be confined to the road transport as water and air transport have no importance in the fresh local markets.
- (b) To investigate the truckers behaviour and how this behaviour affects transport charges.
- (c) To investigate if there is any relationship between the distance covered, transport charges, capacity of vehicle (i.e. size of business) and the price paid to the producer.
- (d) To investigate what percentage share transfer costs take of the wholesale prices.
- (e) To investigate the major variables which affect farmgate and wholesale prices.

The above objectives which are somehow interlinked can be translated into simple questions as follows:

- (a) What types of transport are used and which is the most common type?
- (b) Is the type of transport used public service vehicles or privately owned vehicles. Are the vehicles individually owned, Company owned, Group owned or Society owned?
- (c) Is there any relationship between the type of transport used and distance covered?
- (d) What reasons influence the truckers in choosing the type of transport used?
- (e) Are there any arrangements (contracts) among the producers, traders and the truckers?
- (f) What is the cost per unit of commodity transported?
- (g) Are the price differentials between surplus and deficit areas explained by transfer costs?
- (h) Does back-haul influence the transfer costs?

CHAPTER 2.

2. THE FLOW OF FRUIT AND VEGETABLES TO NAIROBI AND MOMBASA MARKETS

As the structure is not commonly known of the fruit and vegetable markets in Kenya, this thesis has to describe and explain the various market channels before the transport is analysed in detail. This Chapter, therefore, describes the location of production, the collection of commodities, the channels through which the produce to Nairobi and Mombasa Markets are supplied.

2.1 The range of commodities traded in the two markets

A wide variety of produce is traded in Nairobi and Mombasa markets.

See table 2 below.

Table 2: Fruit and vegetables traded in Nairobi and Mombasa markets.

Fruits		Vegetables	
Avocadoes	Mangoes	Cabbages	Kales
Bananas (cooking)	Oranges	Carrots	Leeks
Bananas (Table)	Passion fruits	Beans	Lettuce
Coconuts	Pineapples	Beetroot	Onions
Gooseberries	Plums	Capsicums	Parsley
Grapes	Pawpaws	Eggplant	Peas
Grape fruits	Sweet melons	Celery	Potatoes
Guavas	Strawberries	Cauliflowers	Artichokes
Limes	Tangerines	Chillies	Marrows
Lemons	Tomatoes	Cucumbers	Babymarrows
		Spinach	Brussel sprouts
		Sugarcane	

Source: Eyaruhanga, K.J., The Performance of the Horticultural Co-operative Union Limited (HCU), (Agricultural Economics Studies No. 2), 1977. (Appendix 1, P. 96, 97 and 98).

2.2 The origin of commodities

2.2.1 Nairobi Market

Fruit and vegetables for Nairobi market come from many districts. Table 3 contain the main production centres for the 10 most important products. The quantities in Kilograms were recorded in one week of March 1972 at Wakulima Wholesale Market. Of these commodities, cabbages formed the bulk, of which most important production centres are Nyandarua (56 percent) and Kiambu (34 percent). Potatoes ranked second in terms of volume handled. These are from Narok (31 percent) Nyandarua (27.9 percent), Nakuru (12.5 percent), Kiambu (6.9 percent) Nyeri (3.2 percent), Machakos (2.4 percent) and Murang'a (1.0 percent). Third in position are cooking and table bananas which come mostly from Kisii District (55.7 percent). Murang'a, Kisumu and Kiambu have minor shares. The rest of the commodities (green maize, pineapples, mangoes, tomatoes, 'sukuma wiki' and green peas) pass through Wakulima Wholesale Market relatively smaller volume.

2.2.2 Mombasa Market

From Mombasa Market the range of produce traded in is known but not their volumes since no research has been executed in Mwembe Tayari Wholesale Market to determine the volume which pass through it. Major commodities traded in come mostly from Taita-Taveta District. The main production centre is around Wundanyi township. Table 4 shows type of produce from Taita-Taveta District.

Table 4: Range of produce from Taita-Taveta District.

Division	Produce			
Taita	Tomatoes	Cabbages	Carrots	Onions
	Capsicums	Cucumber	Leeks	Artichokes
	Chillies	Beans	Bananas	Aubergines
	Eggplant	Marrow(Baby)		
	Kale	Marrow	Parsley	
			Mint	
Taveta	Bananas (cooking)		Bananas (table)	

Source: Field Survey 1978.

Table 3: Quantities and Origin of the 10 major commodities handled through Wakulima Wholesale Market, during March 26th - 1st April, 1972.

Commodity	Origin	Tonnage Kgs.	Percentage %
1. Cabbages	Kiambu District	83,090	34
	Nyandarua "	136,010	55.6
	Nakuru "	17,780	7.3
	Narok "	2,100	.9
2. Potatoes	Kiambu District	13,545	6.9
	Murang'a "	1,890	1.0
	Nyandarua "	54,705	27.9
	Nyeri "	6,300	3.2
	Machakos "	4,725	2.4
	Nakuru "	24,465	12.5
	Narok "	60,795	31.0
3. Bananas	Kiambu "	100	0.1
	Murang'a "	4,944	3.6
	Kisii "	76,220	55.7
	Kisumu "	7,416	5.4
4. Green Maize	Kiambu District	59,620	77.8
	Nyeri "	13,200	17.2
	Kajiado "	3,850	5.0
5. Pineapples	Kiambu District	2,702	99.1
	Machakos "	245	0.9
6. Mangoes	Machakos District	187,980	92.3
	Embu "	2,400	1.2
	Meru "	12,800	6.3
7. Tomatoes	Kiambu District	4,517	36.0
	Murang'a "	564	4.5
	Machakos "	3,495	27.8
	Kajiado "	480	3.8
8. 'Sukuma Wiki'	Kiambu District	14,006	41.6
	Nyandarua "	135,583	40.3
	Machakos "	470	1.4
	Nakuru "	1,551	4.6
9. Peas (green)	Kiambu District	405	60.0
	Nyandarua "	270	40.0
10. Carrots	Kiambu District	18,975	100.0

Source: Heinrich, F.A., Basic Data on the Domestic Horticultural Marketing System in Kenya 1972, tables 22 and 23.

In Taita around Wundanyi township the main commodity which is transported to Mombasa market is tomatoes, as exemplified in table 5 by the following rural assembly points: Wasinyi, Mbengonyi and Wesu.

Table 5: The tonnage of tomatoes as a percentage of the total weight transported in the months of January - March 1978 from three locations in Taita Division.

Assembly Point	Month of the Year (1978)	PRODUCT	
		Total Weight	Tomato weight expressed as a percentage of total weight
Wasinyi	January	4,755	
	February	2461.5	
	March	1938.5	
Mbengonyi	January	7811.0	
	February	4452.0	
	March	3699.0	
Wesu	January	4138	
	February	3555	
	March	4089	

Source: Field Survey 1978.

Although the survey covered only three months, January to March 1978, it is clear that the bulk of produce transported from Taita to Mombasa is tomatoes. The percentage share of tomatoes of the total weight of produce on the average is 74, 80 and 90 per cent for Wesu, Wasinyi and Mbengonyi respectively, for the three months when the survey was done.

2.3 Market Channels

2.3.1 Overview

The market channels for most of horticultural produce have not been investigated and described in detail. The author identified 5 channels

through which horticultural produce reach the consumer, during the survey months. See Fig. 1

- (a) Farmer - Direct Marketing
- (b) "Farmer - Middleman" Channel
- (c) Farmer - trader Channel
- (d) Group - Direct Marketing
- (e) Co-operative Society Marketing.

Farmer - Direct Marketing

This is the channel where individual farmer takes produce directly to market and sell it to the retailers (sometimes consumers). In the following text I will refer to this type of marketing as the "Farmers channel".

'Farmer Middleman' Channel

This is a type of channel where a farmer is business minded. When his/her produce is not ready he/she buys from other farmers and takes to the market and acts as wholesaler.

Farmer Trader Channel

Here real traders (middlemen) buy from farmers and take the produce to the market as wholesalers.

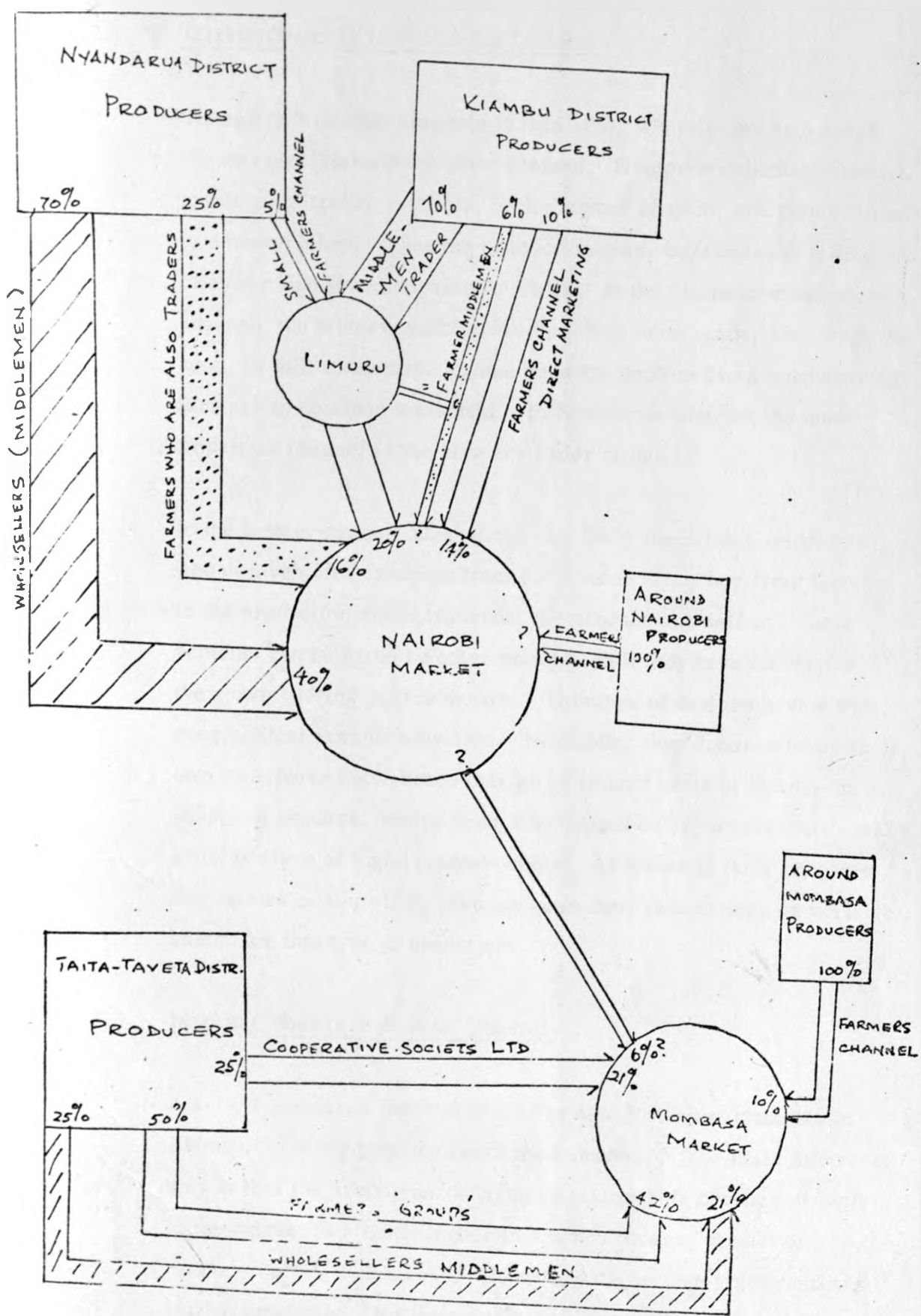
Group-Direct Marketing

In Taita-Taveta a number of farmers join together informally and market their produce. This group is not registered under the Co-operative Act and we therefore will call this type of marketing group-direct marketing.

Co-operative Society Channel

This is a channel where farmers are members of a Co-operative Society. The Co-operative Society markets the produce on behalf of its members.

CABBAGE MARKET CHANNELS.
FOR NAIROBI AND MOMBASA MARKETS.



Source: Field Survey 1978.

2.3.2 Market Channels in Nyandarua District

There are 3 market channels in this area, whereby produce reach the market. Namely farmer channel, 'farmer-middleman' channel, and farmer-trader channel. In the farmer channel, the farmer usually owns a pickup. When the produce is ready he/she takes it directly to either Nairobi, Naivasha or Thika. In the "farmer-middleman" channel, the farmer markets his/her crop when ready, but when the crop is still immature, he/she buys the produce from neighbouring farmers to continue marketing. In Nyandarua District the most important channel is the farmer-trader channel.

In the farmer-trader marketing, one finds specialised middlemen, who own vehicles, ranging from 5 - 7 tons. They buy from farmers in the production zones, transport the produce and sell it. Their vehicles can be hired by other middlemen if they have no crop of their own during scarce season. This type of dealers have a wide geographical area of operation. Normally, they underestimate their own transport costs, hence they go to remote parts of Nyandarua in search of produce, where those who depend on hired transport usually avoid because of high transport costs. As shown in later chapters the traders owning these vehicles base their calculations on variable costs for this type of operations.

2.3.3 Market Channels in Kiambu District

As in Nyandarua District there are also 3 market channels in Kiambu, whereby produce reach the consumer. The main difference only is that the proportion of farmers taking their produce directly to the market is slightly higher in Kiambu because of nearness to the market centre (See table 6). However, the farmer-trader channel is also important. But the quantity handled by the traders is much smaller as compared to that of Nyandarua. The traders in this District transport 1 - 5 bags on the average. Many of these small

dealers are mostly women who transport 'Sukuma' wiki' in big baskets known as 'Kiondos.'

In Kiambu there are also retailers who bypass the wholesalers and buy directly from farmers in production zones then transport the produce by 'matatus' to various destinations where they retail these produce in their shops, roadside sheds or in open air markets such as Uthiru and Kawangware.

A few businessmen transport large quantity by their own vehicles from Kiambu to Wakulima Wholesale Market and act as wholesalers.

2.3.4 Market Channels in Taita-Taveta District

The market channels in Taita-Taveta District are different from those found in Nyandarua and Kiambu district except for farmer-trader marketing channels, though this type of channel is less important in Taita in comparison to the other types of marketing channels.

The share of the group-direct marketing in Taita-Taveta District is surprisingly high. Groups have members ranging from 50 to 150, (usually all farmers in a village). They select office bearers who are responsible for permanently employed shed clerks. The shed clerk documents individual members produce and pays the individual at the end of the month, having deducted the running costs.

The office bearers are only remunerated for the time spend at sittings. Besides the very active groups we find at Taita-Taveta Co-operative Societies registered under Co-operative Act. The Co-operative Society Ltd. may enter into a contract with its members, either in its bylaws or by separate document binding the members to dispose all their agricultural produce through the Society, Crow and Ram (1969, P.28). See Table 6.

2.3.5 Participants and importance of different market channels

To estimate the importance of different channels the interviews were conducted at Wakulima and Mwembe Tayari Wholesale Markets, and the number of supplies in different market channels were recorded. Table 6 contains the results of randomly drawn interviews during the week(12 - 18/4/1978).

Table 6: Participants in fruit and vegetables trade supplying Nairobi and Mombasa markets grouped according to their trading channels and home districts.

Channel	District								Total	
	Kiambu		Nyandarua		T/Taveta		Misc		No.	%
	No.	%	No.	%	No.	%	No.	%		
1. Farmer-Direct marketing	3	18	-	-	-	-	1	7	4	7
2. 'Farmer-Middleman'	1	6	5	28	-	-	-	-	6	10
3. Farmer-trader	13	76	13	72	2	25	14	93	42	72
4. Group I/ 5. Co-Op. Soc. Ltd. I/	-	-	-	-	4	50	-	-	4	7
	-	-	-	-	2	25	-	-	2	4
Total	17	100	18	100	8	100	15	100	58	100

Source: Field Survey 1978.

I/ Group and Co-operative Society Ltd. each with over 50 members (not individuals)

Table 6 shows that the most important channel through which produce reach the consumer is the farmer-trader channel. This channel accounts for about 70 percent of the total sample over all the districts. If each District is taken separately the farmer trader-channel accounts for 72.0 percent in Nyandarua, whereas in Kiambu it accounts for 77.0 percent and in Taita-Taveta for 25.0 percent only. Table 6 also contains "miscellaneous Districts". Under this column all participants from

different districts other than the selected districts, were summed up. It is evident that in these areas the farmer-trader marketing channel contribute over 90 per cent.

Group and Co-operative Society channels are important in Taita-Taveta District but Group channel accounts for 50 per cent while Co-operative Societies account for 25.0 percent.

2.3.6 Harvesting, packaging, and transportation of fruit and vegetables

Fruits and vegetables are bulky and perishable, and once harvested begin to deteriorate. If handled carefully and kept fairly cool, perishables such as cabbages and "sukuma wiki" can be kept for about one week. But this is not possible in local fresh markets, where refrigerated vehicles are not used. This, then, necessitates that produce must be moved quickly to reach consumer while it is still fresh.

2.3.6.1 HARVESTING

In Nyandarua, a private trader or his representative goes to the producer early in the morning (or a day before the market day) to ascertain the amount of produce he/she is able to get from the producer. The price is negotiated. The private trader then hires people to harvest the produce. If it is cabbages, they harvest healthy big heads leaving small or damaged ones. After harvest, it is the business of the farmer to transport the produce to the point where it is accessible to the vehicle. If the farmer does not carry the produce to the accessible point the buyer deducts 2.00 per bag of cabbage (which has an average weight of 90 Kgs) See Table 7. Hired labour costs Shs. 2.00 to transport a bag of cabbages a distance of 0.5 Km. or Shs. 3.00 for a distance greater than 0.5 Km. but less than 1.5 Km.

Table 7: The net weight of sales/carrier units of 6 selected commodities traded in Wakulima Wholesale market (1975).

Commodity	Unit	Mean Weight <u>1/</u>
Cabbages	Bag	90 Kgs.
Carrots	"	116 Kgs.
Peas	"	53 Kgs.
Potatoes	"	105.1 Kgs.
"Sukuma Wiki"	"	54.2 Kgs.
Tomatoes	Ordinary Box	26.6 Kgs.

Source: Maritim, L.H.K., Analysis of Produce Flow to Wakulima Wholesale Market. (Agricultural Economics Studies No. 3). Nairobi, Department of Agricultural Economics, University of Nairobi. 1977. P. 50.

1/ Checked also by the author 1978 and both figures agreed.

These charges apply to carrots and potatoes although there is another aspect of carrots. Carrots have to be washed before bagging. The farmer has to do the washing but if he/she doesn't, the trader has to hire labour at the rate of Shs. 1.50 to wash a bag of carrot and will deduct this amount from the agreed price.

In Kiambu District harvesting is done by the farmer himself. Produce is harvested late in the afternoon, or early in the morning depending on whether the produce has to be taken to the market the same day or the following morning. Normally middlemen buy the produce and take it to Wakulima market in the afternoon arriving in the market at around 5.00 p.m.

In Taita-Taveta harvesting is done in the morning only. Assembling of produce start at 10.00 a.m. Produce is taken to local assembly point where it is documented by shed clerk with regard to ownership, type of produce and its weight.

2.3.6.2 PACKAGING

Produce is packaged for three purposes - to provide a unit of sale, convenience of handling and transportation and finally to provide protection to delicate produce such as tomatoes. There are many types of carriers used in transportation of produce: Gunny bags, wooden boxes, crates, cartons and baskets. See table 8.

Table 8: Types, weight and cost of containers used in transportation of fruit and vegetables.

Commodity	Carrier or sales unit	Container weight		cost <u>1/</u>
		Range	Mean	
		<u>Kg.</u>	<u>Kg.</u>	<u>Shs.</u>
Cabbages, carrots, green maize, 'Sukuma wiki' and potatoes Tomatoes	Gunny bag	1.5-2.5	2.0	3.00
	Small retail box	2.5	2.5	2.50
	Ordinary box	5.5-7.0	6.0	5.00
	Medium box	8.0-8.5	8.0	7.50
	Large box	10	10.0	10.50
Cauliflowers	Crate	-	-	1.50
	Carton (small)	-	-	1.00

Source: Maritim, L.H.K., Analysis of Produce Flow to Wakulima Wholesale Market. (Agricultural Economics Studies No. 3), 1977. P. 51.

1/ Field Survey 1978.

To fasten the carriers securely, nails and packaging twine are used. To make a "full" bag of cabbage, carrots and green maize, weighing anything between 80 - 120 kgs., a length of twine is required.

This was calculated to cost on the average Shs. 1.50 See table 9.

A bundle of sisal twine in Nairobi is valued at Shs. 14.00. While in the production zone it costs Shs. 18.00. A bundle of twine is used for 10 - 12 "full" bags of cabbages, carrots, and green maize, 60 bags of 'Sukuma wiki', potatoes and peas are made from the same length of twine.

Table 9: Average number of bags per bundle of twine and average cost of length of twine used per bag.

Produce	Average number of bags per bundle costing Shs. 14.00.	Average cost of twine used (per bag)
	<u>Number</u>	<u>Shs.</u>
Cabbages, carrots Green maize Potatoes, Peas and "Sukuma wiki"	10 - 12	1.50
	60	0.30

Source: Field Survey 1978.

Twinning of bags require labour which is either provided by the buyer of the produce or casual hired labour. When labour is hired to twine one bag of cabbages, it costs 4 shillings in Nyandarua District. For other commodities other than cabbages, See table 10.

Table 10. Cost of twinning one bag of produce in Nyandarua and Kiambu Districts.

Produce	Cost of twinning one bag of commodity in	
	Nyandarua	Kiambu
	<u>Shs.</u>	<u>Shs.</u>
Cabbages, carrots, Green maize	4.00	4.00
Potatoes, Peas	2.00	Owner does
"Sukuma wiki"	1.00	Owner does

Source: Field Survey 1978.

2.3.6.3 TRANSPORTATION

"Bulk handling of vegetable-oil in tankers whether-by road, rail or ship reduces the direct costs of transport" Whetham (1972, P. 110). During the Survey in Nyandarua, the author observed that bulk transportation of cabbages by 'Matatus' occurred between Bamboo and Thika, but still 99% of the products are transported and traded in bags. The buyer negotiates with the producer for the price on the basis of one bag which in the case of cabbage for instance is supposed to contain 35 - 40 heads (Large ones) or 45 - 50 heads (small ones) of drum variety, or 65 - 80 heads in case of the variety "Copenhagen." However, this phenomenon of transporting cabbages by bulk cannot be assumed to reduce the transport costs, directly as such, but rather reduce the transfer to charges (handling costs) for instance, cost of empty gunny bags, sisal twine, and cost of casual labour, for twining the bags.

To load a 6 - 7 ton lorry with bagged cabbages in Nyandarua District cost 20 shillings. But in other districts like Kiambu and Taita - Taveta all loading is done by the owner of the produce assisted by turnboys.

In Nyandarua District collection of produce takes place early in the morning till 2.00 p.m. before it starts raining. They then travel to Bamboo township where they rest before completing the journey. The reason why the truckers aim at reaching Bamboo before resting is that tarmac road starts at Bamboo and they try to avoid muddy roads when it is raining. The rest of the production zone is untarmaced and hence vehicles get stuck, many times during rainy season. Truckers from Bamboo travel straight to Nairobi, where they arrive at 5.00 p.m. They then queue up for the next market day which opens at 4.00 a.m. This means the loaded vehicles have to stay during the night in front of the market.

If the produce is hauled by buses, they are unloaded at Machakos Bus station. The dealers have to hire handcarters to take the produce to market at rates shown in table 11.

Table 11: Average cost of hiring handcart from Machakos Bus station to Wakulima Market.

Commodity	Carrier Unit		
	Bag	Box	Bunch
	<u>Shs.</u>	<u>Shs.</u>	<u>Shs.</u>
1. Cabbage, green maize, carrots, potatoes	2.00 - 2.50		
2. Tomatoes		1.50 - 2.00	
3. Bananas			0.50

Source: Field Survey 1978.

To unload a 7 ton lorry costs the owner of produce 30 shillings whatever the produce may be. But if the produce is less than a lorry load, each bag or box is charged at the rates ranging from .50 shillings per bag for light commodities such as 'Sukuma wiki' to 2 shillings per bag for heavy commodities such as cabbages. This apply for both Nairobi and Mombasa markets.

Table 12: Market fees for 1978 at Wakulima Wholesale Market per commodity.

2.4 Market Fees

All commodities and vehicles entering Wakulima Wholesale market or Mombasa market are charged a certain fee. The fee charged 1978 at Nairobi Wakulima market is shown in table 12.

Commodity	Charges per carrier unit									
	Bag	Crate	3 bundles	Car-ton	12 pineapples	25 canes	BOX			
	Shs.	Shs.	Shs.	Shs.	Shs.	Shs.	Small Retail Shs.	Ordinary Shs.	Medium Shs.	Large Shs.
1. Cabbages, carrots, potatoes, onions, Beans, Peaches, 'Sukuma wiki'	2.50									
2. Sprouts, Peas, Maize, Mangoes	3.00									
3. Cauliflower, Celery, leeks, Pawpaw		3.00								
4. Lettuce, Citrus, Plums, apples.		2.50								
5. Bananas			3.00							
6. Cucumbers, Pears.				2.50						
7. Pinapples					1.50					
8. Sugar canes						2.50				
9. Tomatoes							2.50	5.00	7.50	10.00 - 15.00

Source: Cess charges Nairobi City Council: Finance Committee held on 14/11/1977. P. 784 - 785.

Vehicles are also admitted to the market as follows: Car admission (45 shillings per month), Lorry admission (30 shillings per trip), Handcart admission (5 shillings per day). Admission charges quoted in table 12 are supposed to be charges on normal weights of produce, but traders package their produce in excess, for instance a bag of cabbages should weigh between 48 - 50 kilograms. But traders try to lower the charge by increasing the weight per bag thus exceeding the weight by upto 50 kilograms (average weight of a bag of cabbages is 90 kg.) See table 7. The City Council of Nairobi has tried to discourage this by increasing charge of overweights to 5 shillings. But due to incorrect handling of this regulation the traders are still making "profit" by handling very heavy bags.

Producers supplying Mombasa Market, because of congestion in enclosed Mwembe Tayari Wholesale Market, have shifted to the pavement and Kwashibut road. During peak hours (6.00 a.m - 8.00 a.m.) the road is completely blocked. Hence market inspectors find it very difficult to collect cess, and also because there is no proper entrance and exit as it is in Nairobi Wakulima Wholesale Market. Participants do not package their produce in excess as compared to those who supply Nairobi Market, in fact they package them in small quantities. The market fees charged on a variety of crops range from .5 shillings to 2 shillings per bag or crate. The Municipal Council of Mombasa also obtain cess from 12 auctioneers, who each is charged 150 shillings per month. The auctioneers in turn get their income from producers. Each auctioneer gets 6 percent commission for every sale made.

CHAPTER 3:

LITERATURE REVIEW

Reduction of transportation costs is of great importance to both the individual shipper and the society as a whole - Kohls and Downey (1972, P. 281). Many scholars have looked into ways and means of reducing transportation costs. A lot of work has been done, in this respect especially in developed nations such as United States of America. Many angles of transportation has been looked into, for all farm produce, for instance grains, fruit and vegetables. In general one can distinguish between two approaches to tackle the problems of transportation:

- a) The traditional "simple" cost approach
- b) and the operation research based on the more mathematically oriented systems approach.

The authors subsumed under a) approach the problems from the traditional cost theory. They worked out standard costs for the different means of transport and compare these costs with the charged rates - the emphasis is based on performance of the transport sector or the comparison of the cost of different means of transport and conclude out of these comparisons as to what mode of transport (road, rail, water and air) is more economical.

The authors following the method named under b) use the more mathematically oriented systems approach, they try at first to build a operational model of the whole transport sector. They then try to estimate the elasticities of transport tariffs and simulate optimal strategies for the use of the different means of transport. Miklius and Carrod (1976) give a good example of this approach. They used a complex model for the transport system in Michigan (U.S.A.) and tried to show optimal strategies for the shipment of apple and cherries. Due to the problems given by the complexity of the transport sector this approach needs a perfect knowledge of all parameters of the

different components of the systems. As this knowledge is simply not compilable in a developing country such as Kenya, it is not surprising that the few studies already done in Kenya use the "simple" cost approach. Consequently, this thesis will also follow suit.

In Kenya only few studies have focussed on transportation problems.

The World Bank (IBRD) has studied the problems of milk transportation, in Kenya. However, this study did not look into the performance of the whole sector, they simply recommended a better use of Kenya Co-operative creameries Ltd., vehicles and better distribution of costs to consumers according to distances transported. Schmidt (1979) in his study of the Maize and Beans market also looked into the transport costs, charged by the road transporters versus rail tariffs. As his emphasis was on the marketing of the commodities he treated the transport component consequently, as an external variable. However, it is of interest to note that the charges per ton kilometer are directly comparable to costs in this thesis.

Heinrich (1972) also looked into the aspect of modes of transport, to establish which mode of transport is important in hauling fruit and vegetables to Nairobi and Mombasa markets. He found out that road transport led in hauling the produce to the markets. Of the total quantity of produce transported to Wakulima Wholesale market, 94 per cent was by road. See table 13.

Table 13: Quantity of fruit and vegetables delivered to Wakulima Market by transport (1972).

Commodity	Total Quantity Delivered	MEANS OF TRANSPORT		
		Lorries & Pickups	Hand Carts	Railway
	<u>Kgs.</u>	<u>Kgs.</u>	<u>Kgs.</u>	<u>Kgs.</u>
Fruits	16, 108	11, 154	1, 611	3, 343
Vegetables	47, 633	43, 593	4, 019	21
Total	63, 741	54, 747	5, 630	3, 364
Percentage	100	85	8.8	5.3

Source: Heinrich. F.A., Basic data on the domestic Horticultural Marketing system in Kenya (1972)

Heinrich went on to look into transport costs to Wakulima and Mwembe Tayari Wholesale Markets in the same year. See Table 14.

Table 14: Transport costs to Wakulima and Mwembe Tayari Wholesale Markets.

Distance	Cost per ton per Km.		
	Nairobi		Mombasa
	4.5 - 7 tons	1.5 - 3 tons	4.5 - 7 tons
<u>Km.</u>	<u>cts</u>	<u>cts</u>	<u>cts</u>
0 - 30	Na	19	42
30 - 60	5	10	41
60 - 100	4	8	21
100 - 200	2- 5	5	15
200 - 500	1 -5	na	9

Source: Heinrich, F.A., Basic data on the domestic Horticultural marketing System in Kenya (1972).

Heinrich went a step further and worked out transport costs from Wakulima Market to various outlets within the town. He described the mode of transport utilized for shipping commodities from Wakulima to retailers, and the frequency of deliveries to the same retailers.

Table 15: Transport costs from Wakulima Market to Nairobi retailers 1972.

Mode of Transport	Average Transport costs		
	Bag	Box	Bunch
	<u>cts</u>	<u>cts</u>	<u>cts</u>
Hired motor-vehicle	207	66	52
Hired handcarts	169	68	42
Bus	129	61	50
Average	175	67	42

Source: Heinrich, F.A., Basic data on the domestic Horticultural Marketing system in Kenya (1972).

Another aspect of transport, which has been looked into in Kenya as early as 1973 is the estimation of transport costs of different alternatives.

This was done by the Ministry of Co-operative Development - Manual on Transport for Co-operatives of Kenya, (1973 P. 29 - 39). Cost comparisons are done to facilitate decision making, on whether to use own means or to hire a vehicle. The calculations done, were based on a 7 ton Bedford lorry. The actual cost calculated in this report was 2.85 shillings per Km. for owned vehicles (7 ton Bedford P. 37). They also quoted costs for "external" vehicles of Shs. 2.40 Km. But the report made quite clear that the cost of the cooperatively owned vehicles is a function of the kilometers driven a year. The quoted costs were calculated on a mileage of 22, 040 Km. per year. Calculations in the report showed that above 28, 387 Km. per year owned transport would be cheaper than hired vehicles (P. 38).

It will be one task of this study to countercheck the figures given in this report and the 1973 figures with the present costs. Lorenzl and Quick (1975, P. 30) felt that for planning purposes reliable data are required, especially on transfer costs to optimize the movement of horticultural products from supply areas to consumption centres. This study, thus intends to fill this very gap.

CHAPTER 4.

HYPOTHESES TO BE TESTED.

Arising from the above discussed situation the following workable hypotheses are set out for testing:-

4.1 Hypotheses as regards the structure of transport system.

1. That the farmers and traders near the market use simple transfer methods such as headloads, handcarts, donkey carts and oxcarts to ship horticultural produce to the market. But as the distance from the market increases the farmers and traders turn to more sophisticated transfer methods such as: buses, lorries, and 'matatus' to ship their produce to the market.
2. That there is a relationship between the capacity of vehicles and scale of business (size of lot), type of produce and the length of haulage.

4.2 Hypothesis as regards conduct of the transport system.

- (1) That the transfer arrangements (contracts) affect transport costs, but that there are no arrangements which give single transporters or groups of transporters the opportunity to exploit the situation.

4.3 Hypotheses as regards the performance of transport system.

- (1) That the transport charges are directly related to actual cost and therefore inflexible and hence explain the reason why, when there is a big decline of market prices for perishable, produce the prices are passed directly to the producers as low farmgate price.

- (2) That the transfer costs is charged per unit of weight, (and this means products with a high value per unit (for instance tomatoes) are less affected by long distance transport than low valued products such as cabbages).

CHAPTER 5:

METHODOLOGY OF THE STUDY.

5.1 Selection of the study areas

The methodology applied to the study is based on the time limitation given and the special difficulties given by the very complex structure of this sector of the economy. After the review of the information discussed in the literature review, it was obvious that a field survey using questionnaires was necessary, to obtain data to describe the structure conduct and performance of the transport system. Due to financial constraints, the field survey had to focus on the most important supply areas. As it was described in Chapter 2, major commodities are supplied by Nyandarua and Kiambu for Nairobi Market, and Taita-Taveta for Mombasa Market. Therefore, the main producing centres in these districts were chosen for the field survey.

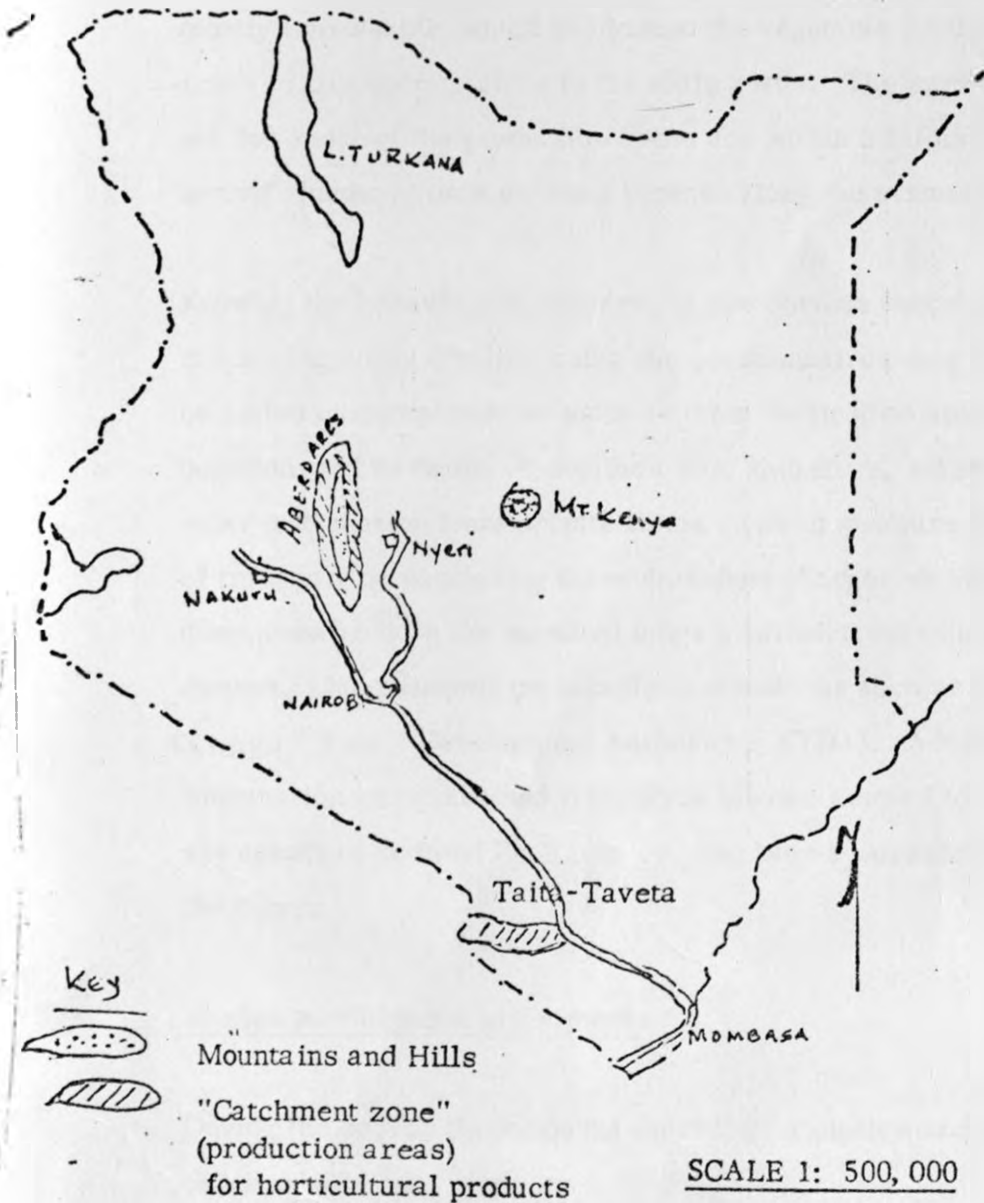
Figure 2 shows, the map of Kenya showing the main production areas supplying Nairobi and Mombasa Markets.

Figures 3 and 4 show the road connections joining the supply areas and the markets. Figure 3 shows that the Kiambu area has a very good infrastructure containing several tarmac roads.

Nyandarua area (North and South Kinangop) is linked to the main roads with one good tarmac road between Bamboo and Limuru, where it continues through Muthaiga to Wakulima Wholesale Market in Nairobi or to the main highway Nairobi - Kisumu, through Uthiru (Naivasha road) to Wakulima Market. North of Bamboo the roads are called "all weather roads" but are poor and sometimes impassable during rainy seasons.

The map illustrates that the production areas are located on the slopes of important mountains, as many vegetables are plants from temperate climates, requiring cool temperatures.

FIG 2: LOCATION OF THE STUDIED AREAS



Source: Field Survey 1978.

Figure 4 shows the road network at Taita-Taveta District. The District is connected with a very good tarmac road from Wundanyi to Voi where it joins the main Mombasa - Nairobi highway. West of Mwatate to Taveta town road is not tarmaced but all weather murrum road, which is passable whole the year round.

The small roads inside the wetter areas close to the hills are mostly impassable which has forced the vegetable production areas to concentrate close to the main roads. The survey found out that most of the production areas are within 6 kilometers radius around Wundanyi town or other centres along the tarmac road.

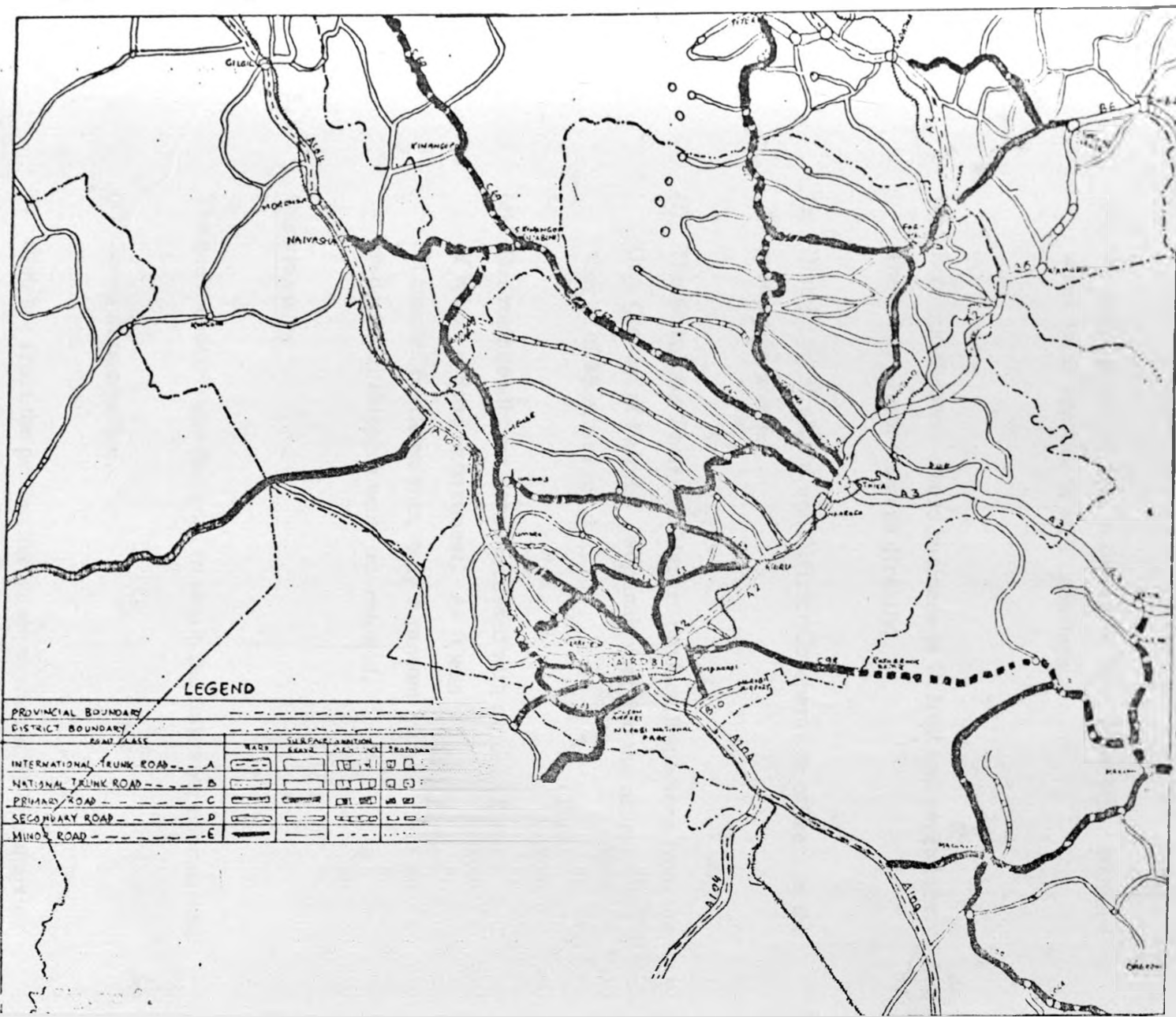
Knowing the behaviour of traders, it was obvious that the data concerning costs obtained using the questionnaires only could not be relied on completely as many of them declined to answer the questions put to them. A decision was, therefore, taken to get other information from private firms so as to measure the efficiency of transport by comparing these transport charges obtained using questionnaire with the standard costs obtained from other vehicle owners, who transport perishable commodities such as tea - (Kenya Tea Development Authority - KTDA). Additional information were obtained from Ryce Motors Kenya Ltd., who are agents of Bedford 7 ton lorries, and have a workshop for the same.

5.2 Market participants interviewed.

During the survey the following market participants and government officers were interviewed:

- (a) Truckers who rented the vehicles only.
- (b) Truckers who participated in the trade - these are the owners of the vehicles who are able to move from place to place

FIG. 3: Road connections, between Production centres (Nyandarua, Kiambu) and Nairobi.



in search of produce).

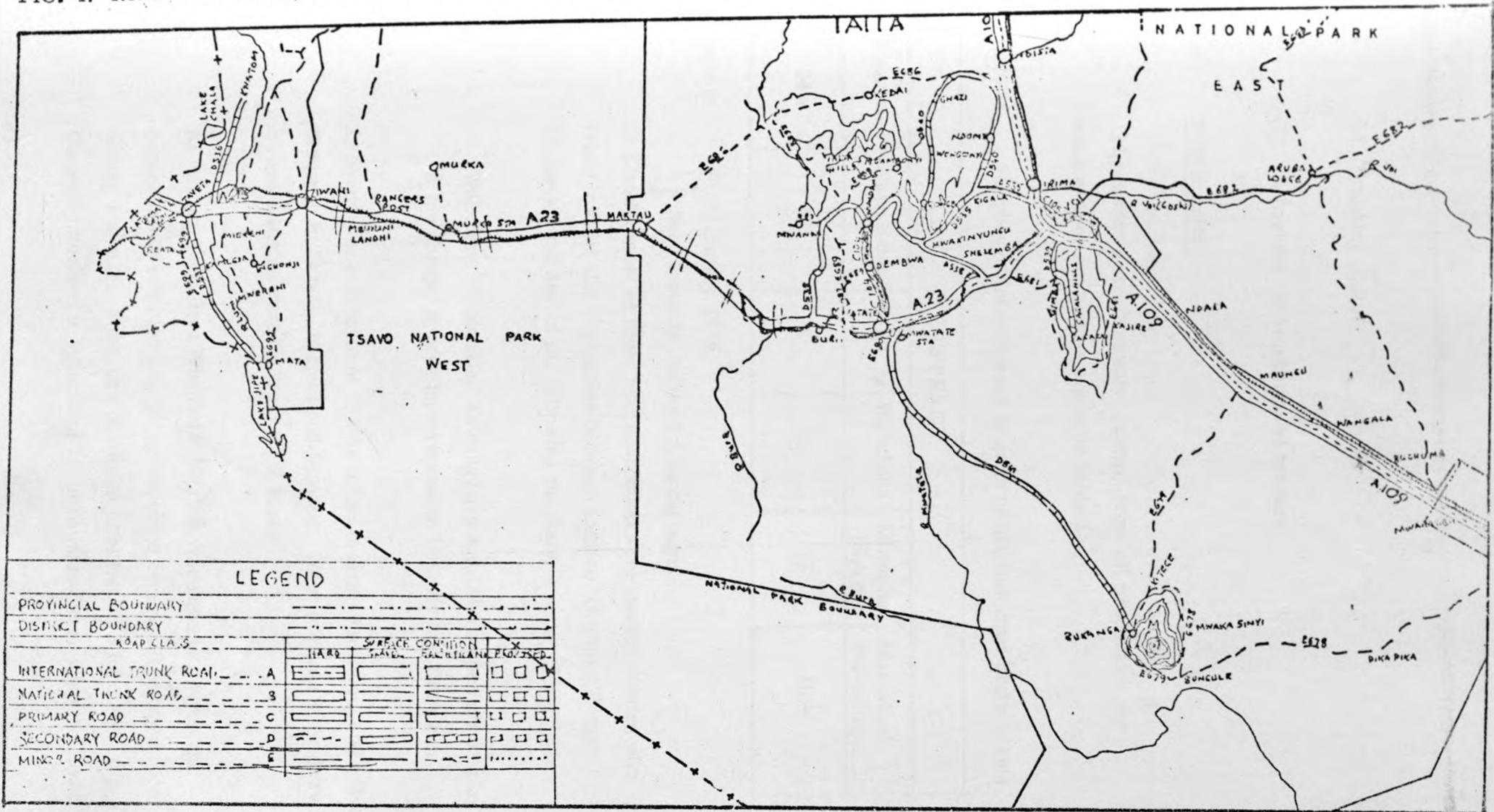
- (c) Farmers who take part in the trade buy from other farmers when their produce is still immature.
- (d) Pure middlemen - whose business is in fruit and vegetables. These buy from farmers directly.
- (e) District Agricultural and District Co-operative officers in the production zones.
- (f) The Wakulima Wholesale Market produce Inspectors from the City Council of Nairobi, superidentant and the officers in charge of Mombasa market.
- (g) The road conditions were discussed with officers in the Ministry of Works - Road Department. As it was not possible to interview all market participatants, only a random sample of the specified traders and shippers were interviewed.

5.3 Questionnaire

The questionnaire was designed to obtain the following information:

- (a) Zones of production.
- (b) Distance from the production zones to the major consumption centres.
- (c) Vehicles involved in the transfer of fruit and vegetables and their capacities.
- (d) Type of produce transported, buying prices, selling prices, and transport charges.

FIG. 4: Road connection between production centre (Taita-Taveta) and Mombasa Market.



Source: Road Map of Kenya.

(e) Transfer costs:

(f) "Behaviour" of truckers and traders.

5.4 Sample size.

114 persons were randomly drawn, from all production and consumption centres as shown in table 16.

Table 16: Number of interviewees in each production zone and markets.

DISTRICT					
Kiambu	Nyandarua	Taita 1/	Wakulima	Mwembe Tayari	Mariakani Waybridge
24	19	8	38	15	10 ^{2/}

Source: Field Survey 1978.

1 } See footnote on the following page.
2 }

In Kiambu most of those who responded were mostly women who trade in fruit and vegetables between Limuru (Limuru Rongai Market) and any of the following markets:-

Wakulima Wholesale, Kawangware and Uthiru open air markets.

A few farmers were interviewed in Uplands and Kimende.

In Nyandarua a sample of 19 was taken in South Kinangop, and a few farmers in Karati, Njabini and Bamboo. Most of those interviewed owned vehicles ranging from 5 - 7 tons.

At Nairobi Wakulima Wholesale Market, the number, types and capacities of vehicles and the transported commodities were recorded during 3 weeks. Many drivers were interviewed informally. Out of the well informed a sample of 38 were interviewed with the questionnaire.

Handcarters, porters and City Council officers were also included in the interview.

In Coast Province, samples were taken from the following areas - Taita-Taveta District, Mariakani - Waybridge and Mwembe Tayari Wholesale Market. In all a total of 33 interviews were taken. Additional information was obtained from Municipal Council officers, County Council officers and Auctioneers at Mombasa.

5.5 Data Analysis

The collected data was cross-tabulated and analysed by regression analysis. For regression analysis the ICL Standard Programme XDS3 was used. A detailed description of chosen dependent and independent variables will follow the discussion of the findings.

The data obtained on charged rates were set against the standard costs calculated according to the modern theory of costing.

1/ In Taita-Taveta District, a sample of 8 persons was taken. The reason why the sample is small is that the interviewed persons are Chairmen of groups and societies. For instance, farmers sell their produce through Co-operative Society or groups. The author interviewed the Chairmen of the following:

- (a) Werugakosa Farmers - with membership of 25
- (b) Mbengonyi Farmers - with membership of 45
- (c) Wesu Farmers - with membership of 60
- (d) Wasinyi Vegetable Growers - with membership of 50
- (e) Ngangao Vegetable Co-operative Society - with members of over 100.

2/ Discussions were held with a much bigger number to obtain more informations about the transport system.

5.6 Execution of the Survey and the problems encountered

5.6.1 Survey time and execution

As it has been indicated above the major tool which was used to obtain a primary data, was a questionnaire. The questionnaire covering the objectives of the study was prepared in October and November 1977. It was pretested in Nyeri District around Karatina in December. Changes were made and the final questionnaire typed ready for execution, which started in January and ended in May 1978.

Other types of data obtained without the use of questionnaire is the secondary data which was obtained from City Council of Nairobi, Municipal Council of Mombasa, County Councils, Societies, Ministry of Works, and Overseas Trading Company Ltd. (O.T.C.).

5.6.2 Problems encountered during the survey

Major problems during survey were lack of funds and time. The 5 month time given for data collection was too short for a detailed survey of this kind.

In the production zones, travelling from one township to another was difficult, because the researcher depended on public service vehicles. As public service vehicles have fixed destinations to travel to, 'matatus' drivers sometimes might change their minds and decide to go back the same route on half the journey, if few passengers are in (uneconomical to them). The researcher had to cover many kilometers on foot, which was difficult during rainy period of March - May in Kenya.

Communication was also difficult because most of the dealers in the production zone could not speak Kiswahili or English, but their mother tongues. Interpreters had to be hired, who also had some degree of difficulty in communication. There was also general unwillingness on the part of traders, especially those in Wakulima Wholesale Market to answer questions as regards prices and volume of produce, because most of them suspect researchers as informers of Market Inspectors or Tax officers.

Lastly, the researcher found out that records kept by traders were incomplete in most cases and unreliable.

CHAPTER 6.

STRUCTURE OF TRANSPORT SYSTEM

6.1 Introduction of transport structure

"Railroads, trucks, watercarriers and airlines all serve agriculture----"
US Department Agriculture (The Year Book of Agriculture, 1954, P. 89).
In this study, however, not the whole Sector of Agriculture has been
looked into but Horticultural Industry only.

The Kenyan economy is characterized by a dualism. We have the state
controlled sector for instance, the maize market and other main food
commodities and a private not planned (informal) sector like the market
of fruit and vegetables. The author concentrated the study on the later
to avoid influences from parastatal control organs.

The export market was not studied as it is under complete control from
many angles. Consequently air and water transport is excluded.

The remaining road and rail transports was studied and from the start
the author found out that railroad transport has become almost obsolete
in the transfer of fruit and vegetables. The rail line which used to
link Wakulima Wholesale Market and Mombasa line has closed down
(the line which used to serve the market with bananas, especially
from Uganda, and Western Kenya). This leaves road transport as
the only way, whereby horticultural produce reach the market.
According to Heinrich (1972, table 4) road transport accounted
for 85% of the produce delivered to Wakulima Wholesale Market.
Handcarts contributed 8.8%, but this also is a road transport.

6.2 Number of vehicles entering Wakulima Wholesale Market per day

A daily average of 53.3 vehicles enter the market, all the year round.

According to Maritim (1977, P. 42) a minimum number of vehicles recorded in December 1975 was 16 and the maximum number recorded was 80 vehicles per day. In the survey week (10 - 4 - 78 to 16 - 4 - 1978) an average of 62.1 vehicles entered the market from 4.00 a.m. to 8.00 a.m. (excluding vehicles which enter the market between 4.00 p.m. and 5.00 p.m.). See table 17.

Table 17: Average number of vehicles entering Wakulima Wholesale Market per day.

Day of the week	March/ April 1975	September 1975	December 1975	Total	April ^{1/} 1978
	No.	No.	No.	No.	No.
1	50	80	65	195	65
2	59	46	60	165	60
3	45	87	50	182	70
4	47	39	48	134	75
5	32	55	16	103	60
6	51	80	46	177	51
7	51	66	47	164	54
Total	335	453	332	1,120	435
Average	47.9	64.7	47.4	53.5	62.1

Source: Maritim, L.H.K., Analysis of produce flow to Wakulima Wholesale Market (Agricultural Economic Studies No. 3), Nairobi, Department of Agricultural Economic, University of Nairobi 1977, P. 43).

^{1/} Field Survey 1978.

The survey was done on 10-16/4/1978 on the number of vehicles which entered the market.

Of the vehicles which entered Wakulima Wholesale Market in the survey week (10 - 16/4/1978) a large number of them ranged from 5 to 7 tons in capacity. The rest of them were 1 to 2 tons, and 8 to 13 tons. According to Maritim (1977, P. 43) an average of 65 per cent of the vehicles entered the market only once in the Survey weeks of 1975.

Maritim found out that each day at least a different vehicle entered the market. From the average of 62.1 found by the author on the survey week of April 1978, it can be deduced that large number of vehicles are involved in the transfer of fruit and vegetables.

6.3 Categories of vehicles involved in the transfer of fruit and vegetables

6.3.1 Overview

Trucks which are involved in the transfer of fruit and vegetables can be grouped into four categories:-

- (a) Conventional trucks
- (b) Public Service vehicles
- (c) Farm vehicles
- (d) "Others"

(a) Conventional trucks

These are vehicles, especially lorries, which transfer fruit and vegetables from production zones. They are owned by traders. They are either owned individually, in group, company or Co-operative Society. They are always for hire.

(b) Public Service Vehicles

These are buses and 'matatus'. Their main function is commuting passengers from their place of residence to towns for work in the morning and back home in the evening. In the process of transporting people they also transfer fruit and vegetables. 'Matatus' are also known to be hired. And when hired, the space

where passengers usually occupy is filled with bags of produce, and also the rack. This sort of transportation is common in Kiambu where 'matatus' ply between Limuru and Nairobi. Buses transport produce also, but on the racks only (between Wundanyi and Mombasa, Karatina and Nairobi, and between Limuru and Nairobi). According to Manual on Transport for Co-operative development (1973, P. 23) Public means, where existing and applicable is in most cases the most reliable and economical. But due to very limited areas they service, they cannot be utilized all over the country.

(c) Farm Vehicles

These are small vehicles ranging from 1 - 2.5 tons mostly pickups of 1 ton in capacity. They are individually owned. They use these vehicles to transport produce to the market. Infact, according to Nation report of 1978, the largest vehicles registration in 1977 were Vans and Pickups which accounted for 63.8 percent. These vehicles, when they are not transporting farm produce, are used as leisure vehicles.

(d) "Others"

- (i) These are group of vehicles whose main function is to transport other commodities, but in their empty return journey they carry horticultural produce. Those group of vehicles are instanced by tankers (Petrol tankers and trailers) which carry various commodities to Rwanda, Uganda and Western Kenya. On their return journey they carry say 10 to 15 bunches of bananas, 3 to 4 bags of cabbages and potatoes. Family cars fall into this category. A family goes for a weekend in their car and

on their return journey come along with horticultural produce to Nairobi and Mombasa market. Some even use luxury cars such as Volvos, Mercedes and Range Rovers to transport produce to Market. A case in mind, is when the author noticed on several occasions a Volvo Saloon bringing produce to the market in the survey weeks.

(ii) Handcarts, donkey carts and ox-carts

The major function of handcarts is to transport produce from Machakos Country Bus Station to Wakulima Wholesale Market, which is about 1 kilometer. The charges is as shown in table 18. Handcarts are also used to transport produce to retail outlets.

Table 18: Average hiring charges for handcarts from Machakos Bus Station to Wakulima Wholesale Markets, for selected Commodities.

Commodity	Cost per K.Shs.	carrier	Unit
	Bag	Box	Bunch
1. Cabbages, Green Maize, Carrots, Potatoes, Sukuma wiki, Peas.....	2.00 - 2.50		
2. Tomatoes		1.00 - 2.50	
3. Bananas			0.50

Source: Field Survey 1978.

Donkey carts, and ox-carts are used in production zones only, especially around Limuru township. They transport produce from farms to Limuru Rongai Market; at varying rates depending on the distance. For a distance of about 6 kilometers the owner of the

produce is charged 6 shillings per bag of cabbages or carrots. The same apply to the ox-carts.

Table 19 below shows the categories of vehicles involved in the transfer of fruit and vegetables in Kiambu, Nyandarua, and Taita-Taveta.

Table 19: Major categories of vehicles involved in the transfer of fruit and vegetables and their percentages for respective districts.

Categories of vehicles	Districts					
	Kiambu	Nyandarua	Taita-Taveta	Miscellaneous	Total	Percentage of the total
	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	
"Matatus"	14 (74%)	2 (11 %)	-	-	16	25%
Buses	2 (11%)	-	2(20%)	1 (9%)	5	8.0%
Lorries	3 (16%)	17 (89%)	8 (80%)	14 (95%)	42	67.0%
Total	19 (100%)	19 (100%)	10(100%)	15(100%)	63	(100%)

Source: Field Survey 1978.

Figures in parenthesis are percentages of the total of each district.

6.3.2 Specific Categories of Vehicles in each area studied

Each area studied has specific categories of vehicles as described below:

6.3.2.1 Kiambu District

In smaller farms or where only small quantities is handled, women transport the produce as back loads or head loads from farm to the roadside, where the produce is bulked into bigger loads. "Matatus" and lorries then transport the produce to the market. Donkeys which are harnessed to carts (either singly, in twos or in threes) transport

produce from nearby farms to Limuru Rongai Market.

But for longer distance, motor-vehicles are used. If the farms do not have farm vehicles, private trucks, or public service vehicles are hired. Private traders also hire motor vehicles. The survey revealed that the capacity of vehicles used in Kiambu range from 1 ton to 3 tons. "Matatus" play a major role in Kiambu in transporting farm produce. These "Matatus" operate between Kimende and Nairobi (54 kilometers). The most common makes of these "Matatus" are Datsuns, Toyotas, Chevrolets and Canters.

Buses also transport produce from Limuru and Githunguri on their regular trips. To transport one bag of cabbages, carrots or potatoes from Limuru to Nairobi Wakulima Wholesale Market costs 3 to 4 shillings. The quantity carried by buses is less as compared to those carried by "Matatus".

6.3.2.2 Nyandarua District

Porters carry produce from the farms to the road, at the rate of 2 to 3 shillings per bag for a distance of about 1 kilometer. In Nyandarua, the most common form of transport is by conventional trucks ranging from 5 to 7 tons in capacity. Public Service vehicles are used to transport produce from Nyandarua to Ruiru and Thika. "Matatus" transport the produce in bulk.

6.3.2.3 Taita-Taveta District

In Taita, porters carry produce from farms to the local assembly points, where they are bulked and transported to Mombasa Market by conventional trucks and public service vehicles. See table 20.

6.3.3 Ownership of the Vehicles

The survey at Wakulima Wholesale Market also looked in to the ownership of the vehicles transporting the produce. Table 20 shows the outcome of the random sample drawn in the survey week of April 1978. 28 percent of the vehicles were personally owned by the shippers of produce, while 72 percent of these vehicles were hired. As the majority of the vehicles had almost the same capacity and load, it can be assumed also that about one third of the produce were transported by vehicles owned personally (i.e. belonging to the traders) and about two thirds of the produce were moved by hired vehicles. See table 20.

Table 20: Ownership of vehicles used.

Description	Districts			Percentage of the total
	Kiambu	Nyandarua	Taita-Taveta	
Vehicles owned personally	4 (21)	5 (25)	1 (12)	
Hired vehicles	15 (79)	14 (74)	7 (88)	
Total	19 (100)	19 (100)	8 (100)	

Source: Field Survey 1978.

Figures in parenthesis are percentages.

The findings in table 20, do not agree with the figures given by the study of Heinrich (1972, table 33 and 28), which was recorded in the two survey weeks of 4/9 - 10/9/1972 and 26/3 - 1/4/1973, that about 10-40 percent of the produce are transported by hired vehicles. Table 21 shows Heinrich figures for comparison. The development during the last five years may have brought in more private vehicles for hire. Infact the Economic Report of the Nation Newspaper (1978, P.29), reported that during 1977, the number of vehicles increased by 37 percent, the increase of pickups and vans by 63.8 percent taking 1976 as the basis.

Table 21: Characteristics of Deliveries by vehicles to Wakulima market by areas of origin weeks 4-10/9/1972 and from 26/3 - 1/4/1973

Area of origin	4 -10/9/1972			26/3 - 1/4/1973		
	Total No. of vehicles	Vehicles hired		Total No. of vehicles	Vehicles hired	
		No.	%		No.	%
Nairobi	23	0	0	28	8	28.6
Kiambu	82	4	4.9	121	64	52.9
Muranga	25	11	44.0	19	8	42.1
Nyandarua	71	1	1.4	76	25	32.9
Kirinyaga	11	3	27.3	0	0	0
Nyeri	4	0	0	5	0	0
Central Province	193	19	8.8	221	97	43.9
Total	216	19	8.8	249	105	42.2

Source: Heinrich F., Basic Data on the Domestic Horticultural marketing system in Kenya, 1972 Nairobi, Berlin 1975 table 28 and 33.

CHAPTER 7:

CONDUCT OF THE TRANSPORT SYSTEM

7.1 Overview

In this Chapter, conduct of the shippers of fruit and vegetables will be looked into to determine the effect of behaviour of individuals, on the market prices, for instance, beforehand arrangements and contracts.

7.2 Behaviour of the Market participants

Since over 60 percent of the produce are transported by hired vehicles, the behaviour of the participants was felt necessary to be looked into to determine whether these participants have any pattern when hiring vehicles, whether they hire from the same person or hire from different persons every time they make a trip. See table 22.

Table 22: Behaviour of Market participants in hiring vehicle in the Survey weeks.

Description	Districts				Total number	Percentage of total
	Kiambu	Nyandarua	Taita - Taveta	Misc.		
	<u>No.</u>	<u>No.</u>	<u>No.</u>	<u>No.</u>	<u>No.</u>	<u>%</u>
1. Those who hire from the same person always	5(21)	2(11)	5(63)	6(26)	18	(24)
2. Those who change frequently the transporters	11(46)	11(59)	3(36)	15(65)	40	(54)
3. Those who hire from the same person, but have a choice to change if need be	6(25)	2(11)	-	2(9)	10	(14)
4. Those who responded, "they didn't know"	2(8)	4(21.0)	-	-	6	(8)
Total	24(100)	19(100)	8(100)	23(100)	74	(100)

Source: Field Survey 1978.

All the figures in parenthesis are in percentages.

Table 22 indicates that 38 percent hire from the same person (24 + 14) always, but those who hire from different persons accounted to 54.0 percent of the total of the sample. But if district by district is looked into, those who hire from the same person always is 46, 58, and 38 percent for Kiambu, Nyandarua and Taita -Taveta respectively. But as regards "Miscellaneous" districts, those who change transporters frequently accounts for 65 percent. Those who hire from the same person, each time they make a trip, are as follows: 21, 11, and 63 percent for Kiambu, Nyandarua

and Taita-Taveta districts respectively, while the Miscellaneous districts, accounted for 26 percent only.

From table 22, it can be concluded that traders do not necessarily hire from the same person whenever they make a trip to the market. Although the author found out during the survey that in Kiambu if one is a constant customer, there is reduction in the rates charged. This encourages traders to hire from the same person. See table 23.

Table 23: Costs charged on customers and non-customers between Limuru and Nairobi by handcarts, 'Matatus' and buses.

Commodity	Buses		'Matatus'		Handcarts ⁽¹⁾	
	Customer	Non-Customer	Customer	Non-customer	Customer	Non-customer
	<u>K.Shs.</u>	<u>K.Shs.</u>	<u>K.Shs.</u>	<u>K.Shs.</u>	<u>K.Shs.</u>	<u>K.Shs.</u>
1. Cabbages, carrots, potatoes, maize	3.00	4.00	5.00	6.00	2.00	2.50
2. Leeks, 'Sukuma wiki' peas	3.00	4.00	5.00	6.00	1.50	2.50
3. Tomatoes	-	-	-	-	1.50	2.00

Source: Field Survey 1978.

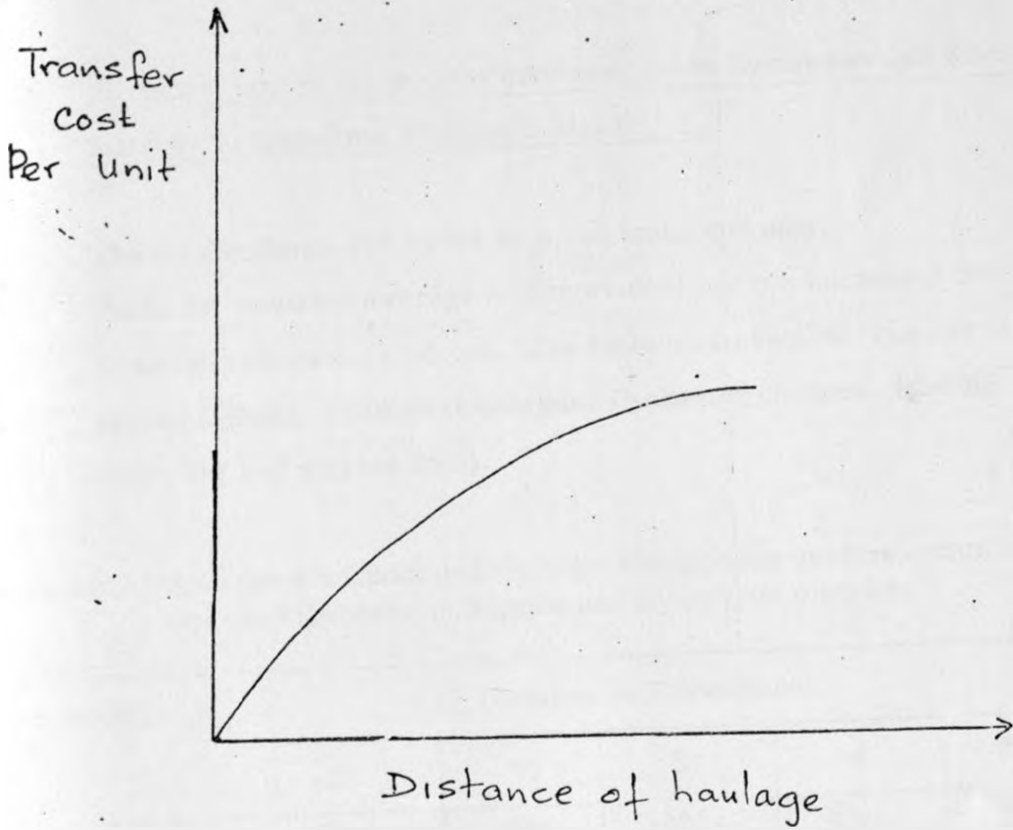
(1) Handcarts used only between Machakos Bus Station and Wakulima Market.

7.3 Transfer charges

7.3.1 The Theory

Bressler and King (1970, P.110) points out that transfer costs is usually a continuous function for most commodities, (See figure 5).

FIG. 5: TRANSFER COST PER UNIT KILOMETRE.



Source: Bressler and King (1970, P. 109)

The figure describes a situation where costs increase at a decreasing rate with distance. This usually describe commercial rates.

Figure 6 shows a total cost curve per unit in relation to distance. But for practical purpose it would be of interest to know how the cost per unit develops as distance increased. Figure 6 shows the average cost curve, developed out of figure 5 theoretically.

In this Chapter, tariffs will be looked into to find out whether the general theory holds true under different zones and produce.

7.3.2 Transport tariffs for various commodities in Nyandarua and Kiambu districts to Wakulima Wholesale Market

The tariffs shown are based on hired transport only.

Table 24, contains average transport cost per ton kilometer obtained from interviews carried out. The table also contains transfer charges (which include, Transport charges, Packaging charges, loading, unloading and market fees).

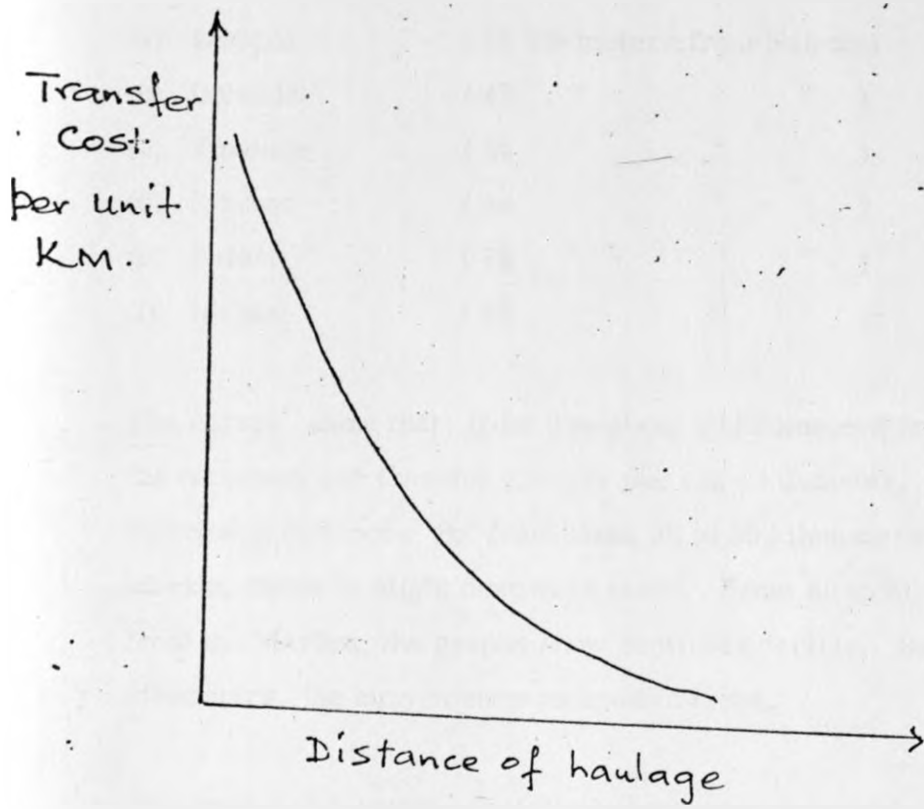
Table 24: Average transport and transfer charges for various commodities per ton-kilometer in Kiambu and Nyandarua districts

Commodity	Distance in Kilometers					
	38	47	54	64	78	88
	Shs.	Shs.	Shs.	Shs.	Shs.	Shs.
1. Cabbages (90 Kg)	1.27(4.92)	1.65(5.54)	2.06(5.15)	1.96(4.45)	1.81(3.83)	1.86(3.7)
2. Potatoes (105 Kg)	0.88(3.18)	1.52(3.55)	1.68(3.36)	1.96(3.16)	1.73(2.74)	1.56(2.7)
3. Carrots (116 kg)	0.91(3.95)	1.38(3.64)	1.52(3.49)	1.50(3.57)	1.31(3.13)	1.37(2.9)
4. 'Sukuma wiki' (54 kg)	2.00(5.25)	2.96(5.80)	3.60(5.94)	2.63(4.67)	2.90(4.57)	3.16(4.7)
5. Peas Green (53 kg)	1.49(4.85)	2.81(5.77)	3.14(5.52)	2.37(5.02)	2.81(5.22)	3.08(5.1)

Source: Field Survey 1978.

Figures in parenthesis are transfer charges for ton-km.

FIG 6: AVERAGE COST CURVE FOR TRANSFER CHARGES



Source: Field Survey 1978.

Figure 7 shows transport charges per ton kilometer expressed as graphs for each commodity. Figure 8 show the same phenomenon except that, it shows transfer charges, expressed graphically.

All the curves describe, a continuous function, through the following local assembly points:

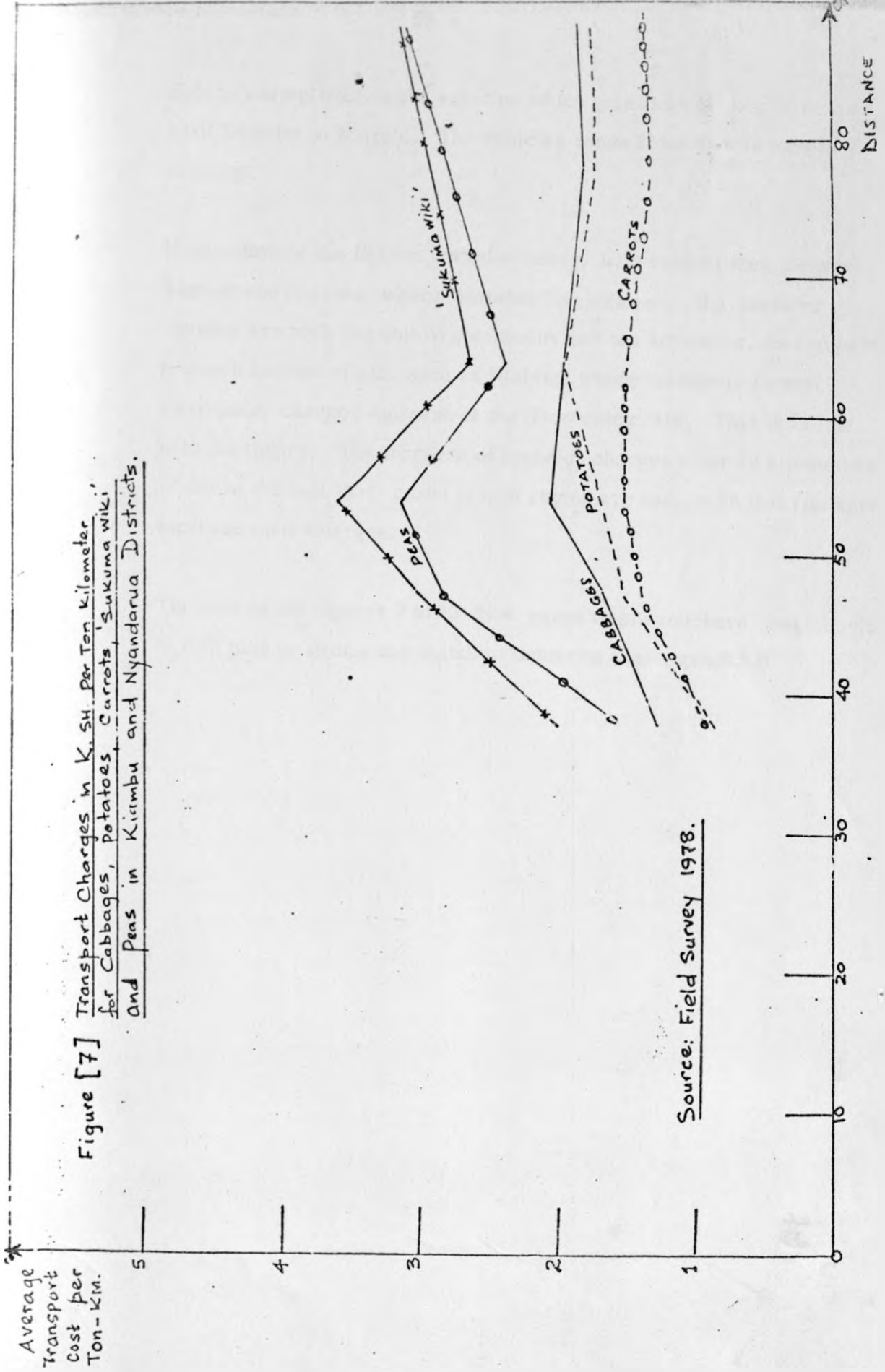
(a) Limuru	(38 kilometers from Nairobi)
(b) Uplands	(47 " " ")
(c) Kimende	(54 " " ")
(d) Bamboo	(64 " " ")
(e) Karati	(78 " " ")
(f) Njabini	(88 " " ")

The curves show that from 0 to about 50 kilometers from the Market, the transport and transfer charges per ton - kilometer, increase with increasing distance. But from about 50 to 60 kilometers from the Market, there is slight downward trend. From 60 to 80 kilometers from the Market, the graphs show continuous decline. But after 80 kilometers, the curves show an upward trend.

The continuous function, described above is expected when transfer conditions or the type of carriers used change with distance.

Observations and questionnaires, showed that from about 0 to 50 kilometers from the market, the type of carriers which are used are small, such as pickups, small lorries (ranging from 2.5 to 4.5 tons) and handcarts. Beyond 60 kilometers, the capacity of vehicles used, range from 5 to 7 tons. After 80 kilometers from the market, the curves, show an upward trend again. This suggests that bigger vehicles are required, for hauling produce to the market.

Figure [7] Transport Charges in K. Sh. Per Ton Kilometer
for Cabbages, Potatoes, Carrots, Sukuma Wiki
and Peas in Kiambu and Nyandarua Districts.



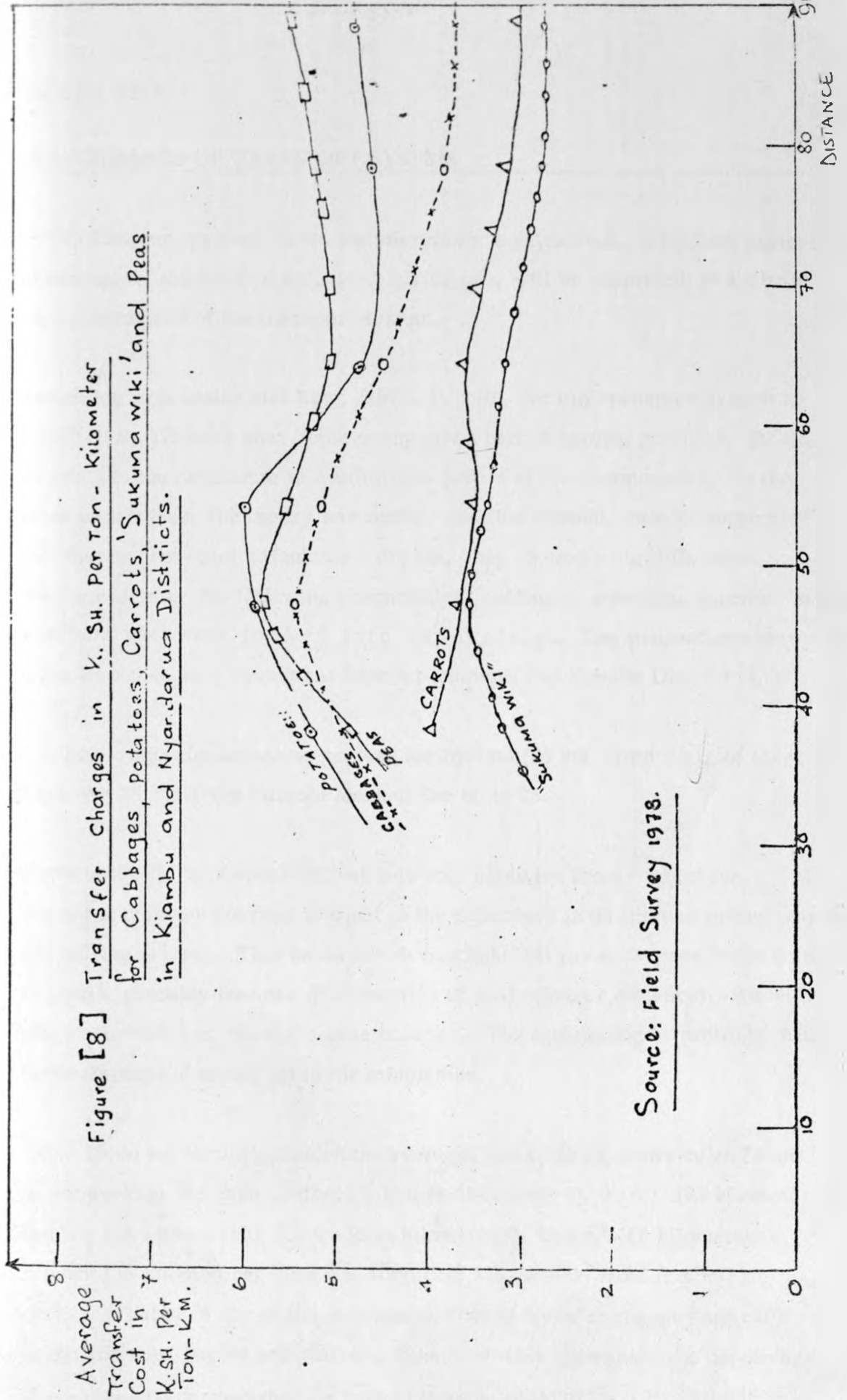
Source: Field Survey 1978.

This is exemplified by the vehicles which transport cooking bananas from Kisii District to Nairobi. The vehicles range from 8 to 13 tons in capacity.

If we compare the figures with the theory, it is evident that, between Limuru and Nairobi, where "Matatus" operate the transfer charges are high per unit of commodity per ton kilometer, as compared to zones further afield, such as Njabini, where transport as well as transfer charges increase at the decreasing rate. This is in line with the theory. The increase of transfer charges after 88 kilometers is due to the fact that roads in this region are bad, such that truckers increase their charges.

The rest of the figures 9 to 13 show range where truckers operate, that is, with plus or minus one standard deviation. (See appendix I)

Figure [8] Transfer Charges in K. Sh. Per Ton - Kilometer
for Cabbages, potatoes, Carrots, 'Sukuma wiki', and Peas
in Kiambu and Nyandarua Districts.



Source: Field Survey 1978.

CHAPTER 8:

PERFORMANCE OF TRANSPORT SYSTEM

In this Chapter, prices, costs, and margins are calculated. Also cost comparisons of owning a 7 ton Bedford vehicle or hiring one, will be examined; to evaluate the performance of the transport system.

According to Bressler and King, (1970. P. 110), for any transport system to be efficient, transfer cost between any given pair of trading partners, should be equal to the difference in equilibrium prices of the commodities. In the study undertaken, the theory was tested, and this showed, results supporting the theory, but other calculations did not, they showed a big difference.

To demonstrate, the following commodities cabbages, potatoes, carrots, "sukuma wiki" and peas were looked into separately. Two production areas were taken into account - Nyandarua District (Njabini) and Kiambu District (Limuru).

- 8.1 The following calculations were done for Njabini (88 km from Nairobi Market) and Limuru (38 Km. from Nairobi Market) See table 25.

From table 25, it is apparent that it is only cabbages from Njabini for which the transfer charges is equal to the difference in equilibrium prices (buying and selling prices). This leads one to conclude that the difference in the transfer is small, probably because of economics of scale (longer distance). But with other commodities, the difference is large. The explanation is probably that, large amounts of money go to the middlemen.

Table 25 do not show figures on the average, but table 26 shows calculations on the average for each centre; Njabini (88 kilometers), Karati (78 kilometers), Bamboo (64 kilometers); Kimende(54 kilometers), Uplands(47 kilometers), Limuru (38 kilometers), and Wundanyi (218 kilometers) from the market centres. Table 26 shows the difference between transfer charges and difference in equilibrium, buying and selling prices. The table shows also the percentage share taken by the transfer charges of the wholesale price. From table 26,

Table 25: Calculations showing the difference between equilibrium prices and transfer charges for the distance between Njabini - Nairobi

Description	Njabini - Nairobi (88 km.)					Limuru - Nairobi (38 km.)			
	Cabbages (90 kg.)	Potatoes (105 kg.)	Carrots (116 kg.)	'Sukuma wiki (54 kg.)	Peas (53 kg.)	Cabbages (105 kg.)	Potatoes (105 kg.)	Carrots (116 kg.)	'Sukuma wiki (54 kg.)
1. Transport from farm to the road($\frac{1}{2}$ km)	2.00	2.00	2.00	1.00	1.00	6.00	6.00	6.00	6.00
2. Cost of empty gunny bag	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
3. Cost of sisal twine per bag of produce	1.50	0.30	1.50	0.30	0.30	1.50	2.00	2.00	2.00
4. Cost of casual labour for twinning one bag	4.00	2.00	4.00	2.00	2.00	4.00	2.00	2.00	2.00
5. Loading cost in the absence of twinners	0.30	0.30	0.30	0.30	0.30	N/A	N/A	N/A	N/A
6. Unloading costs in the market place	0.60	0.60	0.60	0.60	0.60	N/A	N/A	N/A	N/A
7. Cost of washing one bag of carrots	-	-	1.50	-	-	-	-	4.00	-
8. Transport costs for the distance covered	14.00	14.00	14.00	15.00	14.00	3.50	3.50	3.50	3.50
9. Entry fees to the market	5.00	2.50	5.00	2.50	3.00	5.60	2.50	5.00	2.50
10. Total costs	30.40	24.70	31.90	24.70	24.20	23.00	17.30	2.50	17.30
11. Selling price at the market(wholesale)	55.00	150.00	65.00	40.50	90.60	95.50	250.00	135.00	55.00
12. Farmgate price (Buying price)	25.00	105.00	20.00	7.50	48.00	45.00	180.00	60.00	30.00
13. Difference between 11 and 12	30.00	45.00	45.00	33.00	41.50	50.50	70.00	75.00	25.00
14. The difference between equilibrium prices and the transfer charges.	0.40	20.30	13.10	8.30	17.30	27.50	52.70	50.00	7.70

Source: Field Survey 1978.

it can be seen that the difference between buying and selling prices and the transfer charges is small starting from 64 kilometers to 88 kilometers. But from 38 kilometers to 54 kilometers, the difference is big. From the same table, it is apparent that the percentage share of transfer charges increase as the distance from the Market increases. On the average the transfer charges take 41, 12, 29, 18, 23, and 19 percent of the wholesale prices of cabbages, potatoes, carrots, 'Sukuma wiki', peas, green maize and tomatoes respectively.

Another point which is apparent from table 26 is that transfer charges for commodities in Wundanyi are lower than those found in Central Province. This could be explained probably by the societies. It is hard to find individuals dealers in fruit and vegetables in Wundanyi. This lower charges could also be explained by the fact that there are good roads. The major road joining Wundanyi and Mombasa is tarmaced as compared to Nyandarua's poor untarmaced roads. Also high wholesale prices because Mombasa is a tourist centre could also explain the difference between Nyandarua and Taita-Taveta districts.

Table 27 shows average percentage share of transfer costs of cabbages, potatoes, carrots, 'sukuma wiki', peas green maize, bananas, tomatoes and parsley in Central Province (Nyandarua and Kiambu) and Coast Province (Taita-Taveta).

Table 26: Difference between transfer charges, and the difference in equilibrium prices and the percentage share taken by transfer charges of the Wholesale prices, for cabbages, potatoes, carrots, and 'sukuma wiki.'

	(a) Distance of Area of origin	(b) Average Buying price	(c) Average Selling price	(d) Difference between buying & selling price	(e) Average transfer charges	(f) Difference between d and e (d - e)	% share taken by transfer charge of the wholesale price.
	<u>Km.</u>	<u>KShs.</u>	<u>KShs.</u>	<u>KShs.</u>	<u>KShs.</u>	<u>KShs.</u>	<u>%</u>
Cabbages	38	42.50	88.50	46.00	16.84	29.17	19.03
	47	25.00	80.00	55.00	23.43	31.58	29.00
	54	21.00	80.00	59.00	25.01	33.99	31.00
	64	23.33	49.83	26.50	26.61	0.89	53.00
	78	21.75	48.75	27.00	26.91	0.09	55.00
	218	67.50	120.60	83.10	40.50	13.60	34.00
Potatoes	38	145.00	255.00	110.00	12.70	90.95	4.98
	47	150.00	260.00	110.00	17.50	92.50	6.75
	54	160.00	250.00	90.00	19.05	70.05	7.62
	64	98.33	130.00	31.67	21.25	10.47	16.00
	88	94.16	131.66	37.00	25.13	12.28	19.00
	218	84.58	130.83	46.25	27.97	18.28	21.00
Carrots	38	65.00	138.33	73.33	17.40	55.93	13.00
	47	66.33	156.66	90.35	19.83	70.50	13.00
	54	73.33	148.33	75.00	21.88	53.12	15.00
	64	23.50	65.00	41.50	26.50	15.00	41.00
	78	18.33	63.33	45.00	28.34	16.66	45.00
	88	19.13	65.00	45.87	30.08	15.79	46.00
	218	109.04	158.92	49.88	47.56	2.32	30.00
'Sukuma wiki'	38	30.20	57.40	27.20	10.77	16.43	19.00
	47	18.14	52.86	34.72	14.73	19.99	28.00
	54	18.60	62.00	43.00	17.13	26.08	28.00
	64	8.00	35.50	27.00	16.15	10.85	46.00
	78	5.50	27.50	22.00	19.24	2.76	70.00
	88	7.25	40.50	33.25	22.57	10.69	50.00
	218	24.84	55.62	30.78	21.60	9.18	39.00

Source: Field Survey 1978.

Table 27: Average percentage share taken by transfer costs of the wholesale prices of 9 horticultural commodities

Produce	Percentage Share	
	Central Province (80 km.)	Coast Province (200 km.)
	%	%
Cabbages	40.7	34.0
Potatoes	11.7	21.0
Carrots	28.8	30.0
'Sukuma wiki'	41.2	39.0
Peas	18.3	13.0
Green maize	22.7	N/A
Bananas	33.0	22.5
Tomatoes	19.0	18.
Parsley	N/A	14.

Source: Field Survey 1978.

From table 27, it can be seen that for high valued crops such as peas, their transfer charges are comparatively small as compared to low valued crop such as cabbages.

8.2 Calculations showing costs of owning a 7 ton Bedford vehicle, or hiring hiring one in Central and Coast Provinces

In the Sub-chapter, a 7 ton Bedford lorry is considered. Its average life time is given in terms of kilometers (250,000 Km.). Type of fuel used is diesel. The figures used are from the following sources: Kenya Tea Development Authority (Litein Factory in Kericho), Ryce Motors Limited (Workshop in Industrial Area Nairobi), and from vegetable transporters themselves (using questionnaires).

The calculations shown in the Appendix II shows two alternatives of either owning a vehicle or hiring one, and which of the two is cheaper. These calculations are summarised in table 28. From the table it is apparent that there is no cost advantage for vegetable transporters to own a vehicle, except probably for convenience of availability when required. For vehicle to move one kilometer, it costs the owner in Nyandarua District Shs. 4.14 per kilometer, and K. Shs. 3.67 per kilometer in Taita-Taveta District. To transport a lorry load of cabbages, potatoes, carrots, "sukuma wiki" and peas, in hired vehicle, costs K. Shs. 4.30, 4.97, 4.39, 7.50, and 7.30 respectively (i.e. in Nyandarua, between Njabini and Nairobi), and costs K. Shs. 4.33, 4.87, 4.15, 6.77, and 6.44 for the same commodities respectively (between Karati and Nairobi). And for any commodity in Taita-Taveta its costs K. Shs. 3.85 per kilometer.

If costs per kilometer are compared between owned vehicle and hired, it is clear from the table, that is no much difference (taking into account that, the owner of the vehicle has to add a return to investment) except for peas and "sukuma wiki". The explanation which can be given, for this big difference is that in Nyandarua District, transporters are charged transport cost per bag of "sukuma wiki", peas or cabbages, regardless of the weight. (Cf. Taita-Taveta where transporters are charged per kilogramme of commodity). This means in essence, that light commodities such as "sukuma wiki" and peas are overcharged. So that when one compares transport per ton kilometer its high for light commodities. As regards Taita-Taveta District, where transport charges are per kilogramme, the difference is very minimal, indicating that, hiring or owning a vehicle, is of no importance to vegetable transporter.

Table 28: Cost comparison between own and hired transport

Own (7 ton Bedford lorry)				Hired (7 ton Bedford lorry)			
NYANDARUA		TAITA-TAVETA		NYANDARUA		TAITA-TAVETA	
<u>Fixed Costs</u>		<u>Fixed Cost</u>		(a) Between Njabini and Nairobi a distance of about 200 Km. return journey		In Taita-Taveta District transport of produce is charged by kilogrammes rather than bag. 1 Kg. is charged .24 Shs. to transport 436 Km. return journey (no back haul) therefore to transport a lorry load of any produce = $7,000 \times .24$ 436 = <u>3.85 Shs. per Km.</u>	
	<u>Cost/Km.</u>		<u>Cost/Km</u>		<u>Cost/Km.</u>		
Depreciation	0.71	- Same as those of Nyandarua		Cabbages	4.30		
Insurance	0.43			Potatoes	4.97		
Licences	0.08			Carrots	4.39		
Interest	0.67			'Sukuma wiki'	7.50		
Administration	0.10			Peas	7.32		
Wages & Salaries	0.63						
Sub-Total	2.62		2.62				
<u>Variable costs</u>		<u>Variable costs</u>		(b) Between Karati and Nairobi a distance of about 180 Km.			
	<u>cost/Km.</u>		<u>Cost/Km</u>				
Fuel and oil	0.63	Fuel and oil	0.440	Cabbages	4.33		
Repair & Maintenance	0.20	Repair & Maintenance	0.124	Potatoes	4.87		
Overhaul of Engine & Gearbox	0.36	Overhaul of Engine & Gearbox	0.250	Carrots	4.15		
Tyres	0.33	Tyres	0.24	'Sukuma wiki'	6.77		
Sub-Total	1.52		1.054	Peas	6.44		
GRAND TOTAL = 4.14 Shs. per Km.		3.67 Shs. per Km.					

Source: Field Survey 1978.

8.3 Regression Analysis

The data collected in Central and Coast Provinces were subjected to a regression analysis; with farmgate price as dependent variable. Terminal charges, packaging material costs, wholesale prices, cost per ton kilometer, and dummy variable, as independent variables. The dummy variable was introduced into the model to take care of seasonality. Zero for months starting December 1977 to March 1978, and one for months starting April to June 1978. It is important to point out here that no dummy variable was used for the Coast Province and (for peas in Central Province), because observations took place during one season only.

The following Model was developed and tested; as regards the factors affecting farmgate price in relation to the wholesale price and cost factors:

$$F_p = b_0 + b_1 S_p + b_2 \text{TERMC} + b_3 \text{PACKC} + b_4 \text{TRANSC} + b_5 \text{SEAS} + e_1$$

Where	F_p	-	Farmgate price
	S_p	-	Selling price (wholesale)
	TERMC	-	Terminal charges
	PACKC	-	Packaging costs
	TRANSC	-	Transport costs per ton kilometer
	SEAS	-	Seasonality (Dummy variable relating to seasons)

The model is a general one. It is assumed that farmgate price is affected by the transfer charges and seasonality. Tables 29, 30 and 31 give the correlation matrix, the coefficients of the regression and the values of R^2 , where

$$R^2 = \frac{\sum (\hat{Y} - \bar{Y})^2}{\sum (Y - \bar{Y})^2} = \frac{\text{Explained variation of } Y}{\text{Total variation of } Y}$$

Factors affecting farmgate price

Correlation Matrix

Table 29, shows correlation matrix, between farmgate prices and wholesale price and dummy variable. From the table, it can be observed that there is a strong positive relationship between farmgate, wholesale price and the seasonality, for both Central and Coast Provinces. This indicates that, whenever, there is a price change in the market, due to supply and demand, there is always a move either downward or upward (for both farmgate and wholesale prices) depending on the supply in the market. If the supply of fruit and vegetables is high (glut season), prices tend to move downwards, and this is passed back to the farmers as low farmgate price. If there is scarcity, as it was in the months of April to June 1978, the prices of fruit and vegetables is high, and this is passed back to the farmers as high farmgate price.

From the foregoing discussion, one can conclude that it is not only the transport costs which affect farmgate price as regards distance from the market, but also seasonality.

Table 29: Reduced correlation Matrix showing the relations between Farmgate prices, wholesale prices and dummy variable

Commodity	Central Province			Coast Province
	Item	Wholesale Price	Dummy variable	Wholesale
Cabbage	Farmgate	0.584	0.505	0.955
"Sukuma wiki"	"	0.716	0.770	0.662
Peas	"	0.464	†	† †
Carrots	"	0.947	0.957	0.963
Potatoes	"	0.855	0.751	† †
Tomatoes	"	† †	† †	0.534

Source: Field Survey 1978

† Dummy variable was not included for peas.

† † Commodities not studied in each of the provinces.

Regression coefficients

(a) Central Province:

Cabbages. Overall this analysis explains about 73 percent of the variability in farmgate price of cabbage. As shown on the table 30, the expected sign as regards distance is negative. As the distance from the market increases, the more it affects the farmgate price. Of the other independent variables in the analysis only terminal charges and seasonality factor had a statistically significant effect.

"Sukuma wiki". Farmgate price of "Sukuma wiki", is affected by wholesale price, terminal charges and transport costs per ton kilometer. As it was expected, the negative sign indicates the effect distance from the market, as "Sukuma wiki" is a low-valued product, so that transport costs are major part of its marketing margin. The analysis explains about 94 percent of the variability in farmgate price of "Sukuma wiki".

Peas. The analysis explains about 67 percent of the variability in farmgate price. But one point to note is that the zero-one variable was not included in the regression set from the beginning as the observations took place before April 1978. The transport costs coefficient as was expected is negative, which is also very significant. The other variable which is significant is the packaging material costs.

Carrots. 92 percent of the variation of the dependent variable is explained by the equation. But it is worthwhile noting that, not a single variable is significant. Transport costs variable is cut off because it is very insignificant.

Potatoes. The analysis explains 79 percent of the variability in the farmgate price. As shown by the coefficient on S_p , the farmgate price on the average is 79 percent of the wholesale price. Transport costs is significant, but not with expected sign. The positive sign can be explained in terms of monopoly. Those trading in potatoes are few, and mostly own their vehicles. As it has

been said in earlier chapters, potatoe traders move from one region to another without taking into account the extra variable costs incurred. The aim is to get potatoes, and market it.

The Durbin - Watson test for all the commodities, cabbages, "sukuma wiki", peas, carrots and potatoes, are satisfactory significant so that, some confidence can be placed in the estimates.

(b) Coast Province:

In Coast Province, the regression set included the following commodities, cabbages, "sukuma wiki", carrots and tomatoes. From the table 31, the following can be deduced: One, that transport costs coefficients cannot be ascertained, because the variable was not included in the set, (coefficients cut off - Pivot). This due to the fact that commodities are shipped to the market from the same point. There was no variability in distance. Secondly, the factor which is significant (affecting farmgate price) is wholesale price, for all the four commodities except "sukuma wiki". Terminal charges are also statistically significant for "sukuma wiki" and tomatoes. Overall, all their analysis explains about 91 percent, 93 percent and 59 percent of the variability in farmgate prices of cabbages, carrots and tomatoes respectively. It is only the "sukuma wiki" where R^2 is very low (15 percent).

The Durbin Watson statistic for cabbage is only significant at 5 percent significant points of d_1 and d_u , when $K = 3$. All others show some degree of positive correlation, such that very little confidence can be placed on the estimates used.

Table 30: Factors that affect farmgate price in Central Province

$$F_p = \alpha_1 + b_1 SP + b_2 \text{TERMC} + b_3 \text{PACKC} + b_4 \text{TRANSC} + b_5 \text{SEAS} + e_1$$

Commodity	Regression coefficients on						R ²	D - W Statistic	Degrees of freedom
	Intercept	SP	TERMC	PACKC	TRANSC	SEAS			
Cabbages	64.28* (7.50)	0.07 (1.02)	- 4.82* (4.51)	- 0.06 (0.98)	- 9.11* (2.96)	6.45* (2.44)	.73	2.15†	32
"Sukuma wiki"	47.63* (2.38)	0.32* (3.25)	-4.00* (3.21)	- 4.10 (0.80)	- 7.65* (8.28)	5.89 (1.07)	.94	2.48†	16
Peas	-30.60 (0.55)	0.17 (1.28)	0.63 (0.34)	19.60* (2.40)	- 12.79* (2.13)	†	.67	1.51†	7
Carrots	18.62 (0.44)	0.23 (1.04)	-3.22 (0.70)	0.62 (0.16)	†† (0.14)	25.40 (1.24)	.92	1.45†	14
Potatoes	- 42.55 (1.15)	0.60* (3.86)	-1.47 (0.18)	7.43 (1.26)	17.96* (1.86)	8.35 (0.36)	.79	1.93†	22

Source: Regression analysis described in text.

+ Seasonality on peas was not included, as the observations took place in one season only (December - March 1978).

†† Variable not in regression set -----

Figures in parenthesis are t. statistic. figures.

* Significant at 0.05 level.

† 5 percent significance points of d_1 and d_u ,
and $K = 4$.

Table 31: Factors that affect farmgate price in Coast Province (TAITA)

$$F_p = \alpha_1 + b_1 SP + b_2 TERMC + b_3 PACKC + b_4 TRANSC + e_1$$

Commodity	Regression - coefficients on --				R ²	D - W Statistic	Degrees of freedom
	Intercept	SP	TERMC	TRANSC			
Cabbages	- 0.24* (4.26)	0.85* (31.31)	-0.23 (1.10)	** (1.20)	0.91	2.25*	94
"Sukuma wiki"	- 0.26 (0.66)	0.47 (1.62)	1.55* (2.00)	** (0.02)	0.15*	0.98	24
Carrots	-0.25* (2.44)	0.92* (14.01)	-0.47 (1.18)	** (0.36)	0.93	0.71	14
Tomatoes	-0.27 (1.05)	0.37* (4.69)	4.51* (8.41)	** (0.44)	0.59	1.35	93

** Variable not included in the set. Cut off (Pivot) because, all commodities are shipped to the market from one point

* 5 percent significance points of d_1 and d_u and when $K = 3$.

CHAPTER 9.

HYPOTHESIS TESTING AND ANSWERING QUESTION RAISED EARLIER

This Chapter concentrates mainly on the testing of workable hypotheses, and attempts to answer questions raised earlier on, as regards transportation of fruit and vegetables.

- 9.1 The first hypothesis states: that farmers and traders near the market use simple transfer methods such as headloads, carts and bicycles to ship their horticultural produce to the market. But as the distance increases from the market, farmers, as well as the means of transport used are replaced by traders who use 'Matatus', buses and lorries to ship commodities to the market.

This hypothesis holds true. Farmers especially in the production zones, use their heads or backs to transport produce to the local assembly points. This is exemplified by farmers in Taita, and Nyandarua districts. In Nyandarua, because of poor accessibility to the farms, farmers usually carry their produce to the road where lorries pick them up. If not, they are deducted 2/- per bag, for a distance of half a kilometer distance, or 3/- for a distance of more than half kilometer. In Taita, it is the owners of produce who take them to the group's centre or the Society's collecting place. In Kiambu, donkey-carts are the ones used most frequently. They are harnessed to the cart singly, in twos, or threes. In Wakulima Wholesale Market, produce are brought from Machakos bus station by handcarts.

These types of transfer methods do not apply when distance increase. They are replaced by large vehicles such as 'Matatus' ranging from 1 ton to 2.5 tons, when the distance from the market is about 30 kilometers. But when the distance increases further still to about 60 kilometers, they are replaced by lorries, which range from 3 tons to 7 tons.

- 9.2 That there is a relationship between the capacity of vehicles, scale of business (size of lot), type of produce transported, and the length of haulage.

This has been discussed in early Chapters. It is apparent that, near the market, the vehicles used are of low capacity 1 ton to 2.5 tons. Traders as well as farmers transport to the market even one bag of cabbages, potatoes and leeks. A case witnessed during the survey weeks, was a trader from Kijabe who brought to the market only two bales of leeks. Women also go to Limuru Rongai Market to buy two or three bags of 'Sukuma wiki.' But as distance from the market increases, this is replaced by bigger vehicles. For instance in Nyandarua, about 70 kilometers from the market, the vehicle capacity range from 5 tons to 7 tons. The same case applies to Taita-Taveta District about 250 kilometers from the market, the type and capacity of vehicles used range from 7 tons to 8 tons. Farmers group themselves and send their produce in a bulk, rather than individuals. Kisii District which supplies Nairobi market with bananas (cooking) sends its produce there by lorries ranging from 8 tons to 13 tons. To sum up, for nearby areas, 'Matatus' are used to ship commodities to the market, but as distance increases, lorries take their place. Also the type of produce change with distance. Near the market, it is mostly the very perishable commodities, such as 'Sukuma wiki' but as distance increases, such commodities as potatoes and bananas replace the most perishable commodities.

- 9.3 That transfer arrangements affect transport costs. As it has been discussed in Chapter 7, transport arrangements affect transport costs. This was very apparent in Kiambu District, especially between Limuru Rongai Market and Wakulima Wholesale Market. See table 23. For 'Matatus' to transport one bag of cabbages, carrots, potatoes, maize, 'Sukuma wiki' and peas from Limuru Rongai Market to Wakulima Wholesale Market, they charged

5 shillings to customers, and 6 shillings to non-customers. But bus owners charge 3 shillings to customers and 4 shillings to non-customers. The same case applied to the handcarts from Machakos Bus Station to Wakulima Market. Their prices range from 1/50 to 2/- for customers, and 2/- to 2/50 for non-customers, showing that collusion affect transportation, and hence not a pure perfect market.

- 9.4 That the inflexibility of transport costs explain the reason why when there is a sharp market price decline for perishables is passed directly to the producers as low farmgate prices.

The results discussed in Chapter 8, on regression analysis, shows that most of the coefficients on wholesale price are significant in general. This means that if prices are high in the market this is usually passed back to the farmers. But if the prices are low in the market, this is passed to the farmers as low prices as transport costs are constant per ton-kilometer.

- 9.5 That the transfer of high valued commodity regardless of distance covered is very small.

If a commodity is of high value, transfer charges take a small percentage of wholesale price, depending on the region where the produce is produced. See table 27. On the average, transfer costs of peas take 13% of the wholesale price in Taita-Taveta, but in Central Province, this is about 18%. But if crops are of low value, such as "Sukuma wiki" and cabbages, transfer charges for cabbages and "Sukuma wiki" are 41.2 and 40.1 percent respectively in Central Province. While in Coast Province for the same commodities, transfer charges take 34 and 39 percent.

CHAPTER 10:

SUMMARY AND CONCLUSION

The study revealed that a large number of vehicles is involved in the transfer of fruit and vegetables from surplus areas to deficit zones. These vehicles can be grouped into four categories namely: Conventional trucks, Public service vehicles, Farm vehicles and "Others."

About 50 kilometers from the market, 7 ton Buses and small vehicles ranging from 1 to 2.5 tons do operate. The small vehicles include farm vehicles (pickups), Public service vehicles ('Matatus') and "Others" (Saloon cars). After 50 km. buses are replaced by 5 to 7 ton lorries (Bedford and Ford vehicles). But there is an exception that in Taita-Taveta District 7 ton lorries operate and yet it is over 200 kilometers from the market. This could be due to three reasons. One, that road connecting Mombasa market and Taita-Taveta District is tarmaced. Two, that the farmers in this zone transport their produce collectively as Co-operative Societies or groups. Finally, the produce transported are high value especially tomatoes. Beyond 200 kilometers, one finds mostly 8 to 13 ton lorries operating. These transport mostly goods which do not quickly perish for instance bananas and potatoes. In this category, it is common to find oil tankers carrying 10 to 15 bunches of bananas on their empty return journey to either Nairobi or Mombasa.

Most of these vehicles involved in transfer of fruit and vegetables are mostly hired. Individuals interviewed indicated that they hire vehicles from different owners, depending on the availability and not necessarily from the same person whenever they make a trip to markets. The volume traded in by individuals range from 2 bags to a lorry load. It is common to find several traders grouping up to buy produce to fill one lorry. This indicates that there is no monopoly as regards both business and vehicles.

The transfer charges was found to be equal to the difference between average wholesale price and the average buying price, for cabbages in Nyandarua only,

as compared to Kiambu District. The rest of the crops, potatoes, carrots, "Sukuma wiki" and peas showed a big difference, which suggest that probably a large percentage of these goes to the middlemen. The study also revealed that, the percentage share of the wholesale price taken by transfer charges increases with increasing distance from the market, and this affects low valued crops more than high valued crops. This implies that low valued crops should be grown close to the consumption centres, and high valued crops such as tomatoes further afield.

Calculations based on a 7 ton Bedford vehicles, indicated that, there is not much advantage of owning a vehicle as compared to hiring one. The calculations indicated that own vehicle will only pay if intensively used (that is to cover over 40,000 kilometers per year) and well planned as to get backload in most of the trips made.

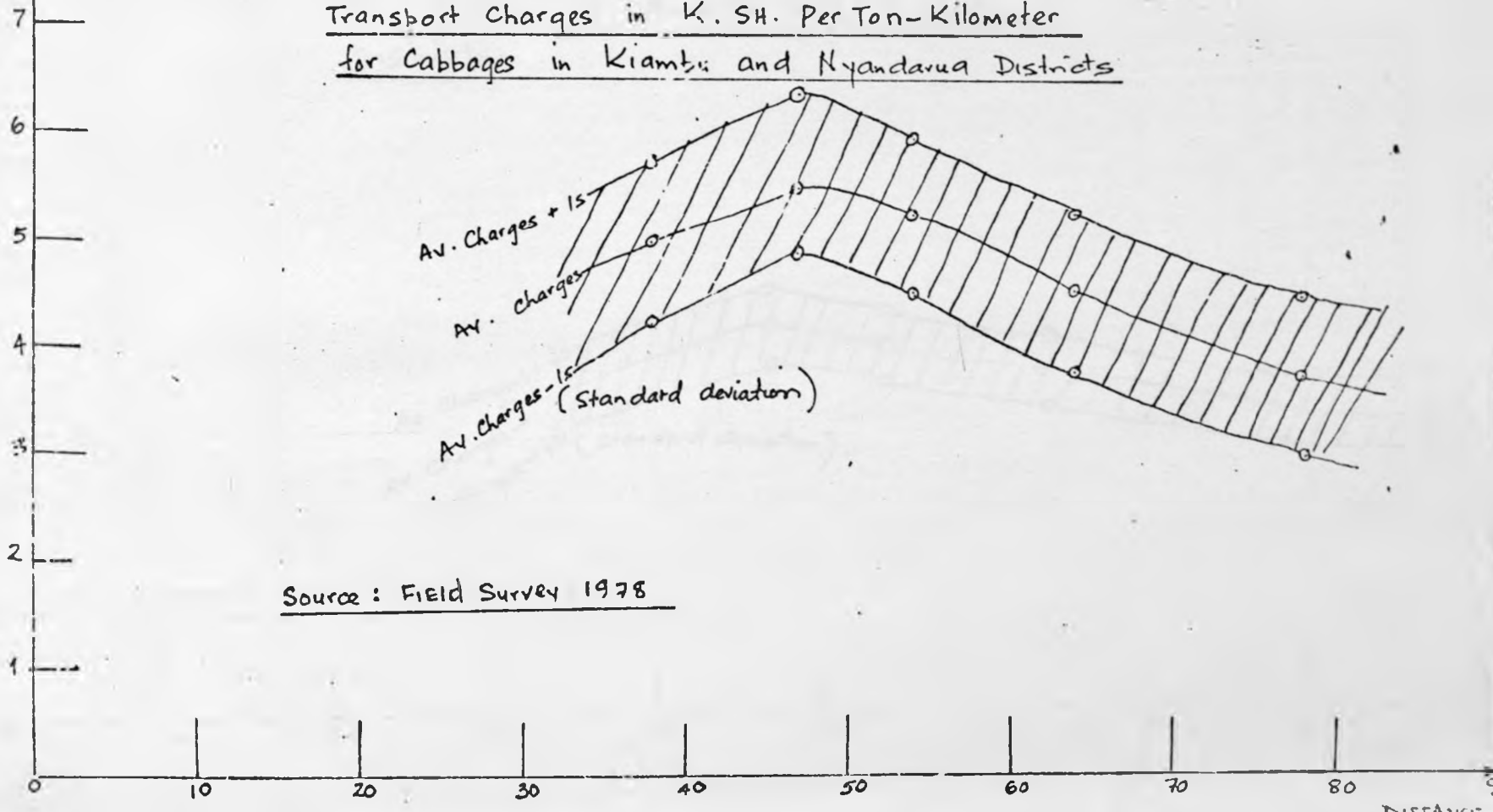
From the study also it was found out that, where roads are poor (Cf Nyandarua and Taita-Taveta Districts), the transport costs are high. In this regard, roads in Nyandarua should be first priority in improvement, to reduce the apparent high transport costs.

In Nyandarua, transport of produce was in terms of bags, rather than in kilogrammes. It is therefore expensive to transport high commodities as compared to heavy ones. What the project advocates, is that all the produce from surplus areas should be transported in terms of kilogrammes (Cf Nyandarua and Taita-Taveta), rather than in bags, as this tend to overcharge on high commodities.

Average
Transfer
Cost in 8
K.S.H. per
Ton-KM.

Figure [9]

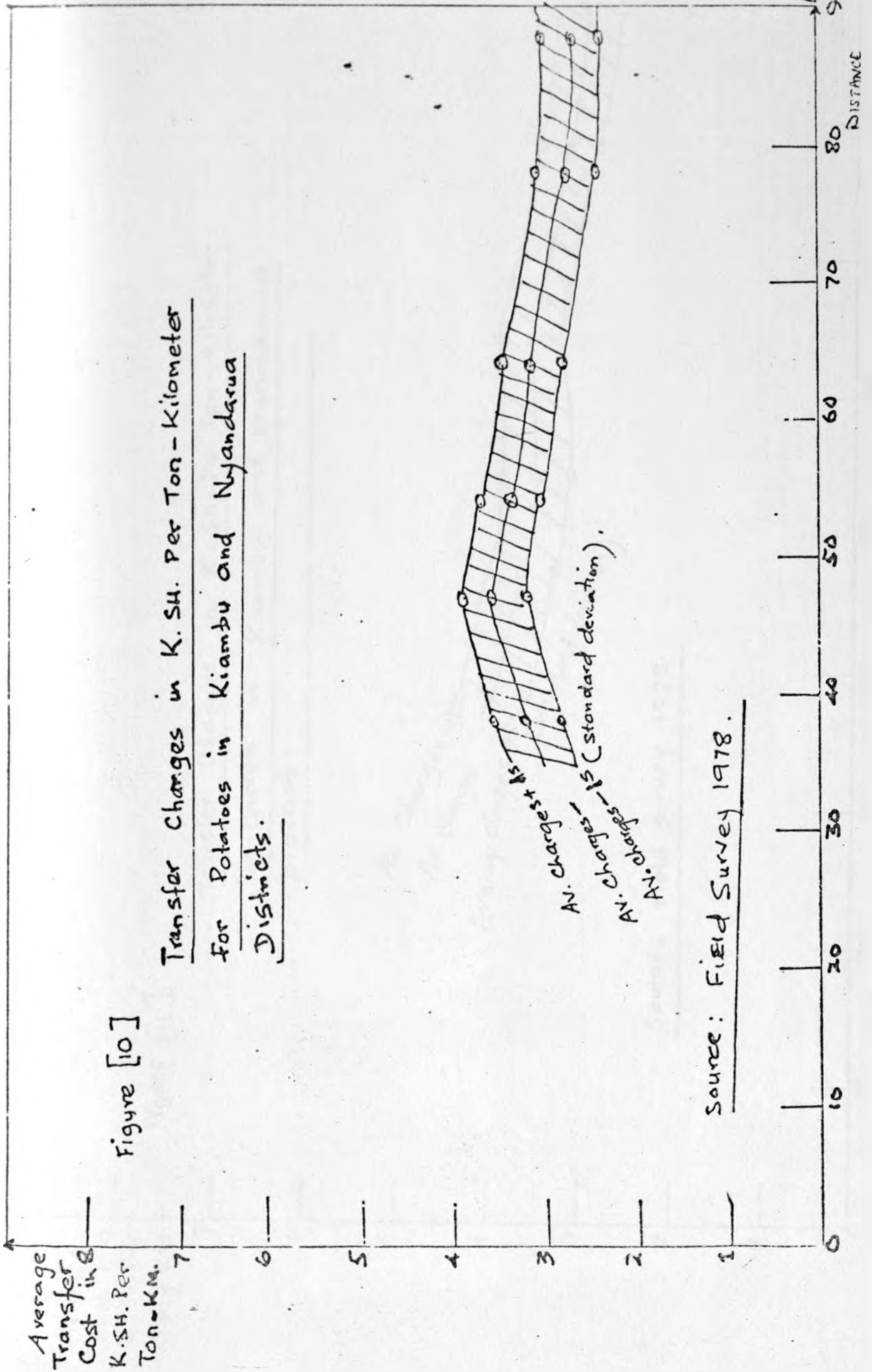
Transport Charges in K. Sh. Per Ton-Kilometer
for Cabbages in Kiambu and Nyandarua Districts



Source: Field Survey 1978

Figure [10]

Transfer Charges in K.S.H. Per Ton - Kilometer
for Potatoes in Kiambu and Nyandarua
Districts.



Source: Field Survey 1978.

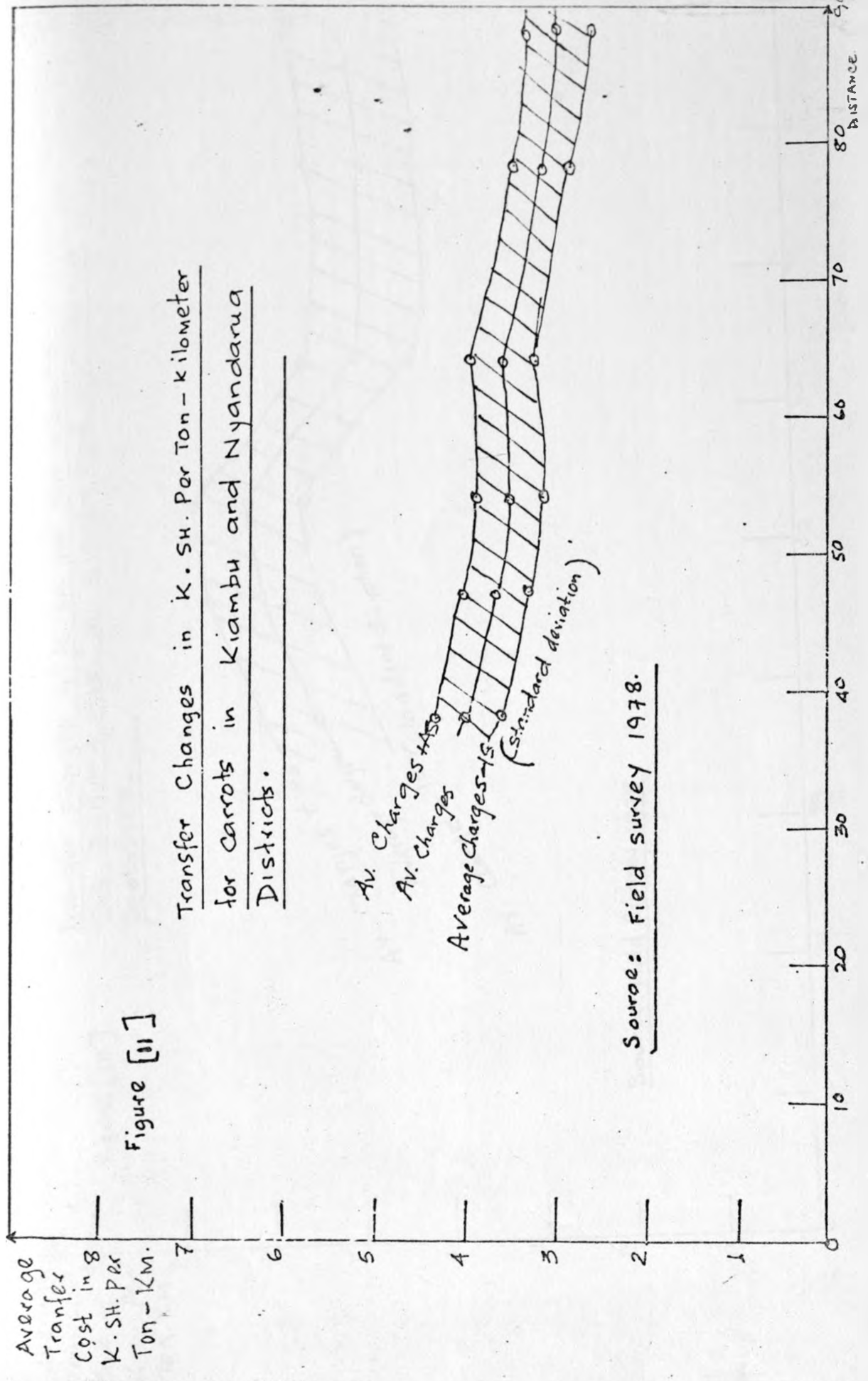


Figure [11]

Transfer Changes in K. Sh. Per Ton - kilometer
for Carrots in Kiambu and Nyandarua
Districts.

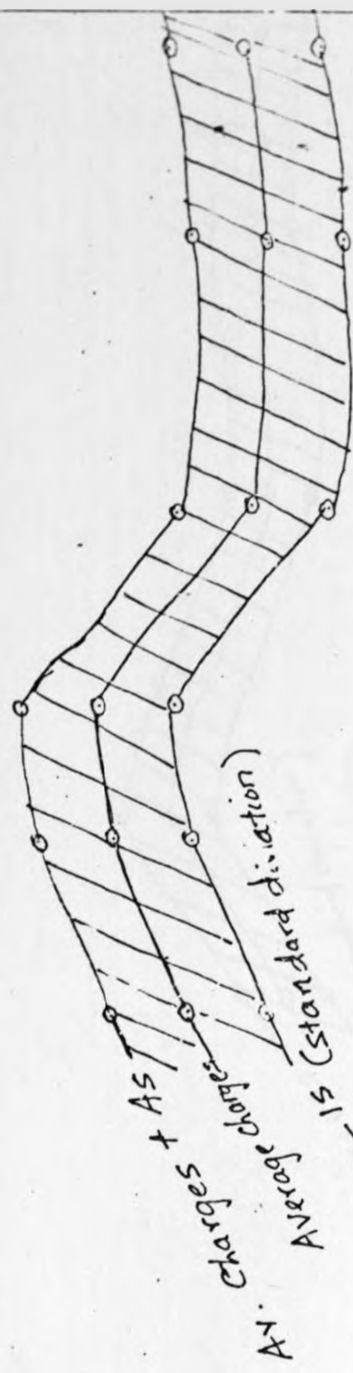
Av. Charges + 1.5
 Av. Charges
 Average Charges - 1.5
 (Standard deviation)

Source: Field survey 1978.

Transfer charges in K. Sh. Per Ton Kilometer
FOR "SUKUMA WIKI" in Kiambu and Nyandarua
Districts.

Figure [12]

Average
Transfer
Cost in
K. Sh. Per
TON. KM. 7



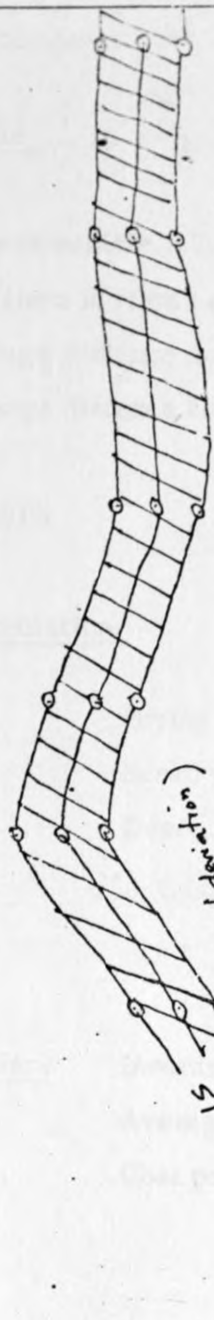
Source: Field Survey 1978

10 20 30 40 50 60 70 80 90
DISTANCE. KM

Transfer Charges in K. SH. Per Ton-Kilometer
for peas in Kiambu and Nyandarua
Districts.

Figure [13]

Average
 Transfer
 Cost in
 K. SH.
 Per Ton
 Kilometer



Source: Field Survey 1978

K.M.S.
 DISTANCE
 0 10 20 30 40 50 60 70 80 90

Appendix II

2.1 Own Vehicle

- 1. Type of vehicle 7 ton Bedford lorry
- 2. Life time in terms of kilometres = 250, 000 km.
- 3. Average distance covered per month = 2, 400 km.
- 4. Average distance covered per year = 28, 800 km.

2.1.1 FIXED COSTS

(1) Depreciation

Buying price	=	192, 000.00
Scrap value	=	15, 000.00
Depreciation	=	<u>192,000 - 15,000</u>
∴ Cost per Km.		28, 000
	=	<u>0.71 per Km.</u>

(2) Insurance

Insurance per year	=	12, 500.00
Average distance	=	28, 800 km.
∴ Cost per km.	=	<u>12, 500.00</u>
		28, 000
	=	<u>0.43 Shs. per Km.</u>

(3) Licences

Licence and No. Plate	=	2, 400.00 per year
T. L. B.	=	40.00 per year
Total	=	2, 440.00
∴ Cost per km.	=	<u>2, 440.00</u>
		28, 000.00
	=	<u>0.08</u> Shs. per km.

(4) Interest • Interest rates at present.
is between 8 - 12%
∴ Taking an average of 10% of
half of the investment cost
(linear depreciation) = $\frac{10 \times 192,000}{28,800 \times 2 \times 100}$
= 0.33 Shs. per Km.

(5) Administration

The Administration charges per month is about 250.00 taking into account the fact that the owner has to follow the working staff that is general administration.

Per year = (250.00×12)

∴ Cost per Km. = 28800

= 0.1 Shs. per Km.

(6) Wages and Salaries

Driver's salary = 600.00 per month

Two turnboys @ 250/- = 500.00 per month

Driver's Food allowance per trip = 15.00

Average number of trips per week = 3

Total per week = 45.00

Per month = 45 x 4

= 180.00

Two Turnboys , each 10/-

per trip in a week = 10 x 3

= 30.00 each

2 turnboys = 60.00

Per month = 60 x 4

† 240.00

$$\begin{aligned} \text{Total for driver and two turnboys} &= 600.00 + \\ & 100.00 \\ & 500.00 \\ & \underline{200.00} \\ & \underline{1,520.00} \end{aligned}$$

$$\begin{aligned} \text{In 12 months} &= (1520 \times 12) \\ \therefore \text{Cost per Km.} & 28800 \\ &= \underline{0.63 \text{ Shs. per Km.}} \end{aligned}$$

2.1.2 VARIABLE COSTS

1. Fuel and Oil

$$1 \text{ Litre of diesel cost} = 2.00 \text{ K. Shs.}$$

$$\begin{aligned} \text{Distance covered using 1 litre of} \\ \text{diesel when the lorry is fully loaded} &= \underline{3.65 \text{ Km.}} \end{aligned}$$

$$\begin{aligned} \therefore \text{Cost of fuel per Km.} &= (2.00) \\ & 3.65 \\ &= \underline{0.55 \text{ Shs. per Km.}} \end{aligned}$$

Cost of oil, take about 15 percent of the cost of fuel according to KTDA transport officer (Litein) and also Ryce Motors Ltd.

$$\begin{aligned} &= (15 \times 0.55) \\ & 100 \\ &= \underline{0.63 \text{ Shs. per Km.}} \end{aligned}$$

2. Repairs and Maintenance

According to the customer invoices taken from Rye Motors Ltd, there are two types of services and overhaul.

- (a) Minor service (after every 5,000 Km between the major services)
- (b) Major service (after 10,000 Km.)
- (c) Overhaul.

Minor Service

Labour	=	320.00
Parts	=	<u>480.00</u>
Total	=	800.00

Major Service

Labour	=	580.00
Parts	=	<u>620.00</u>
Total	=	1,200.00

Total of minor and major Service

	=	800.00 +
		<u>1,200.00</u>
		2,000.00
∴ Cost per Km.	=	1,000.00
	=	<u>2,000.00</u>
		10,000
	=	<u>0.2 Shs. per Km.</u>

Overhaul of Engine and Gearbox

According to Ryce Motors Ltd., engine overhaul and gearbox take place at approximately every 125,000 kms.

$$\begin{aligned} \text{Cost of overhauling the engine} &= 20,000 - 30,000 \\ \therefore \text{Cost per km.} &= \frac{25,000}{125,000} \\ &= \underline{\underline{0.2 \text{ Shs. per Km.}}} \end{aligned}$$

$$\begin{aligned} \text{To overhaul gearbox costs} &= \frac{20,000}{125,000} \\ &= \underline{\underline{0.16 \text{ Shs. per Km.}}} \end{aligned}$$

3. Tyres

A 7 ton Bedford lorry has 6 tyres

Cost of 1 tyre (firestone tyres 900x20)

$$\begin{aligned} &= 2,500.00 \text{ Shs. each} \\ \therefore \text{Cost of 6 tyres} &= 2,500 \times 6 \\ &= \underline{\underline{15,000.00}} \end{aligned}$$

Average lifetime of tyres before retreading

$$\begin{aligned} &= 45,000 \text{ Km.} \\ \therefore \text{Cost per Km.} &= \frac{15,000.00}{45,000} \\ &= \underline{\underline{0.33 \text{ Shs. per Km.}}} \end{aligned}$$

\therefore Total operating costs

$$\text{Fixed Costs} = 2.28$$

$$\text{Variable costs} = 1.52$$

$$= \underline{\underline{3.8 \text{ Shs per Km.}}}$$

As the lifetime s are varying the actual cost will vary around 4 shillings per km.

2.2 Hired Vehicle (External Vehicle)

2.2.1 OVERVIEW

The amount charged. depends on the type of produce, quality, quantity and the distance from the market. Below are facts covering transport of produce from Nyandarua District (Njabini and Karati) to Nairobi Wholesale Market, using a 7 ton Bedford lorry.

2.2.2 VOLUME CARRIED BY 7 TON LORRY

1. 60 bags of cabbages (90 Kg. each)
2. 60 bags of potatoes (105 Kg. each)
3. 60 bags of carrots (116 Kg. each)
4. 100 bags of 'sukuma wiki ' (54 Kg. each)
5. 100 bags of peas (53 Kg. each)

2.2.3 DISTANCE FROM PRODUCTION ZONE TO MARKET

1. From Njabini township to Nairobi is 88 Km.
2. From Karati township to Nairobi is 78 Km.

2.2.4 AVERAGE AMOUNT OF MONEY CHARGED TO TRANSPORT ONE BAG OF PRODUCE:-

1. Cabbages from Njabini to Nairobi is 14.35 Shs.
2. Potatoes from Njabini to Nairobi is 16.59 Shs.
3. Carrots from Njabini to Nairobi is 14.62 Shs.
4. 'Sukuma wiki' " " 15.00 Shs.
5. Peas from Njabini to Nairobi is 14.53 Shs.

2.2.5 AVERAGE AMOUNT OF MONEY CHARGED TO TRANSPORT ONE BAG OF PRODUCE

1.	Cabbages from Karati to Nairobi	12.98 Shs.
2.	Potatoes from Karati to Nairobi	14.61 Shs.
3.	Carrots from Karati to Nairobi	12.46 Shs.
4.	'Sukuma wiki' from Karati to Nairobi	12.20 Shs.
5.	Peas from Karati to Nairobi	11.60 Shs.

Note: Since the owner of vehicle assumed no backhaul, they charge the amount to cover the return journey.

2.2.6 CALCULATION FOR NJABINI 88 KILOMETRES FROM THE MARKET

To and fro = 88×2 = 176 Km.
including the collection routes about 20 percent
of the journey = $176 + 30$
= 200 Km.

(a) To hire a 7 ton lorry costs 60 bags x 14.35 to
transport a lorryload of cabbages = 861 per trip
∴ Cost per km. = 4.3 Shs. per Km.

(b) To hire a 7 ton Bedford lorry to transport a lorry
load of potatoes = 16.59×60
= 995.40 per trip
∴ Cost per km. = 995.40
200
= 4.97 Shs. per Km.

(c) To hire a 7 ton Bedford lorry to transport a lorry load of carrots = 14.62 x 60
= 877.20 per trip
∴ Cost per Km. = 877.20
200
= 4.39 Shs. per Km.

(d) To hire a 7 ton Bedford lorry to transport a lorry load of 'sukuma wiki' = 15 x 100
= 1,500 per trip
∴ Cost per Km. = 1,500
200
= 7.5 Shs. per Km.

(e) To hire a 7 ton Bedford lorry to transport a lorry load of Peas = 14.63 x 100
= 1,463 per trip
∴ Cost per Km. = 1,463
200
= 7.32 Shs. per Km.

2.2.7 CALCULATIONS FOR KARATI (78 Km. from market)

To and fro = 78 x 2 = 156 + 20% collection routes
= 158 + 30
= 180 Km.

Hiring of 7 ton lorry to transport produce (lorryload)

(a) Cabbages = (12.98 x 60)
= 778.80 per trip
∴ Cost per Km. = 778.80
180
= 4.33 Shs. per Km.

(b)	Potatoes	= 14.61 x 60	=	876.60 per trip
	∴ Cost per Km.		=	<u>376.60</u>
				180
			=	<u>4.87 Shs. per Km.</u>
(c)	Carrots	= 12.46 x 60	=	747.60 per trip
	∴ Cost per Km.		=	<u>747.60</u>
				180
			=	<u>4.15 Shs. per Km.</u>
(d)	'Sukuma wiki'	= 12.20 x 100	=	1220 per trip
	∴ Cost per Km.		=	<u>1220</u>
				180
			=	<u>6.77 Shs. per Km.</u>
(e)	Peas	= 11.60 x 100	=	1160 per trip
	∴ Cost per Km.		=	<u>1160</u>
				180
			=	<u>6.44 Shs. per Km.</u>

2.3 Calculations for Taita-Taveta District

2.3.1 Own Vehicle

2.3.1.1 FIXED COSTS

The same as 9.2.1.1 which is 2.62 K.Shs. per Km.

2.3.1.2 VARIABLE COSTS

1. According to Ryce Motors Ltd., the consumption of a 7 ton Bedford lorry depends on the load and road conditions.

The figures given are:

Consumption empty (tarmac) 7 Km per litre diesel

Consumption full loaded 3.6 Km. per litre diesel.

As the road is fully tarmaced between Taita-Taveta and Mombasa and Mariakani Waybridge takes care that no vehicle is overloaded (not like in the Central Province) we can calculate the cost in K.Shs. per Km:

An average of empty lorry	= 7 Km. per litre
fully loaded lorry	= <u>3.6 Km. per litre</u>
Total	10.6
Therefore average	= 5.3 Km. per litre of diesel
cost of fuel (diesel)	= 2.00 per litre
∴ cost per Km.	= <u>2.00</u>
	(5.3)
	= <u>0.38 Shs. per Km.</u>

Again cost of oil take 15% of the cost of diesel	= (15 x 0.38)
	100
	= 0.057
	= 0.06
∴	= <u>0.44 Shs. per Km.</u>

2. Repairs and maintenance

There are also two types of services, minor service and major service and overhaul of engine and gear box.

Minor Service

Labour	= 320.00 (remains the same)
parts	= <u>192.00</u> (taking into account that the
	<u>412.00</u> vehicle is on good roads).

Major Service

Labour	=	580.00 (40% reduction, see above)
Parts	=	<u>248.00</u>
		<u>828.00</u>

∴ Total cost of major and minor services

=	828.00
	<u>412.00</u>
	<u>1,240.00</u>

∴ Cost per Km.

on the average =	<u>1,240.00</u>
	10,000
=	<u>0.124 Shs. per Km.</u>

Overhaul of Engine and Gearbox

Engine - to overhaul engine costs 25,000/-
 Gearbox - to overhaul gearbox costs 20,000/-

(Again taking into account that vehicles on tarmac roads have about 40 percent higher life than those in rough roads,)

∴ to overhaul engine is 140% distance covered of that of vehicle on rough roads.

	=	$\frac{(140 \times 125,000)}{100}$
		<u>175,000 Km.</u>
∴ Cost per Km.	=	<u>25,000</u>
		175,000
		<u>0.14 Shs. per Km.</u>

Gear Box: The same apply to gear box

	=	(20, 000)
		175, 000
	=	0.11
∴ Total	=	<u>0.25 Shs. per Km.</u>

3.1 Cost of Tyres

Tyres used on tarmac roads only have also an increased life - time (mileage). This calculations are again based on about 40 percent recorded on the Manual on transport for Co-operatives of Kenya (Page 29.) by the Ministry of Co-operative Development.

Kilometers travelled	=	(140 x 45, 000) Km.
		100
	=	63, 000 Km.
Cost of new tyre	=	2, 500 K. Shs.
Cost of 6 new tyres	=	2500 x 6
	=	15, 000 K. Shs.
	=	<u>15, 000</u>
		63, 000
	=	<u>0.24 K. Shs. per Km.</u>

Total operational costs:

Fixed costs	=	2.620
Variable costs	=	<u>1.054</u>
		3.674
	=	<u>3.70 K. Shs per Km.</u>

3.2 Hired Vehicle

As reported earlier, the transport cost from Wunda yi to Mombasa, are based on kilograms (not according to number of bags). To transport one kilogram of any produce costs 0.24 K. Shs. (for a distance of 218 kilometers).

The total cost for a 7 ton Bedford lorry (full load)

$$= 0.24 \times 7000$$

$$= 1680 \text{ K. Shs.}$$

Taking into account that normally there is no backload as was found out during the survey, this means, it costs 3.85 K. Shs. per Km. This shows that actual charged prices are only 5 percent (exactly 4.9%) above actual average cost which shows that also at Taita-Taveta the transportation sector is characterised by a complete competition. This means Co-operative transportation will not bring, therefore, any cost advantage.

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