Overview of the vegetable sector in Tanzania

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AfriVeg

Report 1

AfriVeg project

Development of commercial field vegetable production, distribution and marketing for the East African market

Project goals and purpose

Goal
The goal of the project is to contribute to a vital rural economy of Tanzania and Kenya through the development of effective and integrated field vegetable chains for the domestic and regional market in East Africa by:

- participatory development and implementation of innovative, economic feasible and sustainable production methods in line with market demands,
- empowerment of public institutions to sustain the foregoing and
- generate policy relevant information and recommendations.

Purpose
The purpose of the project is to support the development of a restricted number of pilot product-market chains with a high market potential in close co-operation with relevant private and public actors as well as generating and dissemination relevant information for the development of the regional vegetable market in East Africa.

The AfriVeg Programme Management

If you think you could contribute to the goals of AfriVeg in any way, please contact the Programme management.

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The vegetable sector in Tanzania

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1 Introduction

In 2007 a project started with the goal to contribute to a vital rural economy of Tanzania and Kenya through the development of effective and integrated field vegetable chains for the domestic and regional market in East Africa. The purpose is to support the development of a restricted number of pilot product-market chains with a high market potential. In order to develop a product chain action plan a commodity has to be chosen based on a preliminary study based on available literature and other information accessible via internet or other sources.
This report gives a brief overview of the vegetable sector in Tanzania and based on the information a commodity will be chosen as a pilot crop for developing a chain.
Information about the position of the vegetable cultivation, cultivation regions and information about some crops is presented. For this report mainly web based information was consulted besides some available articles and reports.

2 General information

The United Republic of Tanzania is situated on the Indian Ocean just south of the equator in East Africa. The country has a surface of 945,087 sq km compared to The Netherlands with a surface area of 41,526 sq km, and consists of the mainland Tanganyika and the Island Zanzibar. The population in 2006 is estimated at about 37,187,939 people with predominantly Bantu Africans (95%).
In 2002 estimated was that 30% of the people where living in urban areas (Figure 1) with 2.5 million people living in the region Dar es Salaam (Table 1). In Tanzania an urbanisation rate of approximately 20% is present (Jacobi, 1998) with an expected urbanisation of 50% in the year 2010 (Dongus, 2000).

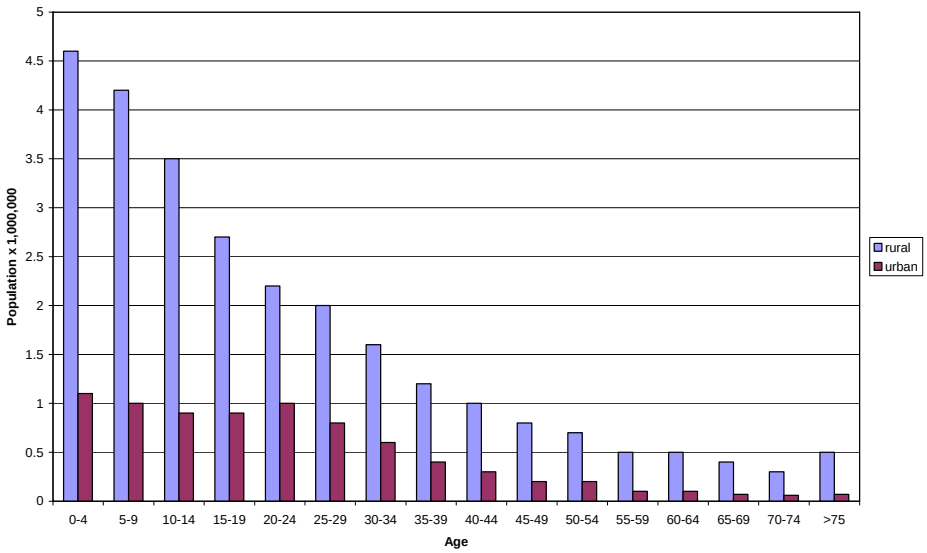

Figure 1. Ratio of people living in rural or urban areas per age in 2002

Table 1. Number of people living in urban areas and number of people per sq. km in 2002 and growth rate 1988 – 2002

Region	Number	people / km2	growth rate 1988 – 2002
Dar es Salaam	2,497,940	1793	4.3
Mwanza	2,942,148	114	3.2
Kilimanjaro	1,381,149	104	1.6
Dodoma	1,698,996	41	2.3
Arusha	1,221,890	35	4.0
Mbeya	2,070,046	34	2.4
Total Tanzania	34,671,453	39	2.9

Source: 2002 population and housing census.

Overall, except for the coastal zone, the altitude of the country is more then 200 m asl. Large parts of the country are even situated higher then 1000 m.
Tanzania's Gross Domestic Product (GDP) amounted to Tsh 13,063,317 million (or € 7,936,879,500) in 2005. Agriculture has a share of approximately 50% in the GDP. Another important sector is trading and tourism with a share of 17% in the GDP. A substantial area, 23% of the total surface of Tanzania, is either designated as a national park, conservation area or game reserve.
Besides that the country has a lot of natural resources like gold, diamonds, natural gas, iron ore etc. Mining and quarrying business has a share of 3.5 % to the GDP.
The official currency is the Tanzania shilling which is subdivided in 100 cents. At the moment the exchange rate of the Tanzania Shilling based on the website of FXConverter™:

1,000 Tanzanian Shilling = 0.78737 US Dollar
1,000 US Dollar (USD) = 1,270,054 Tanzanian Shilling (Tsh)
1,000 Tanzanian Shilling = 0.60757 Euro
1,000 Euro (EUR) = 1,645,913 Tanzanian Shilling (Tsh)

3 Climate

Tanzania has a tropical climate, with temperatures always above 20°C in the coastal zone and temperatures between 10 and 20°C in the highlands. The hottest period occurs from November till February.

Table 2. Long-term average rainfall, number of rain days, temperature (maximum and minimum) and relative humidity measured at some cities in Tanzania.

	Rainfall (mm)	Rain days (nr.)	Max Temp °C	Min Temp °C	RH (%) at 9.00 am	RH (%) at 3.00 pm
Dar es Salaam	1123	98	30.6	20.8	80.8	63.0
Tanga	1884	177	24.9	17.3	84.5	77.0
Arusha	875	95	25.6	13.9	83.8	55.0
Mbeya	928	92	23.7	10.4	72.0	56.0

Source: Website of Ministry of Agriculture and Food Security

In Tanzania two rainfall regimes can be distinguished. A bimodal regime is present at the coastal zone north of Dar es Salaam to the Kenyan border and at a zone alongside the Kenyan border till Lake Victoria while the remaining areas experiences a unimodal regime (Figure 2). At the bimodal regime two rainy periods are present namely the Masika rain starting in March and ending in June and the Vuli rains starting in September and ending in January. With the Unimodal regime the rainy season starts in November and ends in May. Sowing or planting takes place prior to each rainy season while harvest takes place immediately after the rainy season (Fewsnet, Tanzania Food security Update November 2006).

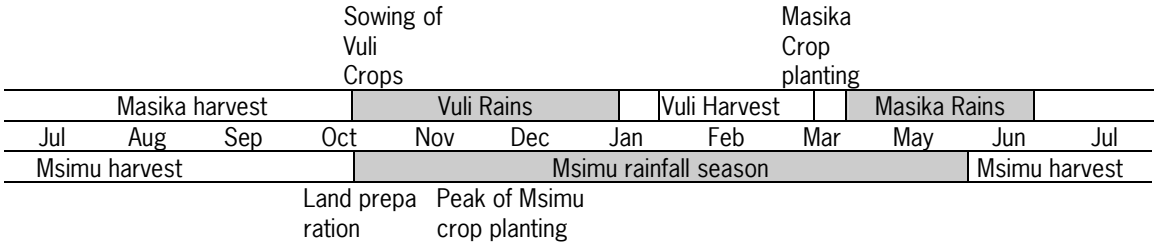

Figure 2. Uni-and bimodal rain regimes (Source: Fewsnet).

In order to ensure irrigation for the cultivation of vegetables farmers have to plant just before the start of the rain periods in October or March, and as a result vegetable production is at its peak during the months July till September. Because of this peak production prices are generally low during that period. When farmers have access to water in other periods also besides the rain periods by introducing efficient and cheap irrigation systems this effect might be reduced. Estimated is that only 39,000 ha or 3.8% of the total acreage used for arable and horticultural cultivation is irrigated

4 Agriculture

4.1 General

In 2005 agriculture contributed 45% to the national GDP of Tanzania and 80% of population has a job in agriculture. Agriculture also contributes 70 to 80% to the foreign exchange earnings of Tanzania with traditional export crops like coffee, sisal, tea and cashew as the most important crop (Peterson, 2003). Table 3 gives an overview of the current land resource, which indicates that of the 44 million ha only 10 million ha or 23% is being currently cultivated. Another source indicates that the area suitable for agricultural production is about 43,000,000 ha, which is 45% of the total surface. Of this total area about only 14% is in use for arable and permanent cropland which is about 6,500,000 ha (Anonymous, 1997). At 3.8% of this area irrigation systems are available (FAO website and ministry of agriculture website).

Table 3. Land resource in Tanzania (million ha).

Total land	95.5
Arable land	44.0
Rangeland	50.0
Land under livestock	24.0
Tsetse infested area	26.0
Cultivated land	10.1
Area suitable for irrigation	1.0
Area under irrigation	0.2
Land under medium and large-scale farming	1.5
Per capita landholding (hectare per head)	0.1
Livestock Population (million):	
Cattle	15.6
Goats	10.7
Sheep	3.5
Poultry (chicken)	27.0

Source: anonymous, 2001.

In the past agriculture was one of the key issues of the countries development plans and communal land ownership systems were introduced, the so called Ujamaa. However, due to the Ujamaa agricultural production decreased to a dramatically low level and since the early eighties the government had to abandon this system in favour of a more free market economy style. Nowadays most farmers are smallholders and predominately farms smaller then 5 ha are present (Table 4).

Table 4. Number of farms per farm size.

	Large scale private owned	Large scale "state" owned	Medium	Small
Number	1,000	1,000	1,140,000	2,660,000
Average land holding (ha)	1,000	900	2 to 5	0.4 to 0.8
Farming system	Many of the large state farms are shifting to private owned or joint ventures.		Typically use animal traction and produce crops for sale	Use hand hoes and are at subsistence level

Source: Fischer, 2006.

Mostly farmers only cultivate a maximum of 2 hectares. Even when farmers have access to a larger acreage they lack equipment to cultivate this.
However, there are some differences per district with Lushoto showing the highest farm size and Iringa showing the highest average yield per hectare (Table 5). However, one must take in mind that per region different vegetables can be cultivated, like onions and cabbage in one region and indigenous vegetables in another one, and with different yield levels per crop this can result in different average yield levels per region.

Table 5. Average farm size (ha) and productivity (yield in ton/ha).

District (region)	Acreage (ha)	Yield (ton/ha)
Arumera (Arusha)	1.3	20.2
Hai (Kilimanjaro)	1.0	7.8
Muheza (Tanga)	0.4	1.0
Lushoto (Tanga)	2.7	7.1
Kibaha (Dar es Salaam)	0.6	7.6
Temeke (Dar es Salaam)	0.4	15.5
Morogoro (Morogoro Rural)	0.03	1.4
Iringa (Iringa Rural)	1.4	21.9
Mbeya (Mbeya Rural)	0.5	11.5

Source: Ministry of Agriculture and Food Security, 2002.

Main crops grown in Tanzania are listed in Table 6, with maize being the most important in terms of production and acreage. Maize is grown in all regions but especially in the northern and southern highlands, cassava is grown in the humid warm tropical coastal belt together with rice while drought resistant millet and sorghum are grown in the central plateau.

Table 6. Production (x1,000 tons) and acreage (x1,000 hectare) of important food crops in Tanzania, 2002/2003.

	Maize	Cassava	Paddy	Pulses	Beans	Sorghum	Sweet potato	Millet	Wheat	Vegetables
Production	3,444	2,844	1,294	650	449	461	989	200	45	455*
Acreage	2,852	1,313	689	642	620	557	479	225	35	-

Source: Ministry of Agriculture/National bureau of statistics
* Data from 1996

When looking at the share of the crops to the GDP the most important crop is maize as well followed by paddy rice (Table 7). The most important vegetable crops are beans and tomato being mentioned as a crop while other vegetables are not listed separately.

Table 7. Share in percentage of different crops in the GDP (679768) of the United Republic of Tanzania.

	2000	2001	2002
Food crops			
Maize	27.5	31.8	31.1
Paddy rice	12.0	12.3	12.5
Bananas	5.4	8.0	8.0
Beans	7.1	6.9	6.9
Millet/Sorghum	6.0	5.3	5.4
Cassava	6.3	5.4	5.2
Vegetables	4.7	4.1	4.0
Sweet potatoes	2.0	3.0	3.1
Tomatoes	2.4	3.0	3.0
Fruits	2.8	2.8	2.8
Groundnuts	3.7	2.8	2.8
Cash crops			
Tobacco	2.2	1.8	2.1
Cotton	1.8	1.8	1.8
Cashew nuts	2.5	2.0	1.5
Coffee	1.5	1.2	1.2
Tea	0.8	0.5	0.5

Source: Fischer, 2006.

According to the Tanzanian ministry of agriculture website 10 different farming systems can be distinguished:

1) Banana/Coffee/Horticulture/Livestock
2) Maize/Legume
3) Cashew/Coconut/Cassava
4) Rice/Sugar cane
5) Sorghum/Bulrush millet/Livestock
6) Tea/Maize/Pyrethrum
7) Cotton/Maize
8) Horticulture
    a. Vegetable cultivation: cabbage, tomato, sweet pepper, cauliflower, lettuce, indigenous vegetables
    b. Maize, coffee, potatoes tea and beans
9) Wet rice
10) Pastoralist/agro pastoralist

System 1 (Figure 3) is predominately present in volcanic upland regions and dense populated areas like Arusha, Kilimanjaro, Tanga, Mbeya, Koigoma and Kagera region. The soil derived from volcanic ashes and lava is fertile and is suitable for intensive cultivation. With this system the main crop is banana and coffee intercropped with permanent trees and shrubs. Besides on separate plots maize, beans, potatoes and yams are cultivated. Manure from livestock is used to fertilize the banana and coffee plots. In these regions two cropping seasons are possible. When farmers have links or access to markets high value vegetables and flowers are cultivated. Characteristic for this system is that in those regions land pressure is high.

Figure 3. Banana and horticulture cultivation.

System 8 can be found in the regions of Tanga, Morogoro and Iringa.
Although vegetables are produced at a certain scale, they are mostly not produced for own home consumption. For instance in the Mhaji region in terms of food and cash crop maize is the main crop (Amend, 2002). Other crops are grown either for own household needs, cash resources or own consumption. As an example mung beans, cabbage, potatoes, onions peas and tomatoes are not grown for the own consumption but as a cash crop to generate income.

4.2 Vegetable cultivation regions

Tanzania has a large area suitable for horticultural cultivation but only a small portion of this is under cultivation.
Regions with suitable conditions for vegetable cultivation are situated in the area of Morogoro, Tanga, Iringa, Moshi, Arusha and Mbeya (Figure 4). The region near Lake Tanganyika has potential for vegetable cultivation but no information is found that horticultural cultivation takes place here. Arusha and Tanga are situated in the north-eastern part and are bordering Kenya. Mbeya ad Iringa are located in the south and bordering to Malawi and Morogoro is situated west of Dar es Salaam. Altitude of these suitable areas is between 1,000 and 2,500 m asl. and precipitation varies between 500 and 2,000 mm annually (Table 8).
Regions were horticulture takes place are the coastal zone, central plateau, lake zone and the highlands. The farms in the coastal zone are relatively small and not sufficient for supplying Dar es Salaam. The central plateau suffers too much from drought and poor infrastructure. Crops grown in this area are tomatoes, onions and sweet potatoes. In the lake zone a lot of tropical fruits is grown and exported to the neighbouring countries. The highlands are the best suited for vegetable production due to the varied climatic conditions, reliable and well distributed rainfall and possibilities for irrigation and the presence of relatively good roads for distribution (Swai, 1991).

Table 8. Regions suitable for vegetable and potato/beans cultivation based on soil and climatic factors.

Region	Vegetables	Potato/beans	Altitude (m asl)	Precipitation (mm)	Area (sq-km)
Eastern plateaus and mountain blocks (west central – Tanga/Morogoro)					
E7		X	750-1300	800-1000	40,961
E12	X	X	1000-2000	800-1000	2,752
E13	X	X	800-2000	800-1000	640
E14	X	X	500-2000	1000-1200	2,976
E15	X	X	800-1700	1000-1200	1,920
High plains and plateaus (South – Mbeya/Iringa)					
H1	X	X	1500-2000	600-700	13,137
H2	X	X	1500-2100	1400-1600	6,989
H3	X	X	1500-2300	1000-1200	13,137
H5	X	X	1200-2400	1000-2000	9,300
H6		X	2300-2700	1000-1200	790
H7		X	1500-2300	800-1000	18,438
Volcanoes and rift depressions (North – Arusha/Kilimanjaro)					
N1		X	1500-2500	600-700	6,114
N2		X	2000-2500	800-1000	1,060
N4	X	X	900-3500	500-600	3,686
N5		X	1300-1700	1000-1200	3,159
N10	X	X	1500-1800	1400-1600	724
Central plateaus (plains)					
P5		X	1100-1300	600-1000	67,855
P6	X	X	800-1800	600-1000	30,079
Ufipa plateau					
U		X	1400-2300	1000-1200	16,654
Western Highlands (west of lake Victoria)					
W1		X	1300-1800	800-1000	8,688
W2		X	1500-1700	1000-1200	13,427
W3		X	1200-1600	800-1000	6,690
W4		X	1400-1500	800-1200	10,622

Source: Anonymous, 2006.
X = suitable for production

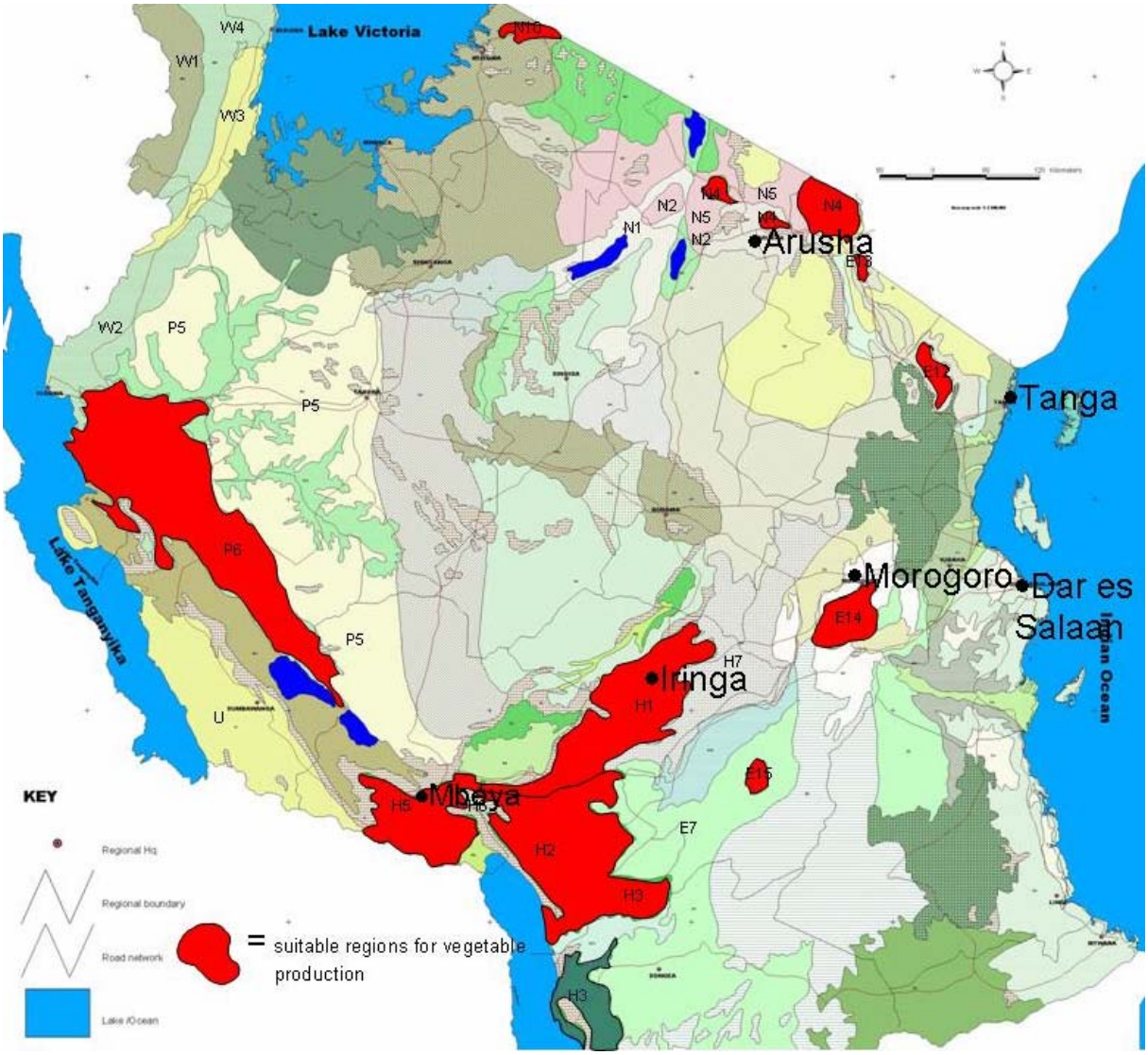

Figure 4. Regions suitable for vegetable production (see table 7 for explanation of the codes).
Source: Website Ministry of Agriculture and Food Security, 2006.

4.3 Vegetable production

Production of tomatoes is the highest with a total of 159,805 tons production and acreage of 7,170 hectare (Tables 9 and 10). The second vegetable crop is cabbage and third crop is onion. Carrots are a minor crop with a production of 4,029 tons.

Table 9. Production in ton per region of vegetables in 2002.

District	tomato	cabbage	onion/leek	carrot	others
Lushoto	38,670	4,800	9,600	550	400
Hai	9,000	9,500	4,000	2,400	36,510
Iringa	101,952	10,695	11,088	-	1,521
Mbeya	4,940	3,510	1,170	1,079	1,521
Morogoro	?	-	?	-	127,548
Temeke	5,243	-	-	-	465
Total	159,805	28,505	25,858	4,029	167,965

Source: Shao, 2002.

Table 10. Acreage in ha per region of vegetables in 2002.

District	tomato	cabbage	onion/leek	carrot	others
Lushoto	1,289	1,600	300	85	20
Hai	900	950	500	300	1,020
Iringa	4,248	713	1,584	-	117
Mbeya	380	270	90	83	117
Morogoro	?	-	?	-	5,102
Temeke	353	-	-	-	72
Total	7,170	3,533	2,474	468	6,448

Source: Shao, 2002.

Other vegetables are for instance eggplant, cauliflower, beans and indigenous vegetables like amaranth and okra. Of the horticultural regions, Iringa shows the highest production and acreage. Also yield levels in this region are high compared to the other regions.
For home consumption only 10% of the yield is used. The remaining is for selling but for all kind of vegetables losses are high. Although no good documentation is available estimated is that about 31% is lost leaving only 59% for selling. Losses are caused by pest and diseases, inadequate sorting/grading, rough handling, lack of cooled storage facilities and lack of adequate packing material. Besides this also a good quality control system and grading system is lacking. Only 13% of the farmers perform some sort of grading where only rotten or misshaped fruits are removed.

4.3.1 Tomato

Tomatoes are cultivated in the southern highlands, northern highlands and Morogoro district. Harvesting season for these regions are respectively August – November, July – September and May – Augustus. A labour input of 124 – 150 man days per hectare is required (Mtaita, 1994).
With the cultivation of tomato different constraints are present (Lynch, 1999). Firstly different fertilizers are required at different stages of the tomato plant. Secondly when a farmer wants to produce tomatoes in order to harvest at the peak in the market prices, which is usually at the end of the May rains a high input of fungicides is needed.
Costs of 1 ha tomato is in total about 2,150,000 Tsh of which 2,000,000 is needed for transport of the tomatoes. Peak prices of 2,500 Tsh per Tenga are paid which is about 42 Tsh per kg. Based on those prices farmers earn 8,350,000 Tsh per ha resulting in a revenue of Tsh 6,200,000 per ha (€ 3800) (Lynch, 1999).
As of 1998 national research priorities in tomato cultivation are:

- Nutritional requirements
- Variety testing
- Seed technology
- Disease control
- Varieties
- Staking

Figure 5. Tomato cultivation in Tanzania where disease control has research priority.

4.3.2 Cabbage

Cabbage is the third important crop in Tanzania (Massomo, 2005). Cultivation of cabbage in Tanzania started only since the early seventies. Cultivation is mainly as a monocrop or otherwise as an intercrop with bananas and coffee. Production takes place throughout the year with a peak period from July till February. For growing cabbage a labour input of 51 – 65 man days per hectare is required (Mtaita, 1994). Farmers can cultivate 2 to 4 crops per season. With this intense cropping problems are present with soil fertility and with diseases. For 80% the harvested product is sold to wholesale or retail traders who collect the product on the farm. About 18% is sold on a local market by the farmer.

As of 1998 research priorities are:

- Agronomical trials
- Disease and pest control
- Seed production

Figure 6. Cabbage cultivation.

4.3.3 Onion

Tanzania is the 6th onion/allium producing country in Africa. In the southern highlands, northern highlands and Morogoro/coastal zone the harvest periods are respectively September – November, October – December and July – September. Labour input for onion is estimated at 208 – 255 man days per hectare (Mtaita, 1994).
Cultivation is mainly by smallholder farmers who sell to local markets. Yield levels are low with an average of 19,000 kg per ha (Mtaita, 1994). On the contrary another study indicates a yield of 33,000 kg per ha (Muendo 2004). Seed is imported or raised from the farmers own grown onions. Seeds are sown first on a nursery bed and protected under shade. Transplanting is done 5 – 8 weeks after sowing. After 2 tot 3 months bulbs can be harvested depending on variety, season location and cultivation practices. Bulbs are sun dried and packed in sacks without any grading. Markets are unreliable with frequent price fluctuation and market loss. Compared to Kenya farmers in Tanzania have better storage facilities and good post harvest management practices.
Per hectare costs are approximately Tsh 1,457,000 while revenues are Tsh 5,338,800 giving a margin of Tsh 3,881,800 per hectare (€ 2,380).
As of 1998 research priorities are:

- Seeds
- Weed control
- Fertilization
- Spacing
- Purple blotch and downy mildew
- Thrips control

Figure 7. Drying of onions.

4.3.4 Indigenous vegetables

Urban farming in Dar es Salaam is common practice and vital with leafy vegetables being in high demand (Jacobi, 1998). This because they are the main components of traditional dishes (Dongus, 2002) Besides, indigenous vegetables are considered as a rich source of nutrients especially zinc and iron and are also regarded as a source of income (Jacobi, 1998). More then 90% of leafy vegetables supply in Dar es Salaam is coming from production in the city itself (Dongus, 2000 and Jacobi, 1998). Leafy vegetables are highly perishable and can not last long transports leading to urban production only since farmers outside the city can not transport this

product to the markets without quality loss. An advantage of indigenous vegetables compared to other vegetables is the year round availability of those crops. However, consumption patterns of indigenous vegetables are strongly related to wealth seeing that 40% of the poor households are buying this type of vegetables compared to 12% of wealthy households. The most popular leafy vegetable is Amaranth being cultivated by 67% of the households living in Dar es Salaam. By the buyers colour, texture, size, shape and taste are considered as the most important factors in purchasing.
Production takes place on a small scale in high density areas, on a larger scale in less dense areas, in community gardens, in open spaces and in the periurban area. It is estimated that in high density areas of Dar es Salaam 15 to 20 % of all households have their own vegetable garden with an average size of 40 to 80 m^2. In low density areas plots can be as large as 4,000 m^2.
In the urban areas perishables are being produced while in the periurban areas a mix of perishables, tropical vegetables and staple crops are produced. Major staple food and temperate crops are supplied from rural areas.
Expected is that cultivation will be more concentrated on vegetable production due to the growth of the city where less land will be available for farming especially extensive crops like fruit trees or low value crops like staple crops. However, it seems that urban agriculture will not disappear in the next coming years seeing that the urban vegetable promotion project is recently implemented under the ministry of agriculture and co-operatives in order to increase urban farming production. To increase production knowledge on cultivation and extension services are needed.
On average about a third of the farmers are cultivating indigenous vegetables. Compared with tomatoes net revenues of Ethiopian mustard and African eggplant are one third of the revenue of onion (table 11). However, cultivation of indigenous vegetables is suitable to small scale poor farmers since production costs are lower compared to other commodities and the crops are easier to grow.

Table 11. Yields, share of produce sold at the market, costs and value of indigenous vegetables

Crop	Yield (t/ha)	% Sales at market	Total variable costs (Tsh)	Net value/ha (Tsh)	Net return / ha (Tsh)
Ethiopian mustard	11.6	63	159585	1487430	1290704
African eggplant	9.5	82	146970	1447851	1331176
Sweet potato	6.7	38	8825	851711	734453
Okra	5.9	65	31499	810745	576930
Amaranth	5.6	65	409052	662710	455127
Nightshade	3.8	67	116672	447298	395757
Pumpkin	1.1	32	2190	247196	143053
Cowpea	0.5	11	3458	109178	105455

(source: Weinberger, 2004)

By Weinberger (2004) the presence of pests and diseases and absence of efficient control measurements and the lack of high quality seeds were listed as constraints in the cultivation of indigenous African vegetables.
Currently a project is running in Kenya and Tanzania funded by the Maendeleo Agricultural Technology Fund of Farm Africa. They granted funds to the AVRDC to empower small-scale and women farmers through sustainable production, seed supply and marketing of African indigenous vegetables. The project is running in the Duluti area of Arusha and the Kiambu district in Kenya.

4.4 Market

4.4.1 Market chains

The food supply chain in Tanzania is very complex and disorganised. This is to the disadvantage of the producers (Lynch, 1994). Currently supply chains are based on the contacts and knowledge of the people involved in the trading and not just in the presence of physically roads, buildings and vehicles (Lynch, 1994).

In general vegetables are sold through 5 different chains. Four of them being local village markets, regional markets, national market and export market (Table 12) (Eskola, 2005). A fifth one is the supermarket (Weatherspoon, 2003).

Table 12. Characteristics of different markets.

	Local village market	Regional market	National market	Export market
Location	cross roads near villages	region centres and/or district capitals	Dar es Salaam	Foreign
Traders	women and children	Large, medium and small traders	Large traders	Foreigners
Supply	unreliable	reliable	reliable	reliable
Products	local / limited choice / low quantity	regional / broad range / low to large quantity	national / broad range / large quantity	national / focused on special crops / large quantity

Source: Eskola, 2005.

Local village markets are run by women and children to earn some money. Choice of products is low and also supply is unreliable.

Figure 8. Local village market near Arusha.

Regional markets are the most important since they are easier accessible compared to the National market and a broad range of vegetables are for sale. Traders at this market can be distinguished in large, medium and small traders. Large traders have more capital available and are in a position to cover a large area for buying products. Medium traders are more restricted to the area where they trade and offer only local products. Medium traders and large traders have better access to capital giving them an opportunity to give credit to buyers thus generating a higher turnover. At the same time, because they are reliable the traders can get credit as well from the farmers when they purchase products from them. Small traders are mostly people who don't own land and have no other option then to trade in order to earn a living. Mostly they buy product from a large trader leaving them only a small margin. At the regional market traders have to buy a permit to trade and besides they have to pay a daily fee. A large trader has an average turnover of 30,000 to 100,000 Tsh per day while a medium trader has a turnover of 20,000 Tsh per day and a small trader a turnover of 5,000 Tsh per day. Personal contacts are very important in order to do business and to make deals. Since the legal system is not functioning in case when a customer is failing in paying for the purchased goods, people only want to deal with someone they know and can trust. Also since a market information system is lacking people like to do business only with someone they know. As a result the supply chain can be very long.

Figure 9. Regional market in Arusha.

The National market is located in Dar es Salaam and the products for sale there are collected from all regions. All fruits and vegetables that are intended for sale and just only for direct consumption in Dar es Salaam must be sold through the national market (Kariakoo market) via licensed wholesalers (Lynch, 1994). However, law enforcement is absent so besides this legal market an informal system has been developed. In 1975 more then 95% of fruits and vegetables sold by retailers was bought at the Kariakoo market. In 1994 this percentage was dropped to 65% and probably this percentage is even an overestimate (Lynch, 1994). Mostly the products sold at the national market are not for local consumption but for consumption in the regions. The market is dominated by a small number of large traders. Access to the National market is limited to most traders since they require capital and transport to collect large quantities of different products from all over the country and to trade it at the market. The Kariakoo market was designed in 1975 with a surface area of 2400 m^2 and a capacity to handle annually a volume of 30,000 tons. However, the facility is now backdated and is the space too limited since in reality on average a volume of 70,000 tons annually is handled at the market. Furthermore is the

ventilation system inadequate to maintain optimal conditions and is the relative humidity at the market often more then 85% and temperature higher then 30°C (Lynch, 1994).
The export market is run only by large traders and they are mostly foreign. Horticultural products that are being exported mainly to Kenya are tomato, onion and potatoes. The export agents collect large quantities at established buying centres. The products are mostly unprocessed leaving the Tanzanian farmers only a low profit while the added value is for the export organization.
Besides the four mentioned markets since the nineties supermarkets starts to operate in Tanzania as well. At this moment 6 Shoprite supermarkets are present of which 5 are based in Dar es Salaam and 1 in Arusha (Weatherspoon, 2003 and Shoprite website). Shoprite owns its own company, Freshmark, in order to collect vegetables and fruits for there stores. Besides Shoprite also two Kenyan based supermarkets try to get access into Tanzania. Supermarkets buy from wholesalers and require large quantities, good quality products which are cultivated according to safety standards (Wheaterspoon, 2003). For the small farmers this can be a threat since they will lose a share of the market whilst supermarkets are expected to exclude small scale farmers from their suppliers (Temu, 2006).
Chains can be very complex due to people's preference to do only business with others they know. In table 13 several actors for an agricultural chain are listed with approximately margins they have. Margins on vegetables to farmers or producers are unknown. For cereals like maize, sorghum and rice, farmers share in consumer price are ranging from 20 to 99% (anonymous, 2001).
Especially Dar es Salaam functions as a hub for all road and sea transport for Tanzania. Tanzania has four main arterial roads which all pass by Dar es Salaam (Peterson, 2003). When a product has to be transported from one part of the country to another part it has to go pass by Dar es Salaam due to the infrastructure.
Taking this into account it seems that the Arusha region has the highest potential to develop a domestic and export market seeing that this region has good access to Kenya, Dar es Salaam en to other countries via the international airport located at Kilimanjaro or via Jomo Kenyatta international airport at Nairobi. In general the three major horticultural regions (North eastern highlands, Southern Highlands and Central and eastern coastal regions) are accessible by paved roads so products can be easily transported to Dar es Salaam or bordering countries. From the central places in those regions, however, roads to farms are mostly in a poor condition giving problems at transporting the vegetables from the farms to a collection point.

Table 13. Market actor and the margins in the national market chain.

Actor	Description	Margin (% of consumer price)
Producers	Live in rural areas, selling products mostly only source of cash, sell product mostly directly at farm to void transport costs.	?
Local brokers	know the region and the producer. Do not have enough capital to act as large trader. Serve as intermediaries between producer and large trader.	4 – 20%
Large scale trader	Buy directly from farmers or through local broker	20,000 Tsh per trip
Transporters and transport brokers	They organize and facilitate transport, they don't buy product themselves.	10% of transport costs
Brokers in Dar es Salaam	They distribute large quantities over small buyers. Act as trade facilitators to match seller and buyer they know and by their presence at the deal act as a safeguard to guarantee a deal.	4 – 10%
Wholesalers at Dar es Salaam	Small scale grain wholesalers have a working capital 200,000 – 1,000,000 Tsh, Large scale have more then 5,000,000 Tsh. They sell large quantities and have equipment to grade and weigh their products. They also have the capital to pay right away in cash for transport.	8% +
Retailers in Dar es Salaam	Mostly small scale traders who buy from larger trader and help them distributing products to the consumer.	20 – 70%
Final consumer	Go to the market several times a week to obtain food. They can rely on a steady supply, but prices can fluctuate.	
Export agent	Collect large quantities from wholesalers or directly from large farms to export.	3 – 5 %

Source: Eskola, 2005

4.4.2 Prices

Prices collected in 2005 at the Kilombera Market in Arusha indicate also that prices for tomato, cabbage and onion in the first half year of a season are relatively higher then in the second half year (Figs. 10, 11 and 12). Average kg price of tomatoes throughout the year is 383 Tsh. For onion the average market price was 238 Tsh in 2005. Average consumer price for tomato and onion in Dar es Salaam was 281 Tsh and 250 Tsh respectively in 2002 (Table 14).

Table 14. Average prices per kg in Tsh of Tomato and Onion in Dar es Salaam and Unguja (Zanzibar) recorded in December.

		1999	2000	2001	2002
Tomato	Dar es Salaam	319	436	191	281
	Unguja	672	598	569	750
Onion	Dar es Salaam	241	256	345	250
	Unguja	440	338	350	362

Source: Website of Ministry of Agriculture and Food Security

Prices in Unguja Zanzibar for the same commodities were approximately two times higher. Both commodities are showing a strong price fluctuation at especially the Dar es Salaam market.

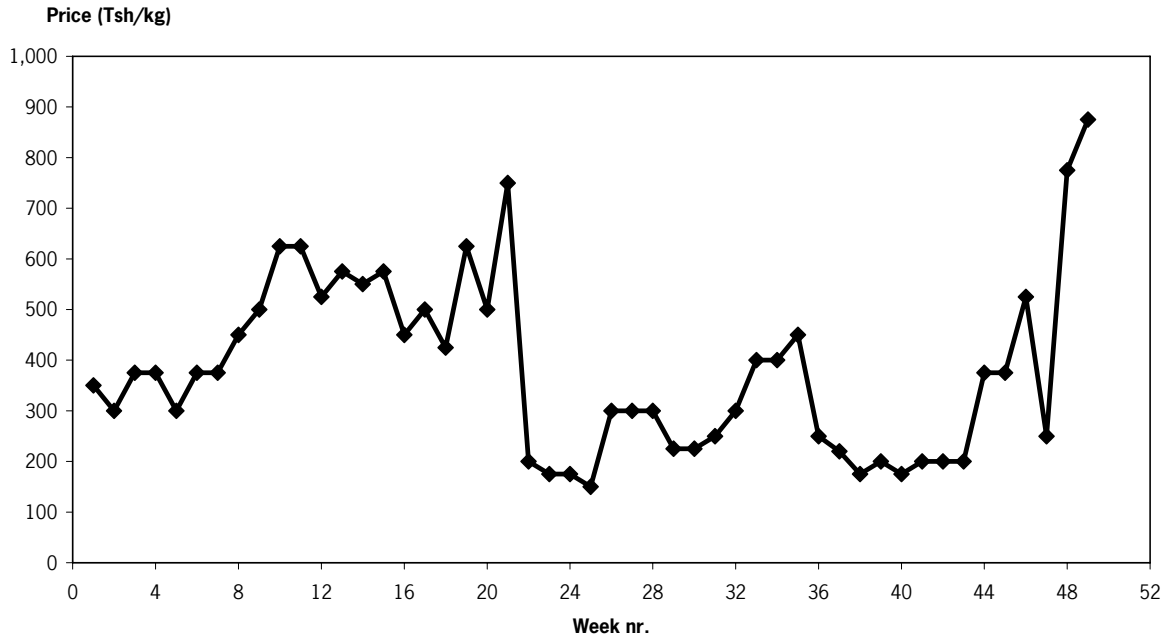

Figure 10. Prices of tomato per kg supplied in Sanduku units (40 kg) at the Kilombera Market in Arusha, 2005.

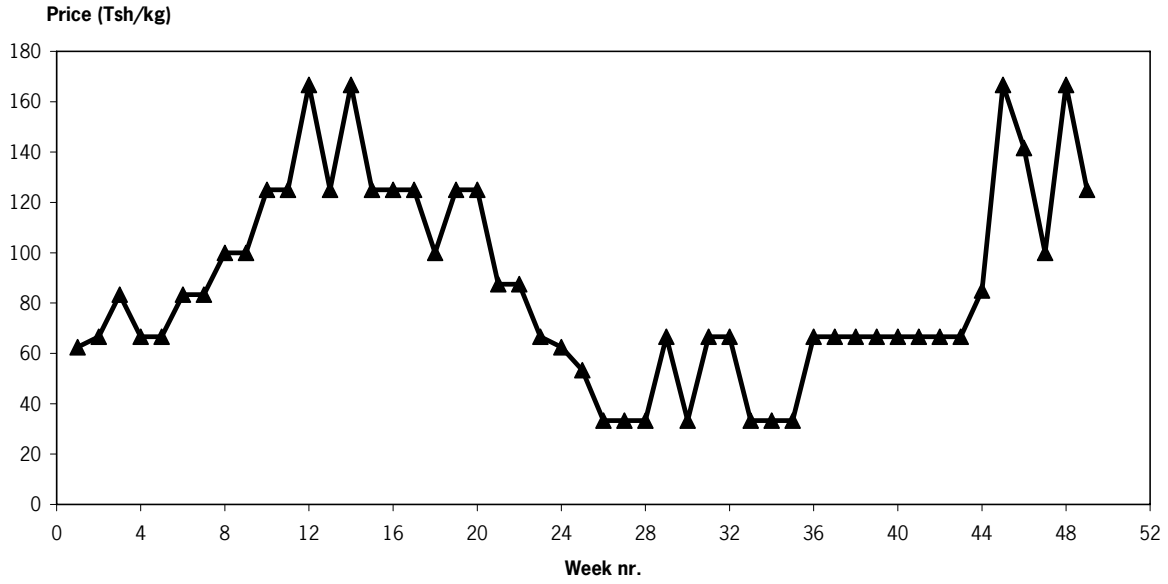

Figure 11. Prices of cabbage per kg supplied in Gunia moja units (120 kg) at the Kilombera Market in Arusha, 2005.

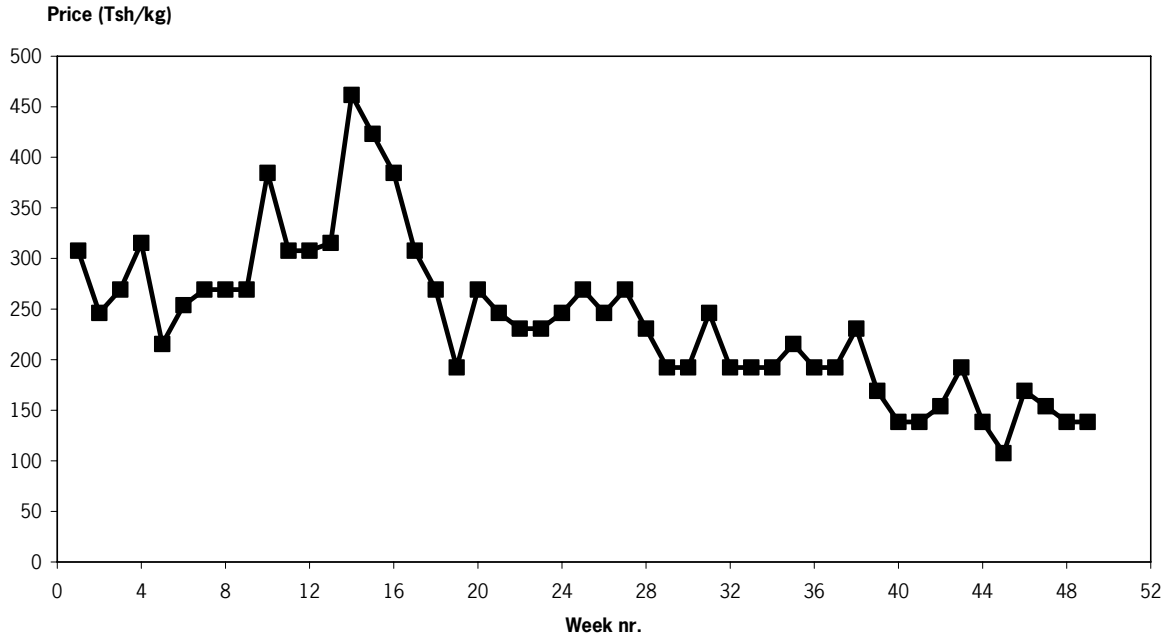

Figure 12. Prices of onion per kg supplied in Gunia moja units (130 kg) at the Kilombera Market in Arusha, 2005.

Prices of indigenous vegetables are also fluctuating (figs 13 till 19). From January till November prices for at instance Sukuma wiki are fluctuating from 100 to 400 Tsh. At the leafy vegetables like amaranth, Sukuma wiki (cabbage leaves) and Ethiopian kale prices at week 48 are very high. For 1 kilo of Sukuma wiki prices of 1,000 Tsh are paid at the market. There is no explanation yet for this, but perhaps due to climatic factors like the presence of the vulli rains leafy vegetables could not be supplied in that specific period leading to a shortage. For eggplant and okra prices are the highest from week 24 till 35.

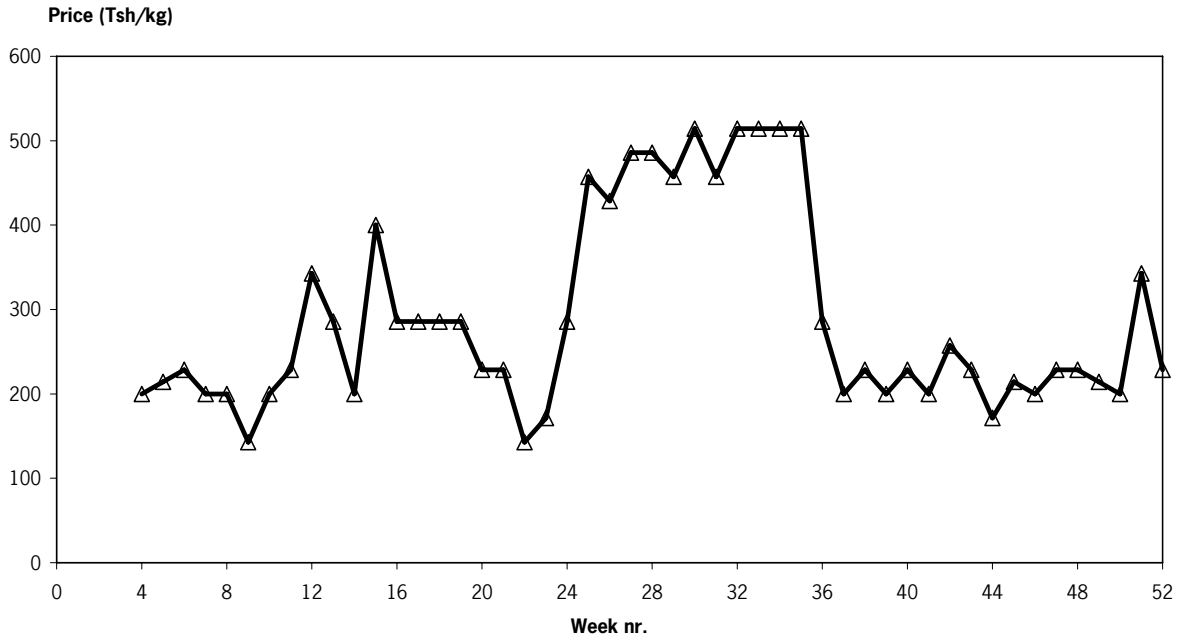

Figure 13. Prices of African eggplant per kg supplied in tpc kiroba units (35 kg) at the Kilombera Market in Arusha, 2005.

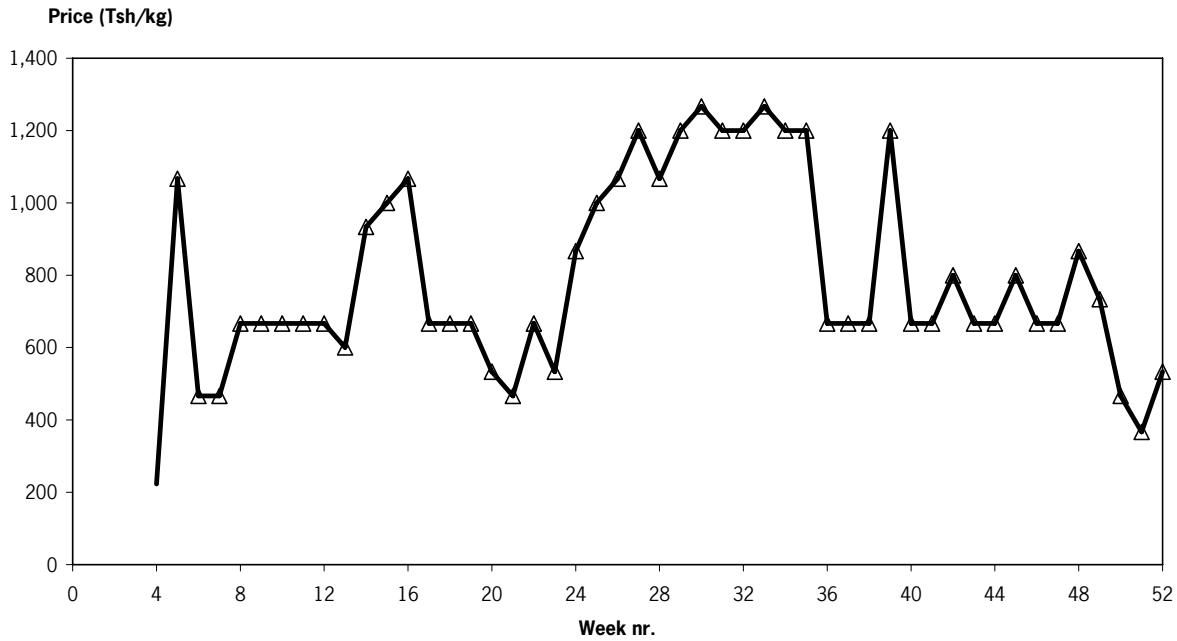

Figure 14. Prices of okra per kg supplied in tpc kiroba units (15 kg) at the Kilombera Market in Arusha, 2005.

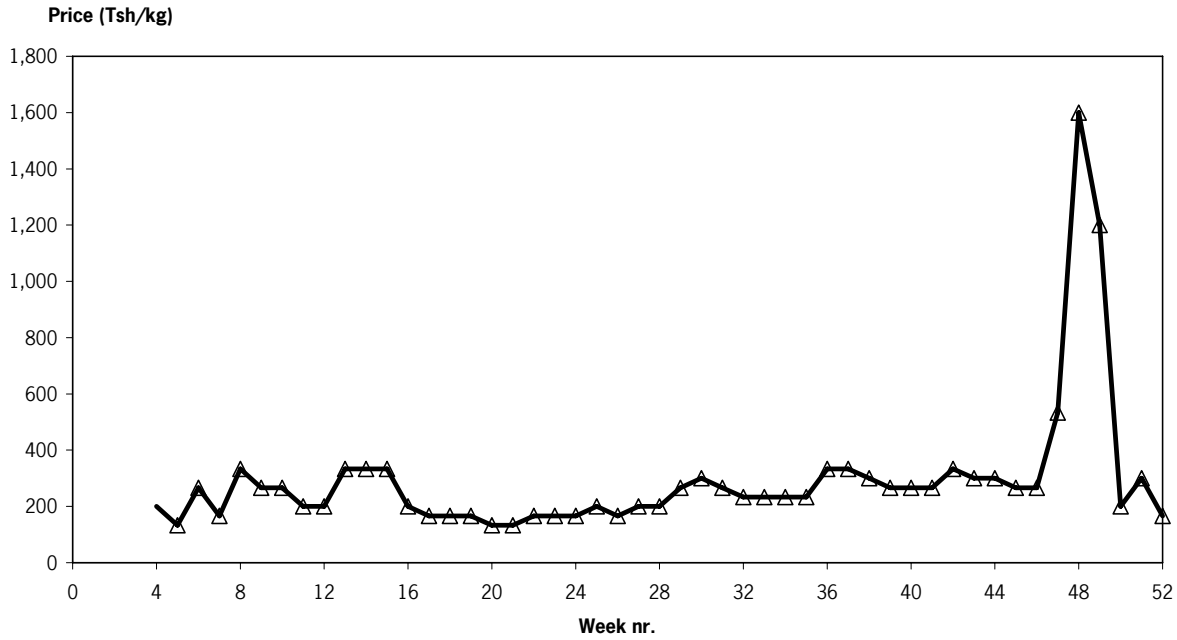

Figure 15. Prices of amaranth per kg supplied in tpc kiroba units (15 kg) at the Kilombera Market in Arusha, 2005.

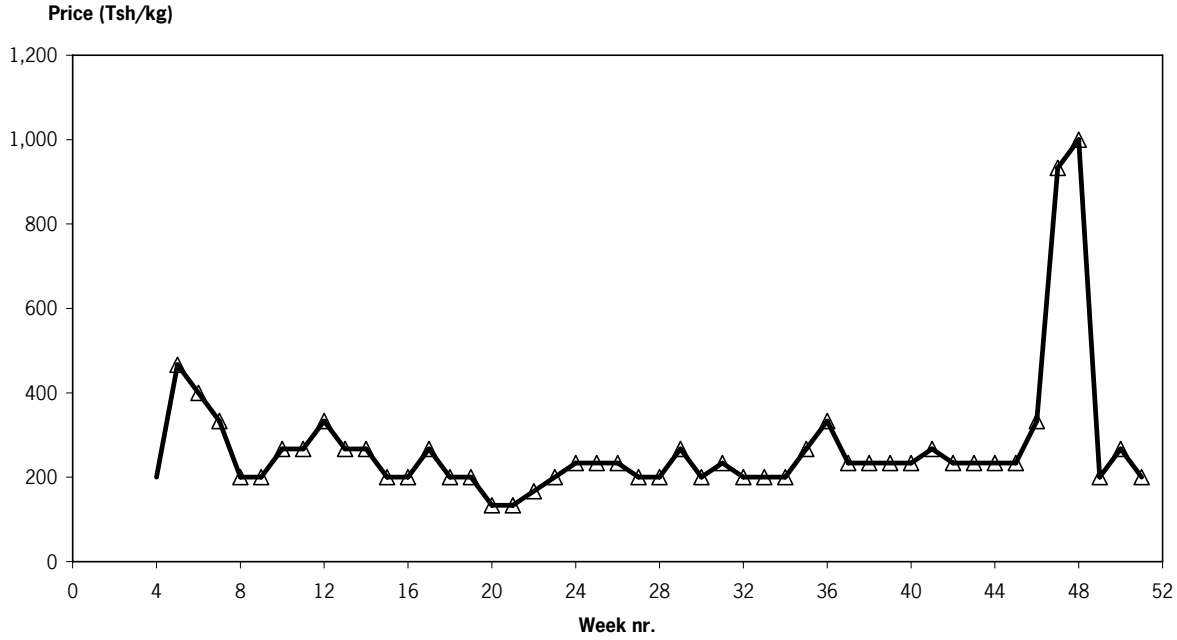

Figure 16. Prices of Sukuma wiki per kg supplied in tpc kiroba units (15 kg) at the Kilombera Market in Arusha, 2005.

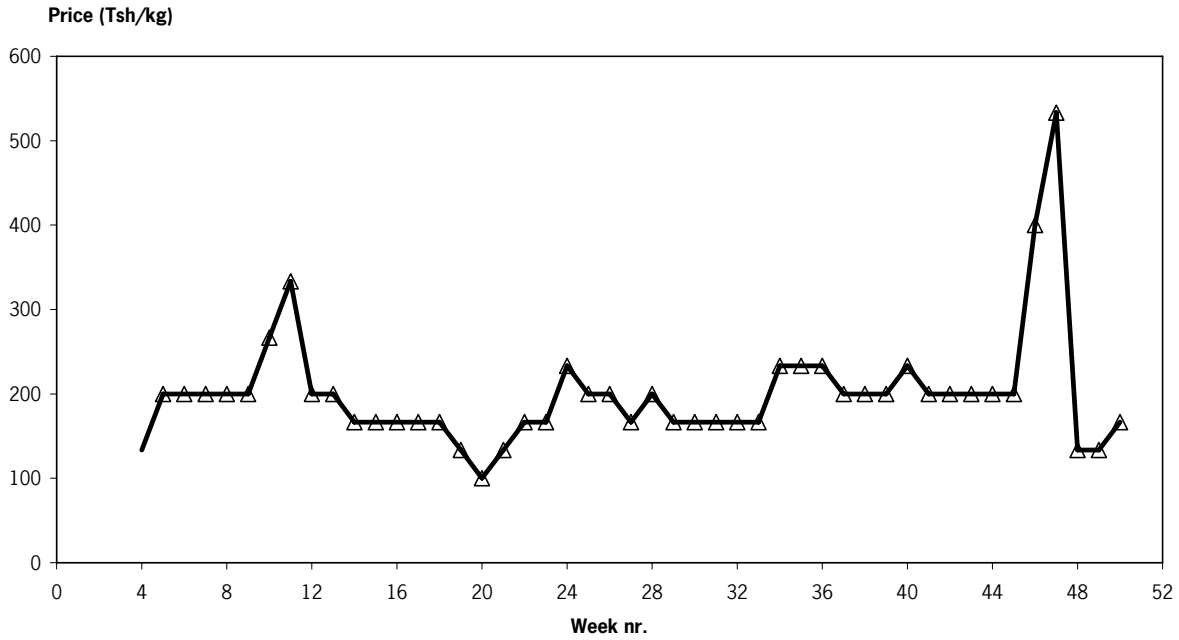

Figure 17. Prices of spider plant per kg supplied in tpc kiroba units (15 kg) at the Kilombera Market in Arusha, 2005.

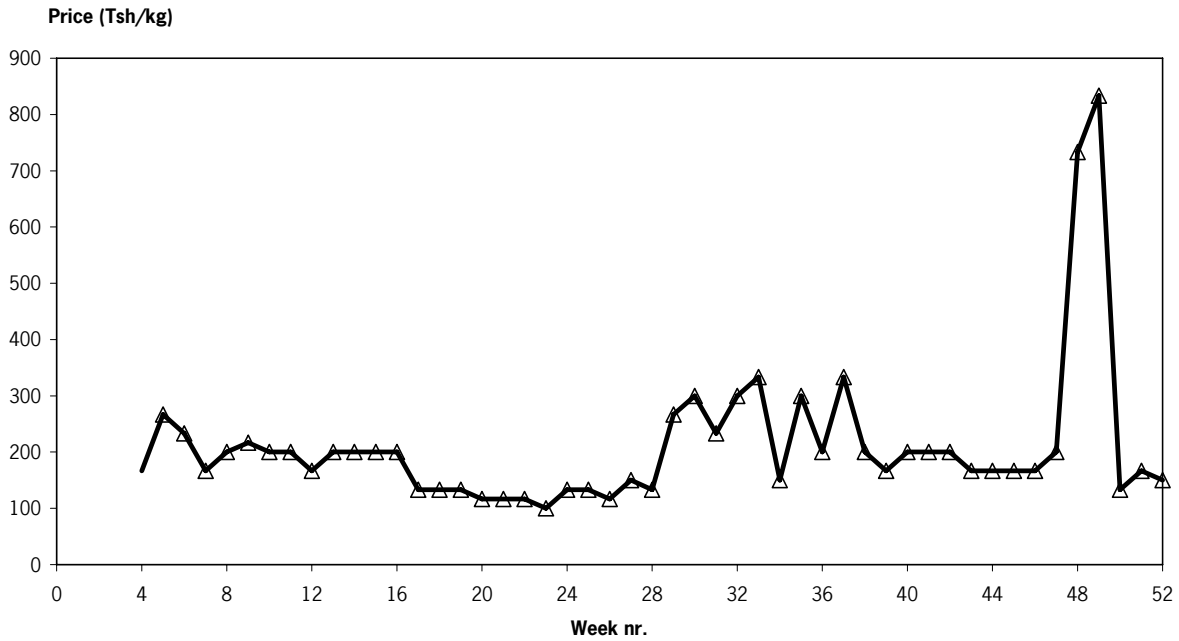

Figure 18. Prices of night shade per kg supplied in tpc kiroba units (30 kg) at the Kilombera Market in Arusha, 2005.

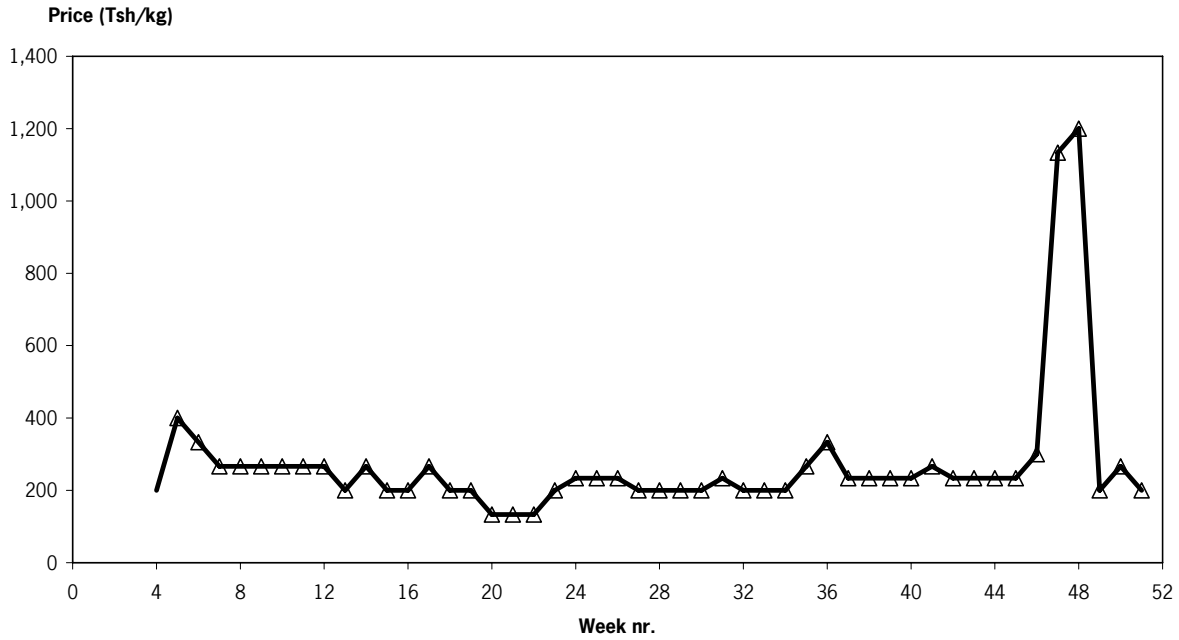

Figure 19. Prices of Ethiopian kale per kg supplied in tcp kiroba units (15 kg) at the Kilombera Market in Arusha, 2005.

Figure 20. Tomatoes for sale at the market.

4.5 Importance, constraints and policy in vegetable cultivation

4.5.1 Importance

The "Study on the horticulture development in Tanzania" (Shao, 2002) stresses that horticulture needs to be stimulated due to the following factors:

- Demand for more nutritional food is increasing in Tanzania due to changes in living standards (also according to the WHO vegetable consumption is too low).
- A higher demand for products is generated by establishment of food processing industries.
- Urbanization has led to disbanding the system of food collecting in the wild and introducing home gardens in and around the cities.
- Horticulture crops have high value in terms of cash revenues (e.g. tomatoes)
- Due to liberalization of the world market, new markets or exporting horticultural crops are possible.
- Export of horticultural crops is an opportunity to earn foreign exchange.
- Especially in the Arusha and Kilimanjaro region land pressure is high; hence a more intensive horticulture cultivation system is required.

In 2003 export of vegetables to the EU amounted for 842 tons or 0.7% of the total export of vegetables from African countries to the EU (Temu, 2006). Export vegetables from Africa in general are asparagus, snow peas, fine beans, round beans, baby carrots, baby corn, hard-shell garden peas, Brussels sprouts, broccoli, chillies and globe artichoke. Besides these, considerable amounts of Asian vegetables are imported into the United Kingdom from Kenya (Singh, 2002). This is compared to other African countries like Kenya with an amount of 48,183 tons and South Africa with 22,112 tons low. However, vegetable production is for a lot of farmers a source to earn cash. By Temu, 2006, estimated is that the amount of cross-border export from Tanzania to Kenya of tomatoes, onions and potatoes is approximately 7,000 ton with a value of 424,000 USD. This amount is probably even estimated lower then it is in reality (Temu, 2006).

4.5.2 Constraints

According to the Ministry of Agriculture and food security described in the report "Study on the horticulture development in Tanzania" (Shao, 2002) and in the agricultural and livestock policy of 1997 the main constraints for developing the horticultural sector are:

- Organization of production is poor
- Lack of a good marketing system
- Infrastructure
- Lack of quality control system, grading and packing materials

Also by Fisher (2003) constraints to increasing incomes of small scale producers were listed:

- Technology development and transfer
- Extension services
- Infrastructure
- Agriculture marketing

By Temu, 2006 the following constraints in order of importance to horticultural production were listed were listed:

High priority	Medium priority	Lower priority	Low priority
Access to market	Processing	Germplasm	Food safety
Infrastructure	Adapted varieties	Water	Market information
Propagation	Appropriate technology	Skilled labour	Agrochemicals
Pests and diseases	Extension	Standards	Climate
Lack of information			Soil
Capital/loans			Policy
			Risk
			Organization

4.5.2.1 Organization

Organizational aspects of production are poor due to e.g. lack of inputs like seeds, fertilizers and pesticides (Shao, 2002). Especially lack of disease free seeds and planting material and the absence of varieties suitable for climatic conditions present in Tanzania are mentioned as a constraint. Another constraint is that also the organization of research institutes as well as extension services is not optimal. Thus they are not functioning optimal in order to support the farmers.

From research and extension service uncoordinated, fragmented and duplicated and overlapping messages are being transferred to the farmers. Also some technologies that are being promoted are not suitable for the farmers to implement.

Besides at the institutes and extension services due to low remuneration and lack op supervision the motivation of the staff is very low and between farmers, research and extension communication is very weak.

4.5.2.2 Marketing

In Tanzania good functioning marketing systems are lacking (Shao, 2002 and Eskola, 2005). A normal procedure is that commissionaires are buying the product at the farm. They go to the farm, negotiate with the farmer about the price while the farmer has no or only limited market price information, and collect the products at the farm. Information systems are hardly present. About 80% of all produced vegetables is sold in this way. The other 20% is sold directly by the farmer on village or town markets.

Due to the absence of a good marketing system a high amount of product is wasted due to quality deterioration and post-harvest losses. Estimated is that 31% is lost of the total production.

Also good marketing strategies and channels are needed in order to increase demand by which production can be stimulated.

4.5.2.3 Infrastructure

Vegetable production areas are 100 tot 200 km away from the cities. A good transport system therefore is necessary. However, most roads are in a poor condition and transportation is hardly available. Feeder roads are especially a problem in collecting the products at the farm. Tanzania has some main roads which are in a fairly good condition. Feeder road density per region is very different (Table 15).

Table 15. Village feeder roads.

Region/District	Feeder road total length (Km)	Area surface (sq. km)	Total density (km road per sq km area)
Arusha	6,494	82,306	0.08
Arumera	674	2,896	0.23
Kilimanjaro	3,003	32,407	0.09
Hai	194	2,168	0.09
Iringa	2,599	56,864	0.05
Iringa rural district	908	24,458	0.04
Morogoro	1,423	70,799	0.02
Kilosa	470	14,918	0.03

Source: Temu, 2005.

In order to get products to Dar es Salaam from the different regions costs are 15,000 to 45,000 Tsh per ton (Table 16). Transport from regions closer by Dar es Salaam is cheaper compared to transport from regions further away like Mbeya and Arusha. Exporting goods to bordering countries from Dar es Salaam cost about 250 to 300 USD per ton.

Table 16. Transportation costs per ton product from different regions to Dar es Salaam.

Region	Distance to Dar es Salaam	Costs (Tsh)	Costs per km (Tsh)
Morogoro	196	15,000	77
Iringa	501	20,000	40
Tanga	354	20,000 – 25,000	71
Kilimanjaro	562	30,000	53
Mbeya	851	45,000	53
Arusha	647	45,000	70

Source: Eskola 2005.

In order to transport the products farmers hire a truck or carry the products. About 20% of the transport is still done by carrying the product on the head.
There are no cool storage facilities and transport is done by normal trucks without the opportunity to cool during transport (Shao, 2002 and Eskola, 2005). Also packing technologies are absent as are adequate packing materials and processing facilities.
Another issue is the availability of production facilities like water supply systems and lack of research facilities (laboratories, research fields etc.).
Finally farmers have very limited opportunities to get business loans.

4.5.2.4 Quality control system

No grading standards, and quality systems is present at the moment. It is necessary to train farmers on how to cultivate crops and how to handle, pack (using right packing materials) and grade products in order to enhance shelf life and reduce post harvest losses.

4.5.3 Policy

By the ministry of agriculture priority will be given to the following constraints:

- to meet stringent product specifications (uniform size, colour, quality as is demanded by the consumer)
- to meet market requirements (reliable steady supply)
- to meet shipping schedule (road transport must be efficient)
- Fast and efficient export procedures

The government of Tanzania wants to remove these constraints by:

- To enhance yield and production of disease resistant varieties high priority will be given to strengthen research extension and small scale irrigation.
- Assisting the private sector with organizing domestic and export markets. The government will take responsibility in the areas of quality control, and by helping funds for investment in storage, packaging, transport facilities and market information systems.
- Supporting programmes in breeding, distribution and production of varieties which are preferred by the market.
- Streamlining export procedures
- Facilitating negotiations between producers and airline companies to increase cargo space.

5 Conclusions

Based on the available information the following conclusions can be drawn:

- Tomato is the most important vegetable commodity in terms of acreage, production and economical value.
- Indigenous vegetables are important as a rich source of nutrients and availability. Net value of these crops are lower compared to "exotic" vegetable crops and for supply in Dar es Salaam are mostly grown (over 90%) in Dar es Salaam itself by the inhabitants. This urban agriculture has been stimulated the past decades and therefore it is not foreseen that it will disappear from the urban area's. Due to urbanisation land pressure is present which can result in loss of land available for agriculture. For that reason expected is that urban agriculture will shift from extensive cultivation like fruit tree cultivation to a more intensive system like vegetable production leading to an even higher production of indigenous vegetables in urban agriculture.
- The most important horticultural region is located around Iringa and Mbeya.
- Trading is mostly done via informal market chains, there is no specific "tomato" or "onion" chain, trading takes place based on trust between persons therefore trading on distance between persons who don't know each other rarely takes place.
- Constraints in the cultivation of vegetables are:
    - Marketing
    - Low prices in the peak season (absence of irrigations systems, no harvest planning).
    - Lack of good planting material and seeds.
    - Presence of pests and diseases.
    - Logistics and transport is difficult.
    - Storage facilities are lacking.
    - Lack of knowledge/training about post harvest handling.
    - Quality control systems are absent.
- The area with the highest potential for marketing is the Northern Highlands despite the higher transport costs to Dar es Salaam, due to its location near to Kenya, ports and airports and because feeder roads are the most dense here compared to the regions in the south.

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