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First Mile Transport Challenges for Smallholder Tomato Farmers along Ihimbo-Itimbo Road, Kilolo District Tanzania

Final Report

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International Forum for Rural Transport and Development

AFCAP Project Reference Number TAN2015C

October 2015

IFRTD

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Cover Photo: Tomato roadside consolidation, Kilolo District, Tanzania

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Quality assurance and review table			
Version	Author(s)	Reviewer(s)	Date
1.1	Njenga, P. Willilo, S. Hine, J.		9 June 2015
		Annabel Bradbury	19 June 2015
		Paul Starkey	22 June 2015
1.2	Njenga, P. Willilo, S. Hine, J.	Annabel Bradbury	8 September 2015
1.3	Njenga, P. Willilo, S. Hine, J	Paul Starkey	25 September 2015
1.4	Njenga, P. Willilo, S. Hine, J	Paul Starkey	6 October 2015
1.5	Njenga, P. Willilo, S. Hine, J	Paul Starkey	16 October 2015

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Abstract

This pilot study looked at *first mile* transport challenges faced by smallholder tomato farmers along Ihimbo-Itimbo Road, Kilolo District, Tanzania. The first stage distance is critical for agricultural products that are time and transport sensitive such as tomatoes. Key issues include: a dearth of means of transport among farmers, compounded by poor first mile infrastructure. Main transport modes to the consolidation points are headloading, motorcycles and bicycles though there is limited ownership of the latter in the area.

Average first mile distances to consolidation points range from 1-4 km. Motorcycles are a relatively more expensive mode compared to headloading for the first mile journey. Average transport costs to consolidation points on normal days were TZS 10,000 (US$ 5) and TZS 16,700 (US$8.35) for head-loading and motorcycles respectively. On rainy days, the average transport cost is higher by 50% for headloading (TZS 15,300 or US$7.65) and 20% for motorcycles (TZS 19,800 or US$10).

The farm gate prices are highly variable, with seasonality and availability of transport being key factors. There is also a huge difference in the price as tomatoes move along the transport chain. Simultaneous price information collected in different markets showed prices of up to 250% higher at the final market compared to the farm gate price.

Closer collaboration between transport planners and the agricultural sector is required. Developing appropriate standards for first mile access and provision of basic infrastructure at load consolidation points are important areas of focus.

Key words

Agriculture Transport, First Mile Transport, Kilolo District, Rural Access, Tomato Transport.

Acronyms, Units and Currencies

$	United States Dollar (USD) In April 2015, USD 1 ≈ TZS 2000. USD 1 ≈ GBP 0.68
AFCAP	Africa Community Access Partnership
ASCAP	Asia Community Access Partnership
DFID	Department for International Development (UK Aid)
GBP	Great Britain Pound, UK Pound (£)
IFRTD	International Forum for Rural Transport and Development
IMT	Intermediate Means of Transport
KENDAT	Kenya Network for Dissemination of Agricultural Technologies
Kg	kilogramme
Km	kilometre
ReCap	Research for Community Access Partnership
TANZAM	Tanzania-Zambia
TCP	Transport Consulting Company
Tonne-km	tonne-kilometre
TZS	Tanzania Shilling In April 2015, USD1 ≈ TZS 2000; GBP1 ≈ TZS 3000
US$, USD	United States Dollar In April 2015, USD 1 ≈ TZS 2000. USD 1 ≈ GBP 0.68

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1 Executive summary

This report contains the results of a small scale pilot study that looked at *first mile* transport challenges faced by smallholder tomato farmers in the hinterland area of the Ihimbo-Itimbo Road, Kilolo District, Iringa Region, Tanzania. The study was carried out between January 2015 and April 2015. The first mile transport is the transport segment between the smallholder farm and the first point of commercial interface (collection point, motorable road, or the first market in immediate proximity). This first stage distance has been found to be a critical transport bottleneck for agricultural produce such as tomatoes, vegetables and fruits etc, that are time and transport sensitive due to perishability and fragility.

These types of products are currently in high demand in the growing urban centres of Tanzania, as is the case in many other countries in Africa. Many farmers are taking advantage of the growing demand to venture into the production of these products that not only possess the advantage of being suitable for smallholder farming, but have a short planting-to-harvest waiting time compared to traditional staples and cash crops.

Tomatoes are a particularly high value commodity and are in high demand not only in Iringa Region, but also in markets as far afield as Dar es Salaam, Dodoma and Morogoro. As mentioned above, tomatoes are a time sensitive crop, especially from harvest to final market owing to their perishability. In addition to the value deterioration that may occur due to marketing delays, their fragility also means the manner in which they are transported could result in squashing and bruising which also affects the price.

A key ingredient to reaping good returns from growing high-value products such as tomatoes is reliability of transport services linking farmers to the markets. Smallholder farmers produce low volumes that require consolidation into viable volumes for effective transportation. Consolidation also requires communication and coordination with traders who collect the produce from roadside collection points and transport them to various markets.

The study covered the eight main tomato growing villages in the area, namely Ibohola, Ihimbo, Isoliwaya, Itimbo, Iwonde, Luwiva, Mlandege and Ndiwiri. In 2014/15 season, there were 127 smallholder tomato farmers in the villages with an average of 0.4 hectares (1 acre) of their farms under tomato cultivation. Average tomato production hectare was 7 tonnes per season. There is only one tomato season per year. Average profit to a farmer from tomato production last year was approximately TZS 331,867 (US$166). They combine tomato production with other crops for subsistence and sale.

Farmers sold tomatoes to traders from Iringa, Dar es Salaam and Dodoma. Traders typically come ahead of the transport and organise consolidation from different farmers before calling in transport that comes and collects along the main road. The farm gate prices of tomatoes are highly variable, with seasonality and availability of transport being the key factor. During peak harvest periods (July-November), prices can be as low as TZS 4,000 (US$2.0) per 60 kg bag while in periods of scarcity (March-June), the prices can range between TZS 10,000-25,000 (US$ 5 – 12.5) for 60 kg bag.

Ownership of transport among farmers is very low. 77% of farmers reported they did not own any means of transport while 19% own a bicycle, 2% own a motorcycle and another 2% own a pick up or a small car. Transport from farm to the roadside is mainly by headloading (89%), bicycles (7%), and motorcycles (4%). The average distance of the journey from the farm to the roadside ranges from 1-2 km in the dry season and can be as long as 4 km in the

rainy season. This is because the villages of Isoliwaya and Luwiva cannot be reached by motorized transport and their nearest consolidation becomes the village of Itimbo. Transport problems are mainly experienced during the rainy season when many parts of the road become impassable or are accessed with difficulty.

Headloading and motorcycles are used for the first mile transport. Motorcycles come out as a relatively more expensive mode of transport compared to headloading for this part of the journey. The average transport costs per tonne-km to the consolidation points on normal days were TZS 10,000 (US$ 5) and TZS 16,700 (US$ 8.35) for head-loading and motorcycles respectively. On disrupted and/or rainy days the average transport cost per tonne-km is higher by 50% for headloading (TZS 15,300 or US$7.65) and 20% for motorcycles (TZS 19,800 or US$10).

. There is a huge difference in the price of tomatoes as they move along the transport chain from the farm gate to intermediate and major markets. We collected simultaneous price information of tomatoes in different markets, and the results showed that prices at the major markets (like Dar es Salaam) can be 250% higher than the farm gate price.

The study notes that the issue of 'first mile' transport affects many perishable products as they are difficult to store and to maintain value. When transport is poor and storage facilities are unavailable, farmers have no bargaining power over traders. Typically, perishable products are produced in the highland areas where road maintenance is difficult and expensive due to rain and terrain.

Consolidation of small volumes of goods is important to both agricultural produce and small freight in rural areas. Small freight is related to farm inputs, stock for shops, household goods. Motorcycles and use of mobile phones can be very useful in the consolidation of agriculture and small freight to achieve economies of scale that are viable for high volume transportation.

2 Background

The objective of this small-scale study is to understand the infrastructure and transport service constraints that farmers face in the initial movement of tomatoes from their farms in the hinterland of the Ihimbo-Itimbo road, Iringa Region. The work builds on another pilot first mile study carried out in Kenya under the support of AFCAP Phase 1 (Njenga, Wahome and Hine, 2014).

IFRTD and AFCAP are continuing to partner in building up a body of knowledge on this issue by collecting a range of transport and household data to understand the transport challenges farmers face in overcoming or paying for this initial trip distance. These studies are helpful in trying to create linkages between the agricultural sector, rural road planners and regulators of transport services so that they can take a more integrated approach in assisting farmers to maximise their farm income and to reduce post-harvest losses especially for perishable products.

Agriculture is an important sector for rural development and poverty reduction in Tanzania (United Republic of Tanzania, 2012). It provides approximately 75% of employment opportunities, it accounts for 24.7% of the GDP and about 95% percent of food requirements in the country. In many places in Tanzania, smallholder agriculture is becoming more market oriented.

There is an emerging structure to the way transport services for smallholder agriculture is organized. Typically, it involves several transport segments each with its own characteristics and costs. They can be described as follows:

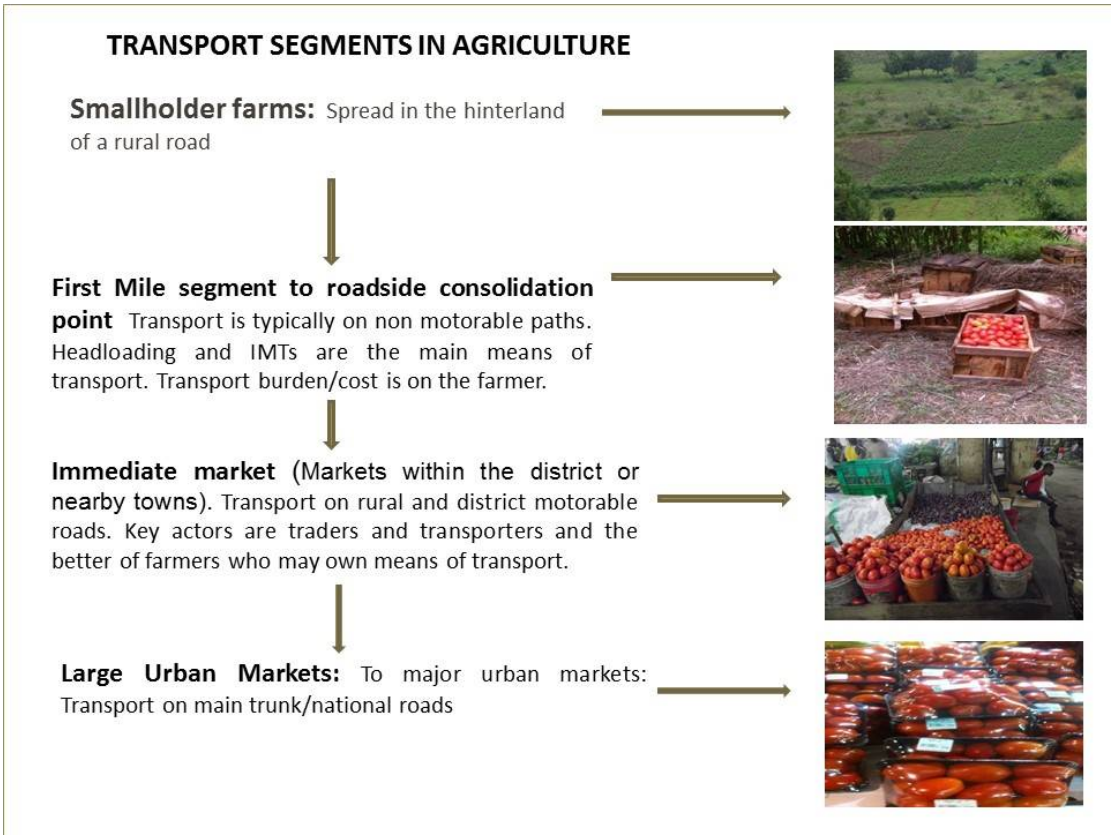
- A primary transport segment from the farm to a collection/consolidation point typically found at the key junctions of a motorable (low volume) road. *Key actors* in the transport system are the farmers who use their own (household) means of transport such as headloading/backloading, animal carts, bicycles and sometimes motorcycles.

- An intermediate transport segment, that is, from the primary collection points to an intermediate trader's market. *Key actors* in this segment are the better off farmers (also doubling up as traders) and transporters.

- Transport to big urban markets through main arterial road networks. *Key actors* here are transporters and traders.

Each of the above transport segments has distinct challenges and associated transport costs. These stages are exemplified in Figure 1.

Figure 1 : Stages in a tomato transport chain



From the point of view of AFCAP's focus on rural access, the initial transport segment - that is between the smallholder farm and the first commercial interface (collection point, motorable road, or primary market) - is of particular interest. This transport segment is critical to a farmer's income, especially where perishable produce such as tomatoes, vegetables, fruit and milk are involved.

The study along Ihimbo-Itimbo area shows the existence of multiple transport stages in tomato movement. A clear first mile segment is discernible between the farms and the roadside. The final markets are also differentiated with some sales occurring at the markets along Iringa-Kilolo road, Iringa town markets, along the TANZAM highway, but produce largely travels onto Dar es Salaam.

A previous study in Kenya showed that the initial crop movement from the farm to the consolidation point is the most expensive (on a tonne-km basis). This is on account of the low individual volumes transported, the poor condition of the road infrastructure, low travel speeds and limited options in the means of transport available.

This study in Tanzania's Kilolo District also found similar findings and observations. Among these are:

- The long but often unseen distances between the farms and the roadside (though figuratively referred to as 'the first mile', this distance is typically much longer than a mile)
- The enormous transport costs borne by the farmers in the first mile segment
- The dramatic increase in price/value between farm-gate and markets along the transport chain
- Innovations in using mobile phones for collective bargaining by farmers
- The unequal gender division of transport labour.

3 Research objective

The work builds upon another pilot first mile study that looked at transport of onions for smallholder farmers in Kieni County, Kenya (Njenga et al, 2014). The Kenya study was carried out in 2014 under the support of AFCAP Phase 1. The current study in Tanzania is looking at high value but more transport sensitive tomatoes in the Ihimbo-Itimbo area of Kilolo District.

The study had the following objectives:

- To understand the infrastructure and transport service constraints that farmers face in the initial movement of tomatoes from their farms to the collection points along the Ihimbo-Itimbo Road
- To analyse the various means of transport used in the first mile, their payloads and transport costs (per tonne-km)
- To understand the gender division of transport labour
- To understand the average distances covered in the first mile
- To understand the condition of infrastructure in the first mile and its impact on the condition of the tomatoes
- To provide an evidence base for further dialogue between transport and agricultural sectors.

4 Review of key documents

There is a growing awareness that rural infrastructure, including the location and standards of roads and markets, needs to be planned together with transport services, in order to optimise productivity, minimise transport costs, minimise crop wastage and gain the maximum advantage for both rural farmers and urban consumers.

Agriculture presents a tremendous opportunity for Africa. Growth in demand for food on the sub-continent is among the highest in the world (Banjo, Gordon and Riverson, 2012). Agricultural activity and transport need to be better integrated to ensure faster growth and poverty reduction. Achieving this integration requires establishing a common set of understandings and facts about the main factors affecting rural growth and their implications for transport activities. Because rural transport demand derives in part from agricultural demand, development planners must evaluate future sources of agricultural growth—the expected demand for and supply of agricultural produce—to identify transport needs.

The organisation of the first mile transport is critically important to the whole agricultural supply chain, from farmer to final consumer. This affects not only the immediate transport costs from farm to secondary roads, but also the scale and efficiency of transport and marketing for remaining parts of the journey. The efficiency of agricultural transport and marketing is a major concern in Tanzania. In an early analysis of staple grain crops in nine Asian and African countries, Tanzania was found to have the lowest percentage of producer price (farm-gate price) to final market price of all countries. This was 41.4% compared with an average of 64.4% for the nine countries. In contrast, for the four Asian countries (Bangladesh, India, Indonesia and Philippines), the average was 81.6% (Ahmed and Rustagi, 1987). Contrary to expectations, the difference in farm-gate price to final retail price was in fact found to be growing during the 1990s and early 2000s in important market sectors that had been liberalised. The issue was reported to be an important concern for the Government. (Kopicki R, 2004).

An indication of the variation in farm-gate prices in different locations collected in 2009 in Tanzania is given in Table 1. This also provides an indication of the efficiency of agricultural transport and marketing. While relatively little variation was found in maize and potato prices, very large variations were found for finger millet (12 fold variation) and groundnuts (6.5 fold variation) while the main subject of this study, tomatoes, were in an intermediate position with 3.3 times variation.

Table 1: Examples of Farm Gate Prices (TZS/kg) on the Southern and Western Corridors of Tanzania

Road Section	Location	Sunflower	Maize	Ground nuts	Potatoes	Beans	Onions	Tomatoes	Paddy	Finger Millet
Mikumi-Mafings	Mikumi		224	933	308	1105	694	363	885	600
	Ilula	321	330			920	950	166		
	Tanangozi	235	345		313	880	650	127		
	Mafinga		294	1061	293	878	579	220	1000	101
Tunduma-Sumbawanga	Tunduma		307		300	744		421	1013	
	Laela	115	226	164		600		150		
	Sumbawanga	413	359		333	582	544	306	633	
Sumbawanga-Mpanda	Chala	330	292			516	1429	371		1250
	Mpanda		366			975	556	333	722	300
Ntendo-Muze	Ntendo	279	305	375		757	1000	306		425
	Muze	337	337						567	667
Kibaoni-Igalukilo	Kibaoni	502	280	343		750	544		1227	
	Igalukilo	333	278	486		725			414	

Source: Road Fund Board, United Republic of Tanzania (2012)

There is no detailed information on the variations in farm gate prices between the markets. However one may expect smaller variations for crops which are very widely traded, such as maize. Large variations may be the result of local produce shortages or gluts, of less traded commodities, such as finger millet in small markets or monopolistic practises that are also easier to sustain in remote smaller markets.

Just as agriculture is changing with the increasing use of modern inputs (seeds, fertiliser, insecticides) so there have been changes in the availability and costs of transport vehicles including bicycles, motorcycles, trucks and buses and in marketing practices. Undoubtedly the biggest change in rural transport now taking place in Africa is the growth of motorcycles. For example in December 2005 there were 31,006 motorcycles registered in Tanzania but by December 2010 this had grown to 323,192 registrations (Ministry of Infrastructure Development, 2010). This is equivalent to an annual growth rate of 60% per year, in comparison other vehicles increased at an annual growth of 6.4%. This increase has been helped by both the recent rise in incomes in Africa coupled with the availability of lower priced motorcycles from China. Another important factor change is the widespread use of mobile phones in rural areas. Now a customer can call the motorcycle driver directly to the house for a pickup, whereas previously this was not possible.

The initial stages of crop movement, from collection at the farm to secondary roads, are the most expensive when expressed in tonne-km terms and provide the biggest transport constraints to the development of agriculture. A study of selected smallholder value chains in Kenya (KENDAT, IFRTD and TCP International, 2013) shows that the initial distance between the farm and the rural road (figuratively called the 1st Mile) can make up one fifth of the total transport costs of a transport chain. These initial movements will usually take

place on local paths and tracks and may involve carrying (by headloading or backloading), or by IMTs such as animal transport, bicycles or motorbikes, and then final transfer to light goods or multi-purpose vehicles. The process is time consuming and expensive, when either the opportunity cost of labour, or the cost of hired labour or hired transport, is taken into account. Headloading, for example, is in the order of 10 to 30 times more expensive per tonne-km than moving goods by truck.

Transport efficiency is not only important for improving financial and time costs in the delivery of inputs and produce, but also, in reducing post-harvest losses. Many crops such as tomatoes, mangos, soft fruit, green vegetables, bananas and even crops like onions can be bruised and lose value as they are mishandled and transported over rough roads. Other crops will experience value decline through time delays in getting to the market. Milk, a growing agricultural sub-sector in Tanzania, is particularly sensitive.

The pattern of transport may vary greatly between the periods when the roads are dry or wet. During the wet season, many tracks and roads will become impassable to conventional motor vehicles creating additional problems which results in extending the first mile transport and increasing costs.

Increasingly, domestic supermarkets that are attracting a growing proportion of the total market share are looking to establish new long term relationships with farmers and to adopt practices whereby produce is harvested and quickly taken for final distribution and avoiding intermediate markets and consolidation. Likewise the development of higher value export crops (particularly green beans, flowers, mangoes, pineapples) is also changing the nature of the patterns of harvesting and marketing.

One solution to help agricultural development is through contract farming whereby farmers agree to supply produce to marketing and processing firms through forward agreements often at pre-determined prices. This can reduce the insecurity of both buyers and sellers. Because the farmer knows that they can sell their produce at a given price they are better able to secure credit and invest in the farm. The processor can also plan production knowing that they have a contract with farmers to supply a certain quantity of produce. (Romanik, 2007).

A wide range of contract farming schemes now operate in Tanzania covering produce such as sugar cane, cotton, tea, pyrethrum, tobacco, cashew, sisal, Nile perch, dairy products, and maize. However although they are perceived to be broadly successful, it is recognised that the schemes are ‘buyer dominated’ and that there is enormous scope for improvement. The comparative advantage of Tanzanian crops involved in contract farming schemes is low and quality is often poor (Ministry of Agriculture Food and Cooperatives, 2006).

Farmers are also responding to new markets in supplying high value products to foreign markets such as fruit, vegetables, fish and flowers. These require modern supply chain management, involving quality control, cold storage, careful packing, and timely transport to meet specific flight schedules. Supermarkets like to work with medium and large scale farmers. However, in Kenya, 75% of fruit and vegetables come from small farmers (Sieber, 2009).

For most farmers, with limited loads to harvest, load consolidation at markets, buying posts or bus and truck stops is crucial in order to gain the advantages of the economies of scale and lower transport costs of larger vehicles.

Despite its importance relatively little quantitative information is available on the harvesting and load movement of ‘peasant’ agriculture. Similarly there has been relatively little

analysis on how the situation might be improved. An early cost-benefit analysis of different 'first mile' interventions was undertaken in Makete District in mountainous terrain in Southern Tanzania in 1996. In this analysis, infrastructure (e.g. feeder roads, footpaths etc), transport services (donkey, bicycle) and other interventions (grinding mills, wells) were compared. Footpaths and donkeys were found to give the highest benefit cost ratios (Sieber, 1996).

In 2014, an exploratory research project of first mile transport was carried out to investigate the initial movements of onions in Nyeri County in Kenya. Here it was found that the costs of the first two kilometres of movement accounted for between 10% and 20% of the net income that farmers would derive from their sale of production. At the same time it has been found that the conventional methods of transport used for these initial journey stages (e.g. backloading, animal transport, and motorcycle transport) costs 16 to 30 times more than lorry and truck transport costs, on a per tonne-km basis. It was also found that the rough handling during short distance first mile movements substantially bruised the onions hence they could only attract second grade prices when sold. Hence it was found that there are potentially huge benefits to be gained by improving first Mile transport, through better infrastructure and load consolidation (Njenga et al, 2014).

The current study builds upon the Kenyan work and investigates the first mile transport of tomatoes in the Iringa Region of Tanzania.

5 Methodology

The study area has six tomato-growing villages which are Itimbo, Isoliwaya, Iwonde, Itimbo, Luwiva and Ibohola. Data was collected through structured surveys with farmers and transporters, semi-structured interviews with key informants, a traffic count and observation of such things as prices in various tomato markets. Details of the tools used are as follows:

- **Transporter Survey (Annex A)**: 58 transporters of different means of transport were interviewed: 22 were female and 36 male. The interviews took place at the roadside collection points, on small markets along Kilolo-Iringa Road and in Iringa tomato market.
- **Key Informant interviews (Annex B):** Key informant interviews were conducted with the following people: District Agriculture, Irrigation and Cooperative Officer, chief engineer Kilolo District, Social Development Officer Kilolo District, District Executive Officer Kilolo District, Regional Administration Secretary for Iringa region, acting District Executive Director for Kilolo and four village leaders in Ihimbo, Itimbo Luwiva and Ibohola.
- **Farmers Survey (Annex C)**: There were a total of 127 tomato farmers in the survey areas during the last tomato season which ended in January 2015 prior to this study in March 2015. The interviews aimed at establishing the volumes produced per acre, amounts marketed, average prices per kg, first mile distances, and means of transport used and costs per tone-km. A total of 52 tomato farmers were interviewed drawn from the six tomato growing villages. Of these 13 farmers were female and 39 male.
- **Traffic Count (Annex D)**: A one day traffic count was conducted at two points, both outside the two markets hubs of Ihimbo and Itimbo.
- **Observations:** Observations were made at the first mile collection points and key markets. The purpose was to cross check transport costs associated with different means of transport, the inter-modal interface between the first mile and the

subsequent transport segment, average volumes transported and prices of tomatoes at different stages of the transport chain.

5.1 Study area

The study villages fall within Kilolo District Council which is one of four districts in Iringa Region. Administratively, Kilolo District is divided into 3 divisions, 23 wards, 93 villages, 484 hamlets and 51,455 households. The divisions are Kilolo Division with 12 wards, Mazombe with 8 wards and Mahenge division with 3 wards.

Figure 2: Context map of Ihimbo-Itimbo Road

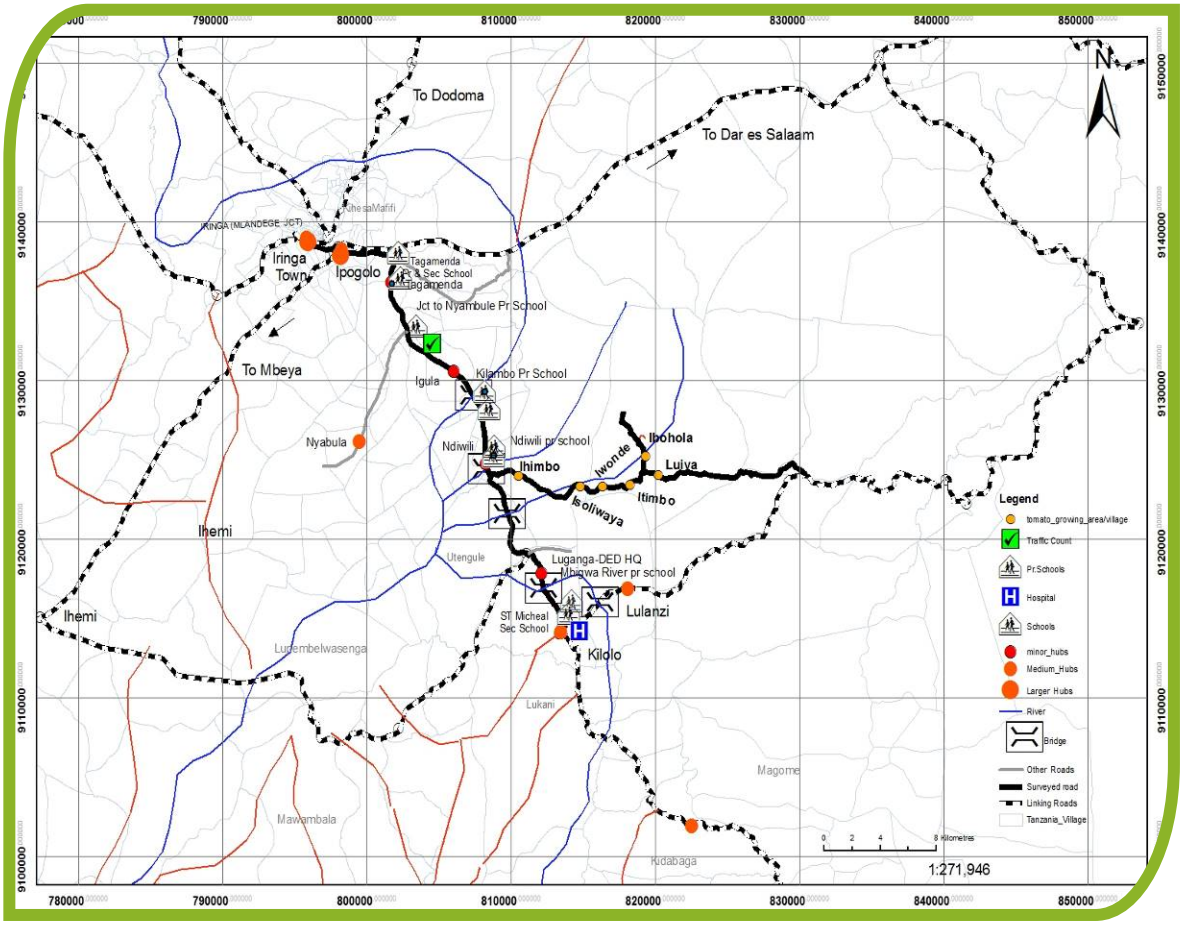
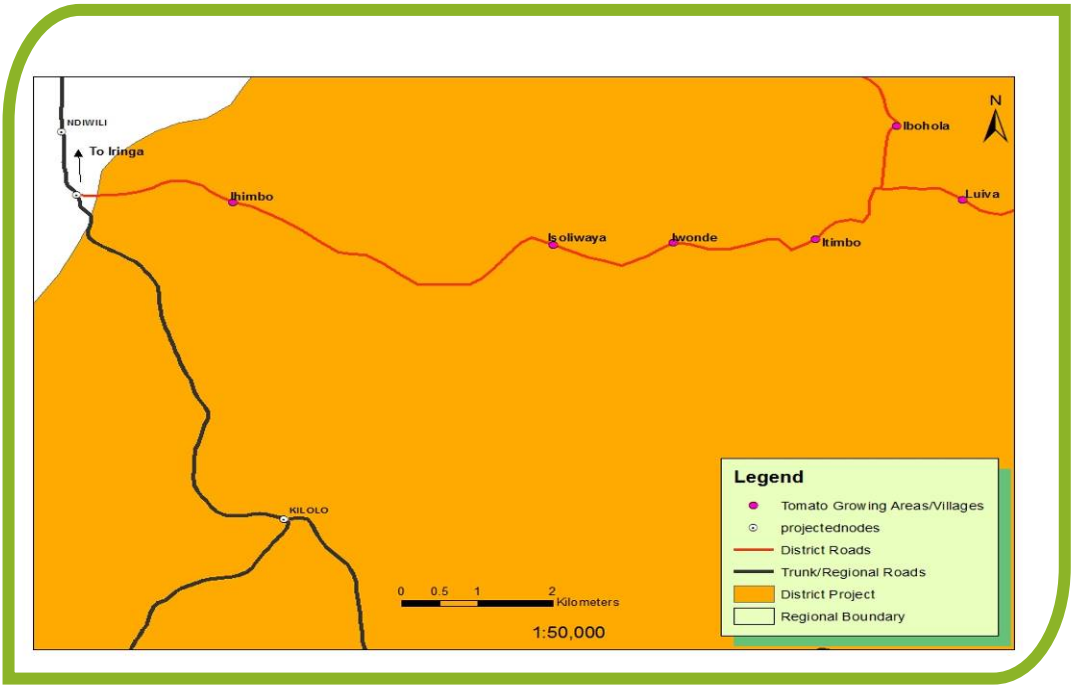


Figure 3: Map of Ihimbo-Itimbo tomato growing villages



According to the national population census of 2012, the district has a population of about 218,130 people (United Republic of Tanzania, 2013) of who 112,274 are female and 105,856 are male.

The major economic activities in the hilly hinterland are agriculture and livestock keeping. Crops grown include maize, sunflowers, beans, peas, vegetables, tomatoes and various types of fruit. Farmers and traders use the village access tracks to bring produce from the farms and onto the more accessible rural roads such as the Ihimbo-Itimbo road where traders buy and transport to nearby markets in the district or onto Iringa town and beyond.

The small scale tomato farms are found in the villages along the Ihimbo-Itimbo road. The villages fall within the Ihimbo ward, which has a population of 10,212 people of whom 4,978 are men and 5,234 women. It has a total number of 2,328 households (2012 Population Census). The zone is about 14 km from Iringa-Kilolo road junction, and about 23 km from Iringa town. According to the Kilolo District Agricultural Officer, the total number of tomato farmers in the last season was estimated to be 127, though this fluctuates from season to season. Figures 2 and 3 show the Ihimbo-Itimbo road, in whose immediate hinterland tomatoes are grown.

5.2 Data collection and cleaning

The data collection was undertaken in March 2015. This activity was preceded by recruitment of enumerators, their training and pilot testing of the field instruments with the enumerators. The integrity of the collected data was reviewed daily after collection. Every evening, the team members checked the collected data for completeness and correctness before assigning identification numbers. All checked questionnaires were assembled for data entry and cleaning. A template was prepared in Microsoft Excel for data entry. Frequency counting and cross tabulations were run to check the accuracy and distribution of the data. Data collected through in-depth interviews and focus group discussions, were transcribed immediately after fieldwork.

6 Results

6.1 Results from farmers' interviews

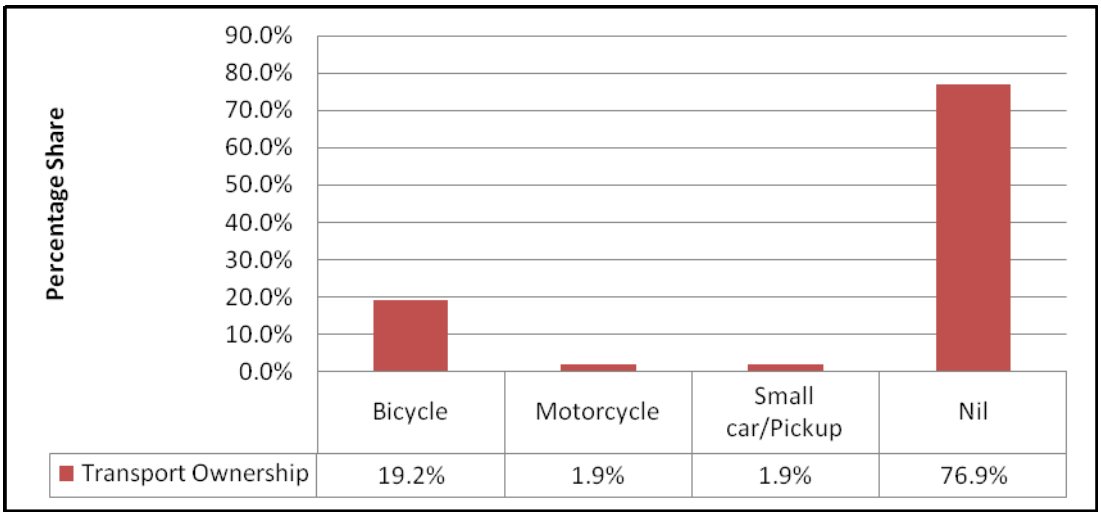
6.1.1 Tomato farming

Fifty two farmers were interviewed, representing 41% of the total population of tomato farmers along the Ihimbo-Itimbo Road, 13 of whom were women and 39 men. The land ownership tenure practiced is predominantly customary (82%)[1], while 18% of the farmers are renting and are not originally from the study area. Farmers combine tomato farming with other crops such as maize, beans, peas and vegetables. The average land holding size under cultivation is 1 hectare (2.5 acres), while tomatoes are cultivated on an average of 0.4 hectares (1 acre). The tomato growing cycle is once a year with the peak harvest months being August to December. Most farmers harvest once a week while some reported being able to occasionally harvest twice a week mainly targeting the local markets. Average production for the farmers interviewed is approximately 7 tonnes per season.

6.1.2 Tomato transport issues

Of the 52 farmers that were interviewed, only 12 owned some kind of means of transport. These were exclusively men, 10 of whom owned a bicycle, while one owned a motorcycle and the other a pick-up. The latter was a farmer as well as a trader within the area. The majority of farmers surveyed (77%) had no means of transport of any kind.

Figure 4: Means of transport owned



The concentration of the tomato farmers increases with proximity to the Ihimbo-Itimbo road. The villages of Iwonde, Itimbo, Ihimbo and Isoliwaya had the highest numbers of tomato farmers in the last season, at 29, 27, 26 and 23 respectively. These villages lie in close proximity of the Ihimbo-Itimbo road, with an average distance of 1.5 km to the nearest consolidation point.

The villages of Luwiva and Ibohola had lower numbers of farmers at 13 and 9 respectively. These villages, while generally accessible by motorised transport in the dry season, get cut off in the wet season, part of which is tomato harvesting time. During this rainy period, they have to find a way of transporting tomatoes to the more accessible Itimbo consolidation

[1] Where land is administered by community leaders and allocated to those who need to use it.

point which is an average of 5 km distance for the farmers that were interviewed. Discussions with the farmers showed that that proximity and ability to access collection points where trucks can reach is a key consideration in the decision to become a tomato farmer. Tomatoes are concentrated nearer the motorable road as this enables them avoid the risk of post harvest losses and also reduces the cost of first mile transport.

The means of transport used in the first mile includes headloading, bicycle and motorcycles. Headloading is the dominant transport mode with 88% of respondents using human porterage as their primary method of first mile transport (all the female farmers interviewed used this mode). Bicycles account for 8% of the transport mode in the first mile while transport by motorcycles account for 4%. Low use of motorcycles is largely due to their higher transport charges.

During the rainy period, there are severe disruptions in the motorability of the Ihimbo-Itimbo road where the first mile consolidation points are located. The rainy period is November to May. There are two months of harvest period (November and December) that coincide with the rainy period. There is a particularly challenging time for tomato farmers as transporters often fail to show up on the expected days at the consolidation points.

6.1.3 Price changes along the transport chain

The farm gate prices of tomatoes are highly variable with seasonality and availability of transport being key factors. During peak harvest periods (August-December), prices can be as low as TZS 4,000/60 kg bag while in periods of scarcity (March-June), the prices can range between TZS 10,000-25,000. There is also a huge difference in the prices of tomatoes as they move along the transport chain from the farm gate to intermediate and major markets. The study collected simultaneous information on the price of tomatoes in different markets, and the results showed that prices at the major markets (like Dar es Salaam) can be 250% higher than the farm gate price (see Table 2).

Figure 5: Roadside Markets along Kilolo-Iringa Road

Figure 6:Major Market in Dar es Salaam

Table 2: Tomato price changes along the transport chain

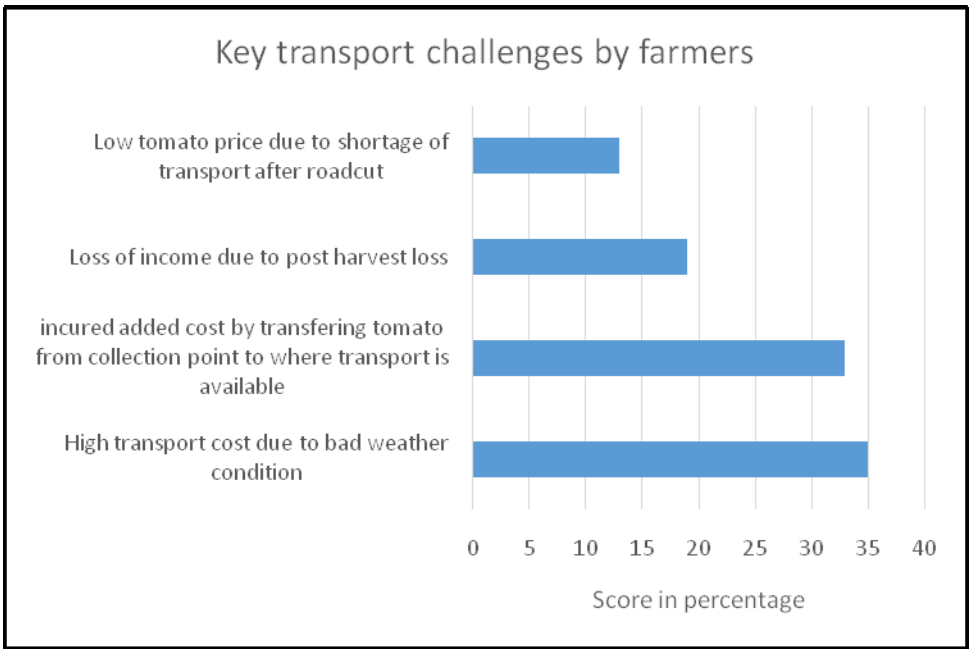
Area	Price (TZS) for 60 kg basket (tenga) at time of study	Percentage price change
Ihimbo-Itimbo Hinterlands	**10,000**	**-**
Iringa-Kilolo Roadside	**14,000**	**40%**
Iringa market	**18,000**	**80%**
Dar es Salaam	**35,000**	**250%**

Source: Field data in this study

6.1.4 Transport Challenges for Farmers

The farmers were asked to list problems in moving tomatoes in the wet season. Thirty five percent cited high costs of transport due to adverse weather conditions as a main challenge. This was followed by the related issue of additional transport and time costs for those who have to transport tomatoes to collection points that are further away during the wet season, because of accessibility challenges during periods of heavy rain. This was cited by 33% of the farmers surveyed (Figure 7). Post harvest losses and falls in tomato prices at the farm-gate when transport is unavailable were also cited as challenges.

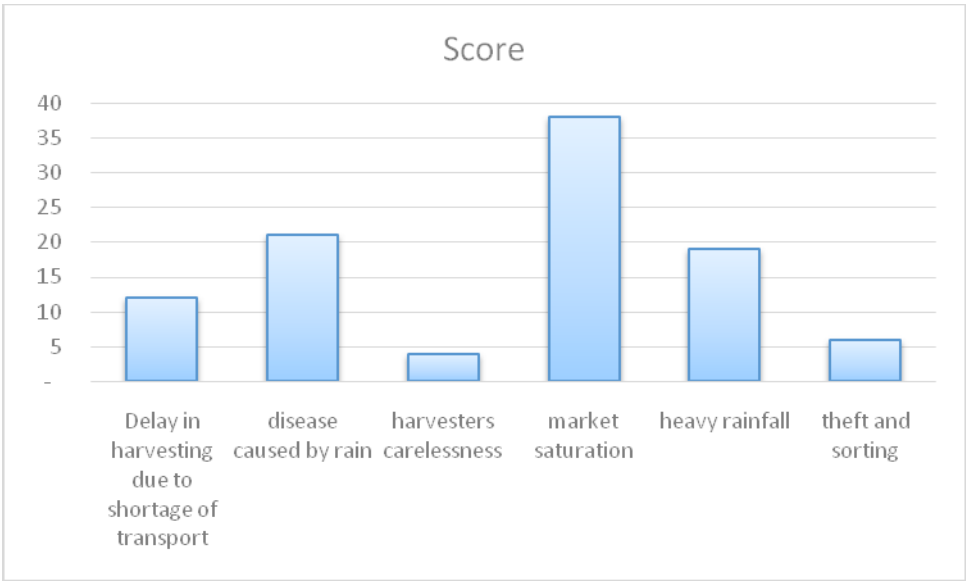
Figure 7: Key transport faced by farmers



6.1.5 Post Harvest Losses

The farmers were asked to rank the main reason for post harvest losses of tomatoes. Their views are shown in Figure 8. Thirty eight percent cited market saturation as the most significant cause as most farmers grow and harvest tomatoes at the same time. This is compounded by the fact that they are perishable and have to be put in the market as soon as they are harvested. Disease, heavy rainfall and transport follow in decreasing significance followed by theft, while harvesting and poor handling were ranked lower.

Figure 8: Reason for post-harvest losses



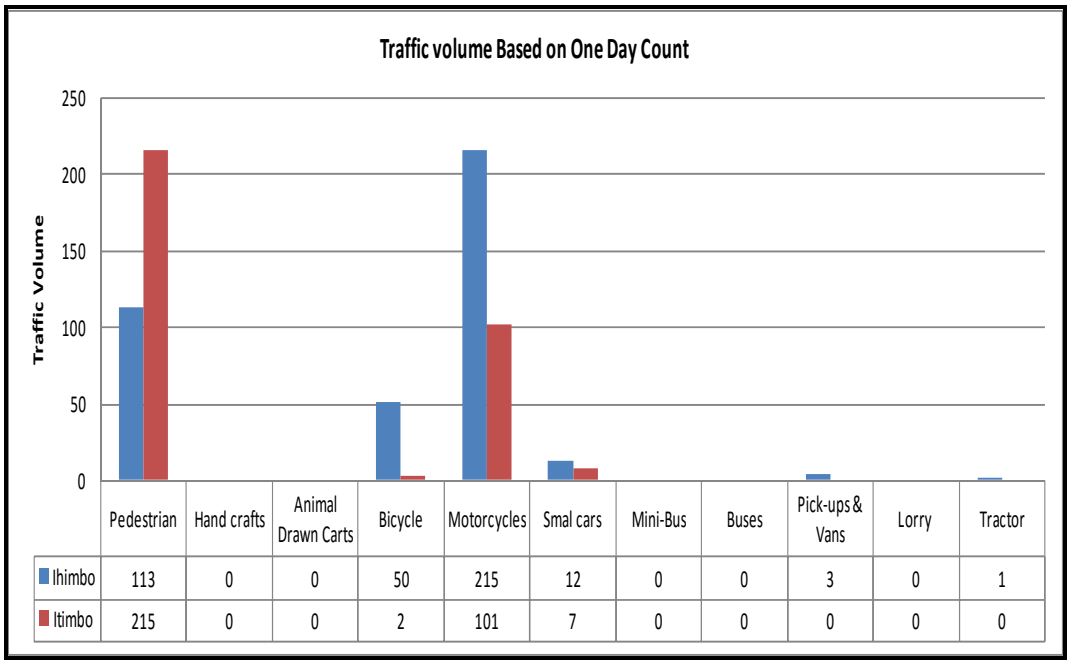
6.2 Results from Traffic Counts and Transporter Interviews

To gain a quick understanding of the modal composition of traffic and traffic volume along the road, a one day traffic count was carried out at two points between 6am-6pm. The

count was carried out on a rainy day and, as expected, there were huge disruptions in pedestrian, bicycle, motorcycle and conventional vehicles. The count was conducted at two points (both outside the two market hubs of Ihimbo and Itimbo).

At Ihimbo the following traffic was recorded: 215 motorcycles, 113 pedestrians, 50 bicycles 12 saloon cars, 3 pick-ups and 1 tractor (Figure 9).

Figure 9: Traffic count at Ihimbo



	Pedestrian	Hand crafts	Animal Drawn Carts	Bicycle	Motorcycles	Smal cars	Mini-Bus	Buses	Pick-ups & Vans	Lorry	Tractor
Ihimbo	113	0	0	50	215	12	0	0	3	0	1
Itimbo	215	0	0	2	101	7	0	0	0	0	0

At Itimbo, 215 pedestrians were recorded, followed by 101 motorcycles, 7 saloon cars and 2 bicycles.

6.3 Interviews with transporters

A total of 58 transport operators were interviewed, of which 22 were female and 36 male. The interview took place mainly in 6 villages which grow tomatoes along the Itimbo - Ihimbo road. The field survey took place a few months after the tomato season had passed. Five truck operators were purposively sampled and interviewed in Iringa Town. Other operators interviewed were as follows: 41 headloaders, 10 motorcycles, 5 lorry operators, 1 cyclist, and I pickup operator.

Women were not found in any other operator category other than headloading. They mainly operated along the first mile segment. Some were hired as transporters, while others were part of the farmers' families. Men were also found in the head/backloading operator category, but also as operators of bicycles, motorcycles, pickups and lorries.

The operators were asked to estimate the numbers of their types of modes that transport tomatoes in the area on a typical non-rainy day. Table 3 shows there were 44 women and 41 men who practise headloading. There were 18 motorcycles and 5 bicycles that are used in the transport of tomatoes for the first mile, and 6 different lorries and 3 pick-ups that came to collect at the consolidation points.

Table 3: Types of modes available on normal days

Gender	Mode	Average number of services when there is no disruption by rain
Female	Headloading	44
Male	Headloading	41
	Motorcycles	18
	Lorries	6
	Bicycle	5
	Pick-up	3

Source: Field data in this study

It was difficult to get a good estimate of the numbers of modes that operate during the rainy days as this depends on the severity of disruption.

6.4 Transport segments and costs

Key transport modes to the road side and/or consolidation points are headloading, motorcycles and bicycles, though there is limited ownership of the latter in the area. First mile distances to consolidation points range from 1-4 km. From the interviews with the transporters using motorcycles, their average distances were 13 km as they supplied mainly the nearby roadside markets and small market hubs within close proximity. The average distance covered by the higher capacity pickups and trucks was recorded at 30 km. Typically during the peak harvest months the distances travelled by trucks would be longer as they would normally be supplying bigger markets in Dodoma and Dar es Salaam. However at the time of this survey, the tomato season had just ended and the small quantities that were available were marketed locally within Kilolo District and Iringa town.

Motorcycles come out as a relatively more expensive mode of transport compared to headloading for the first mile journey. The average transport costs per tonne-km to the consolidation points on normal days were TZS 10,000 and TZS 16,700 for headloading and motorcycles respectively. On disrupted and/or rain days the average transport cost per tonne-km is higher by 50% for headloading (TZS 15,300) and 20% for motorcycles (TZS 19,800).

In contrast, the average costs of transporting tomatoes to the market centres on normal days were TZS 5,100 and TZS 428 per tonne-km for motorcycles and trucks respectively. This indicates that for a typical distance the cost using motorcycles is 12 times higher compared with trucks. During rainy days, trucks often do not make any trips to the study area. The average transport cost for tomatoes being transported by motorcycles during this period is TZS 5,500 per tonne-km (Table 4 and 5, and Figure 9).

Table 4: Average transport cost of tomatoes to consolidation points

Interview Area	Transport Mode	Av. Trip Distance (km)	Av. Transport Cost per tonne - km (TZS) - Normal Days	Av. Transport Cost per tonne- km (TZS) - Rain Days	No. of Transporters Interviewed
Ibohola	Bicycle	1	8,333	8,333	1
	Head/Backloading	2	7,555	7,556	6
Ihimbo	Head/Backloading	2	10,000	11,111	3
	Motorcycle	4	6,250	8,333	1
Isoliwaya	Head/Backloading	4	6,082	6,285	8
Itimbo	Head/Backloading	2	12,001	14,899	11
	Motorcycle	40	3,125	3,125	1
Iwonde	Head/Backloading	2	15,000	17,292	4
	Motorcycle	2	16,667	19,792	4
Luwiva	Head/Backloading	3	10,309	12,032	9
	Motorcycle	10	10,000	10,000	1

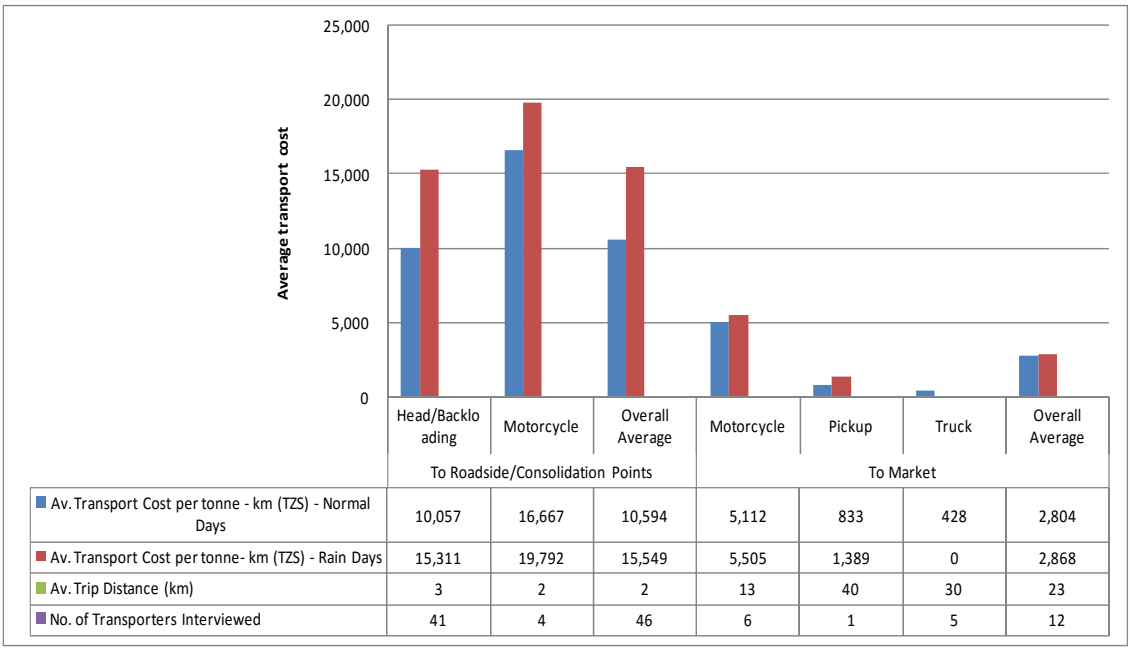
Source: Field data in this study

Table 5: Average transport cost of tomatoes to market centres

Interview Area	Transport Mode	Av. Trip Distance (km)	Av. Transport Cost per tonne - km (TZS) - Normal Days	Av. Transport Cost per tonne- km (TZS) - Rain Days	No. of Transporters Interviewed
Ihimbo	Motorcycle	4	6,250	8,333	1
Itimbo	Motorcycle	40	3,125	3,125	1
	Pickup	40	833	1,389	1
Luwiva	Motorcycle	10	10,000	10,000	1
Ndiwiri	Motorcycle	8	3,765	3,858	3
Mlandege Market	Truck	30	428		5

Source: Field data in this study

Figure 10: Average Transport cost per tonne-km to consolidation and market points



	Head/Backloading	Motorcycle	Overall Average	Motorcycle	Pickup	Truck	Overall Average
Av. Transport Cost per tonne - km (TZS) - Normal Days	10,057	16,667	10,594	5,112	833	428	2,804
Av. Transport Cost per tonne- km (TZS) - Rain Days	15,311	19,792	15,549	5,505	1,389	0	2,868
Av. Trip Distance (km)	3	2	2	13	40	30	23
No. of Transporters Interviewed	41	4	46	6	1	5	12

7 Conclusion

This pilot study is used to illustrate the importance of a good transport response in the marketing of perishable agricultural produce. Tomatoes are an example of an agricultural product that is time and transport sensitive due to perishability and fragility. Many smallholder farmers are increasingly moving into production of produce that has an expanding demand in growing urban centres. The farmers are however confronted by a number of challenges that call for closer collaboration between transport planners and the agricultural sector, especially those dealing with market access issues. Among the key issues is the fact that most farmers do not own any means of transport and are therefore constrained in the initial movement of their produce. This is compounded by poor first mile infrastructure connectivity. It would be worthwhile to investigate the possibilities to develop appropriate standards for basic access tracks and paths that can provide improved access to farmlands where such produce is grown. An important step in this is the development of standards that can help in the improvement of the first mile infrastructure taking into account the typical traffic composition in this segment of the road.

Another notable problem requiring the joint attention of transport and agricultural marketing experts is the issue of supporting more effective consolidation of produce by smallholder farmers. As implied in this study, tomato production is fragmented into small units by individual farmers. The farmers try and cooperate to ensure there is synchronized harvesting and delivery to common consolidation points. However, more can be done to introduce new strategies for load consolidation that combine infrastructural interventions, use of mobile phone platforms in gathering market intelligence, development of marketing cooperatives and in the case of many perishable produce, the location of storage facilities in strategic places. This puts farmers in better position to negotiate prices with the traders.

The study is an example of ways in which transport research can help stimulate discussion and collaboration between the transport sector and other rural development sectors, especially agriculture to ensure that cultivation is optimised and harvests can be evacuated to markets without excessive post-harvest loss. This would lead to improved incomes for farmers, reduced transport costs for traders and lower prices for consumers.

Increased collaboration is needed between the agriculture and rural transport sector in carrying out joint research like this, developing joint recommendations and exploring ways of supporting policies that can lead to more benefits across the two sectors.

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Annex A: Transporters Questionnaire

Objective: This survey instrument aims at documenting the dynamics of transporting tomatoes in the area by covering all the existing modes of tomato transportation and the fares associated with those modes. This is important in analyzing the per tonne/km cost of transporting tomatoes for different modes which will help in understanding the transportation burden farmers undergo in the First Mile segment of Transportation.

Interview Point Name:_____Date of Interview:_____Interviewer :_____

Farm Origin Location Name: _____

Average trip distance in km (From the Farm to Collection Point): _____

Day of the Interview: 1. Normal day 2. Market Day 3. Weekend 4. Rainy day

Name of Transporter:_____Gender: Female Male Age: _____

Are you the 1. Transport Service (TS) Owner: 2. TS operator 3. RTS owner-operator 4. Self (Farmer) 5. Hired *(circle one)*

TRANSPORT MODE:

Options are: Head/Backloading/Mini-bus / Bus/ Saloon/estate, Pickup / Lorry / Motor tricycle / Motorcycle /Tractor / Bicycle / Animal cart / Other (specify)

Other information (optional) _____

N.B. Only one row per table should be completed: that of the transport mode of the respondent

O1-2. How much Tomatoes (in kg) do you carry per trip on this section of the road (distinguish normal days, and rainy days)

Reference number	O1-2a	O1-2b	O1-2c	
Modes	Number of frequency/Day/ Week/Month	Amount of tomatoes Carried per trip (kg) Normal day	Amount of tomatoes carried per trip (kg/Tons) Rainy day	Which and how many months of the year are you busy with the transportation of tomatoes
Headloading/Backloading				
Bicycle				
Motorcycle				
Tri-Cycle				
Pick-up				
Mini-bus				
Bus				
Lorry				
Tractor				
Other (Specify)				

O1-3. How much do you charge in TZS per trip on this section of the road?

	Origins	*Destinations*	*Dist. (km)* *Note 1*	*How much do you charge per trip/unit*	
				Cost - Normal days (TZS)	*Cost - Rainy days (TZS)*
Headloading/Backloading					
Bicycle					
Motorcycle					
Tri-Cycle					
Pick-up					
Minibus					
Bus					
Lorry					
Tractor					
Other (Specify)					

O1-4. What is the overall condition of this road infrastructure in relation to your mode of transport?

Poor throughout the year	Fair condition throughout the year	Good throughout the year

O1-5. How many modes of your type are used for transporting tomatoes on this section of road?

Modes	Number of vehicles - Normal days	Number of vehicles - Rainy days
Headloading/Backloading		
Bicycle		
Motorcycle		
Tricycle		
Pickup		
Minibus		
Bus		
Lorry		
Tractor		
Other (Specify)		

Annex B: Key Informant Checklist – District Road Engineer

Questions	Coding categories Code
SECTION 1:RESPONDENT'S BACKGROUND	
1. Name of the respondent	**Tel. No.**
2. Ministry/Institution	
3. Department/Section:	
4. Position of the Respondent	
5. Gender	**1. Male 2. Female**

SECTION 2: AGRICULTURAL ACTIVITIES			
9. What is the role of your institution/organization in as far road/transportation in the area is concerned?			
10. Do you have any working relationship with small scale farmers? Discuss nature of the relationship briefly?			
11. How would you describe the current state of the roads linking tomato farmers to the collection points			
12. What challenges do you face in provision of roads leading to small scale farms?			
13Which roads are most problematic in terms of access for tomato farmers?	a)Road Name	b)Length	c)Months of difficulties
13. How are you addressing the challenges discussed above?			
14. In the last 3 years have there been any programmes to improve the roads linking tomato farmers to the markets?			

Annex C: Key Informant Checklist – Agriculture Marketing Expert

SECTION 1:RESPONDENT'S BACKGROUND	
1. Name of the respondent	**Tel. No.**
2. Ministry/Institution	
3. Department/Section:	
4. Position of the Respondent	
5. Gender	**1. Male 2. Female**

SECTION 3: AGRICULTURE AND MARKETING EXPERT	
6.How important are tomatoes as an economic activity in this area	
7. What are the main tomatoes growing areas in Kilolo?	
8. How many farmers are involved in tomato farming in Ihimbo-Itimbo villages	
9 How many tomatoes (in tonnes) are produced per year in Ihimbo-Itimbo area	
10. What is the most popular mode of transport used to move their produce directly from the farm to roadside? Why?	
11. What is the most popular mode of transport used to move produce from the roadside to first main collection point?	
12. Does a second consolidation take place before tomatoes are taken to an urban market place or for long distance movement? Explain	
13 Do you have any record(s) on transportation costs of Tomatoes in the area (From farm to collection point) (From collection point to other popular market)?	
14. Would you consider having designated collection points for tomatoes? If so, where would you suggest these be and why?	
15. Do farmers deliberately attempt to coordinate and consolidate their loads together before arranging transport in order to reduce transport costs? Or are transport and crop sales arranged independently?	
16. Which area(s) would you consider as most challenging in terms of transporting farm produce by the small scale farmers?	
19. What kind of roads improvement is needed in Itimbo - Ihimbo road section to make it friendly for Tomatoes farmers in this area?	

Annex D: Farmers Questionnaire

1. Name of the village: _____

2. Number of Tomato Planting Seasons/year _____

3a. Interviewee's name: _____ 3b. Date of Interview: _____

<table>
<tr><td>A).\Name of Farmer:</td><td>B: Farmer's Gender:
1. Male 2. Female</td><td>C). Farmer's Age:</td><td>D: Farmer's Education Level:
1. No Formal Education
2. Primary Education
3. Secondary Education
4. Tertiary</td></tr>
<tr><td>E: Size of farm:
Total area currently under cultivation:
acre

For Tomato cultivation:
acres</td><td colspan="3">F: Land Ownership Status:
1. Customary 2. Leasehold
Rented 4. Other Specify _____</td></tr>
<tr><td>I.Total kg of tomatoes harvested last yr
……
……..kg
Income last year from tomatoes.

……
……TZS</td><td colspan="2">J.Current sale price received per kg
……..TZS/kg.
Who pays for transport (farmer or trader/ transporter)?
To roadside? ……
To main market? ……</td><td>K. Costs of tomato production last year:

Acreage under cultivation last year……(acres)
Labour……TZS
Seeds/plants……TZS.
Fertiliser/chemicals……Tsh.
Tractors/machinery……..Tsh
Land rent……Tsh

Other……Tsh.</td></tr>
<tr><td colspan="3">L. Means of transport from farm to roadside……
……., ……..

Costs of transport (per kg) to roadside per mode stated above
……., ……., ……..</td><td>O. Gender of regular tomato transporters to the Collection point
1. Male
2. Female
3. Both</td></tr>
<tr><td>P. Do you own a means of transport for moving tomatoes? Yes / No.
Types of transport……
……
……</td><td colspan="2">Q. Are there problems in moving tomatoes in wet season, such as a shortage of transport, or transport costs rising? Kindly list the key problems
……
……
……
……
……</td><td>R. How do you coordinate transport and arrange sales of tomatoes? Explain the process……
..
……
…
……
…</td></tr>
</table>

	Or are problems the same throughout the year. Give examples	

Do you experience loss of tomatoes between time of harvesting and the time of selling (post harvest loss)
YES.
NO.

What percentage of post harvest loss for tomatoes?

What are the main reasons for post harvest loss for tomatoes?
1.

2.

3.

Annex E: First Mile Study Traffic Count Sheet

Name of Surveyor: _____ Tel. Contact: _____Date:

_____

Day: 1. Normal Weekday 2. Rainy Day 3. Weekend 4. Other (Specify)

_____

Physical Location of the Cordon Point: _____ Geo

Coordinates: _____

Name of the Road:

_____

Travel Direction:

From:_____to_____

_____

	Means of Transport									
Time	**Head/Back loading**	**Handcarts**	**Animal Drawn Carts**	**Bicycle**	**Motorcycles**	**Small Cars**	**Mini-bus**	**Buses**	**Pickups & Vans**	
6.00-7.00 am										
7.00-8.00 am										
8.00-9.00 am										
9.00-10.00 am										
10.00-11.00 am										
11.00-12.00 am										

	Means of Transport									
Time	**Head/Back loading**	**Handcarts**	**Animal Drawn Carts**	**Bicycle**	**Motorcycles**	**Small Cars**	**Mini-bus**	**Buses**	**Pickups & Vans**	
13.00-14.00 pm										
14.00-15.00 pm										
15.00-16.00 pm										
16.00-17.00 pm										
17.00-18.00 am										
TOTAL										