BACKGROUND PAPER

Agricultural Logistics Management and Related Infrastructure

Agricultural Logistics Management

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Table of Contents

Table of Contents........................................................................................................................................1
EXECUTIVE SUMMARY ...............................................................................................................................i
1. BACKGROUND.........................................................................................................................................1
   1.1 Understanding transport segments in smallholder agriculture......................................................1
   1.2 Produce Consolidation .......................................................................................................................3
   1.3 First Mile Transport Challenges .....................................................................................................4
2 CHALLENGES .........................................................................................................................................6
3 OPPORTUNITIES .....................................................................................................................................7
   3.1 Emerging Markets ..............................................................................................................................7
   3.2 Unexploited land and water resources ............................................................................................8
   3.2 Improving access to Markets ........................................................................................................8
4. SUGGESTED ACTIONS / THE WAY FORWARD ...............................................................................9
5. A SMALLHOLDER MONITORING TOOL KIT/ESTIMATED COSTS ..............................................10
6. REFERENCES ........................................................................................................................................11
EXECUTIVE SUMMARY

The present rapid urbanisation in Africa and the surging demand for fresh, high quality, agricultural products in international markets has opened new income opportunities for farmers, rural food processing industries and transport companies. According to the World Development Report (2008), new markets for high value agricultural produce – driven by rising incomes, liberalised trade, advanced logistics systems and use of ICTs - have proliferated in many African countries. Supermarkets are expanding in many places in Africa. Likewise the adoption of higher value export crops - particularly green beans, fruits, (and flowers) – is also changing farming practices, organisations of transport and the marketing structure. In Europe, customers are buying French Beans from Kenya or Tomatoes from Senegal. Nowadays, high value food products represent a considerable share of marketed agricultural value and have the potential to enable many smallholder farmers with farm sizes of 0.5 -3 acres - to escape the poverty trap.

The trend of diversifying small holder farming from traditional slow maturing staples such as maize and cereals, or cash crops like coffee, cocoa and sugarcane presents an important window for increasing rural household incomes and lifting many out of poverty. In addition, this emerging small holder farming sector provides new opportunities for the youth and women to participate in agri-enterprises value chains, either as farmers, marketers, processors or input suppliers.

The paper focuses on the transport challenges faced by smallholder farmers as they seek to become important players in emerging food supply chains in Africa. The paper draws from the results of two small-scale scoping studies that looked at the transport challenges faced by smallholder farmers in one rural village in Kenya (Njenga P, Wahome G and Hine J. 2014), and another one in Tanzania (Njenga P, Willilo S and J. Hine. 2015). Also reference is made to another study on the same subject (KENDAT, IFRTD and TCP International. 2013).

The Kenya study looked at smallholder onion value chain in a village in Kieni District located in the Central Highlands of the country, while the Tanzania study looked at the small holder tomato value chain in villages along Ihimbo-Itimbo road, Kilolo District in the Southern Highlands.

While recognising the importance of transport as an important component in the overall functioning of the smallholder value chains, we particularly draw attention to the transport bottlenecks the farmers in the initial movement of their produce from the farm to the first point of commercial opportunity – which could be a collection/consolidation point along the rural road, a trucking stop or the nearest market hub. We refer to this initial distance as the first mile.

The first mile is typically the segment of transport that links the farmers to the nearest motorable rural road or a produce collection point. The first mile infrastructure consists of the local village or farms paths and tracks that are inaccessible to conventional transport vehicles. While we figuratively call this distance the first mile, in actual terms it can range from 0.25km to 5km. Means of transport typically used in this segment are human porterage,

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1 IFRTD acknowledges with gratitude the support of the African Community Access Partnership (AFCAP) in supporting the studies referenced here. AFCAP is funded by UK Aid, with the aim of promoting safe and sustainable rural access for all people in Africa and Asia.
animal carts, bicycles, animal carts, motorcycles and in some cases, tractors and pick-up trucks.

Headloading which is commonly used is the most expensive method of transport. This method of transport can be over 20 times as expensive (on a per ton/km basis) than movement by truck. The studies showed that the initial crop movement from the farm to the consolidation point is the most expensive (on a tonne/km) basis. This transport segment can take up between 10%-30% of the produce income to the farmer. This is on account of the low individual volumes transported, the poor condition of the first mile road infrastructure, and limited options in the means of transport available. Even if distances of the first mile are short (0.25km – 5km) compared to the full journey to final markets, the transport costs can make up to \( \frac{1}{3} \) of the overall transport costs of a value chain. This is consistent with findings from developed countries where freight costs for last mile distribution to retail networks can contribute up-to 28% of the total transport costs.

First mile distance for a farmer can also change depending on the seasons as some collection points become less accessible in wet seasons. This transport segment was found to be critical for agricultural produce such as tomatoes, vegetables and fruits etc, that are time and transport sensitive due to perishability and fragility. Crop losses from bruising, exposure to the elements and unpredictable delays are also common bottlenecks of the first mile small holder agricultural value chain.

The paper concludes by noting that poor transport contributes to the non-competitive and chaotic product collection system that is responsible for the “middle-men product brokerage” system that obstructs farmers from having direct access to markets. While advances in information technology means that farmers are now more than ever aware of the market price for their produce, poor rural transport infrastructure and unpredictability of transport puts them at the mercy of any price that is offered by the trader who comes to the farm-gate or the collection point.

We emphasise the small scale nature of the studies that are referenced here to underscore the need for larger studies to validate and amplify the planning and policy implications of these initial findings. It is also noted that these findings and issues are more relevant to countries and contexts where smallholder farming provides a significant proportion of the marketed agricultural Gross Domestic Product (GDP)
1. **BACKGROUND**

Agriculture is an important sector for rural development and poverty reduction in Africa. The sector accounts for 63% of rural household incomes and, on average, for 25% of Africa’s Gross Domestic Product (GDP). Between 2001 and 2008, the agricultural GDP grew at 3.4% while overall GDP in Africa grew 6% annually. Even with this obvious underperformance of the sector, it still presents a tremendous opportunity for future growth and rural transformation. Growth in demand for food in Sub-Saharan Africa (SSA) is among the highest in the world (Banjo G, Gordon H and Riverson J, 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.

![Figure 1: Demand for Fresh Produce a major opportunity for smallholder farmers](image)

1.1 **Understanding transport segments in smallholder agriculture**

The organisation of the first stage of transport is critically important to the performance of the whole agricultural supply chain - from farmer to final consumer. This affects not only the immediate transport costs from farm to the primary roads, but also the profitability of various enterprises along the supply chain, starting with the farmers. Transport efficiency is also very important for improving financial and time costs in the delivery of inputs and produce and 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.
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, distinct challenges and associated costs. They can be described as follows:

- A primary transport (*first mile*) 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.

These stages are exemplified in Figure 2 and 3.

Figure 1 is a generic small holder logistic chain, containing the farm, collection point, processing points and the export market. The first mile from the farm to the collection point has proven to be essential. Figure 2 is a photo representation of the various stages of the small holder transport chain.

![Figure 2: Structure of emerging agricultural value chains](image-url)
1.2 Produce Consolidation

Unlike large scale farming where high volumes are produced and therefore can be collected in one farm, the nexus between smallholder farming and transport is made complicated by the fact the production is on small farms spread over a wide spatial territory. Consolidation of produce into viable volumes system and coordination with traders/transporters is crucial in order for farmers to jointly achieve economies of scale. Load consolidation happens at strategically located places along a motorable road, buying posts or bus and truck stop.
However load consolidation by roadside tends to happen more by default rather than proper planning. A well structured approach is required to help improve the way small farmers consolidate their produce. This would include among others, appropriate infrastructure at the consolidation points and organised coordination of transport (exploiting ICTs) to reduce value deterioration at the farm gate and at collection points.

1.3  First Mile Transport Challenges
The initial stages of crop movement - from the farm to consolidation points are the most expensive when expressed in tonne-km terms and provide the biggest transport constraints to the development of vibrant small holder agriculture. These initial movements will usually take place on local paths and tracks and may involve carrying (by headloading or backloading), or by Intermediate Means of Transport (IMTs) such as animal transport, bicycles or motorbikes, and then final transfer to higher capacity 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.

Figure 5: Backloading from farm to collection point most common. Animal carts also common

Head/backloading, for example, is in the order of 10 to 30 times more expensive per tonne-km than moving goods by truck.
A study of selected smallholder value chains in Kenya (KENDAT, IFRTD and TCP International, 2013) shows that the distance between the farm and the rural road can make up one fifth of the total transport costs of a transport chain.

Another First Mile study for onions in Kenya (Njenga, Wahome, et al, 2014) estimated that farmers spend around 10 to 20% of their income on initial movement costs if they use traditional forms of transport. In the study of the tomatoes’ value chain in Tanzania (Njenga, Wililo et al 2015) it was estimated that farmers spend 20-30% of the tomato income on first mile movement in dry season, and 40-50% in the wet season if they use headloading or motorcycle transport. This is because during the wet season, many rural tracks and roads will become impassable to conventional motor vehicles with the result of extending the first mile distance and the costs.

Another way to underscore the importance of transport as an important component of the agricultural value chain is to look at the price of produce as it progresses along the market segments. The study on tomato transport in Tanzania collected simultaneous price information 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.

Figure 7: Value change along the transport chain
2 CHALLENGES

The range of first mile transport challenges problems faced by the smallholder farmers has been highlighted. We use examples from the case studies that have been referenced in this paper. In Kenya it is estimated that onion farmers spend around 10 to 20% of their income on initial movement costs when they use traditional forms of transport. In Tanzania it is estimated that as a proportion of the roadside price farmers spend 20-30% of first mile movement costs in dry season and 40-50% in the wet season if they use headloading or motorcycle transport. In Kenya it was estimated that in the dry season head and back loading was 16 times as expensive than by truck and in Tanzania 23 times as expensive. Huge economies would result if the produce could be loaded on a truck at the farm and transported direct to market. In fact some of the onion farmers in Kenya were able – in good weather conditions - to arrange to have their produce taken directly from farm to market.

Secondly there were repeated reports of crop damage through both mishandling in transport or through time delays at the farm-gate or consolidation points. The onion farmers in Kenya discovered that their produce deteriorated much more by being carried and loaded and unloaded than if it was placed directly onto a truck. They could only get ‘grade two’ prices. Both sets of farmers complained about a loss of value if the produce got wet either as it was transported or waiting for transport. The tomato farmers in Tanzania complained that diseases (for example mould) would set in if they got wet.

There were complaints by both sets of farmers over the unreliability of transporters. Transport may be booked or expected at a first collection point but very often did not arrive – particularly in the wet season. Again produce would deteriorate and incomes fall as a result. In Kenya there were examples of a complete loss of value of the crop.

There is need to improve policy intelligence to capture some of these new and exciting trends that provide a window for sustainable rural incomes and food security. We identify a number of challenges that need attention in order to unlock the transport and logistical bottlenecks that are constraining the growth of the commercial smallholder agricultural sector.

• Crafting multi-sectoral planning and policy innovations: The first point we make is that while the kind of findings provided here give anecdotal evidence to show that transport is a key hindrance to improving access to markets for farmers, the challenge is to carry more systematic studies to identify the specific elements of the transport system that can be leveraged in order to unlock growth in the smallholder value chain sector. But which sector is responsible in leading and coordinating this? A multi-sectoral approach is clearly needed, involving agriculture and transport sectors, as well as spatial planning which can help in designating strategic consolidation points for produce along rural road networks.

• Planning for consolidation. Whereas it is obvious that smallholder farmers produce small volumes that need to be efficiently consolidated in order to achieve volumes necessary for traders to bring in transport, we find no evidence of any research and planning approaches that have tried to understand and improve the efficiency of rural produce consolidation. Agricultural cooperatives – in their best form – have had as part of their function, produce amalgamation. Apart from governance issues that plague many cooperatives, are they equipped to respond to a fast evolving sub-sector where issues of timeliness of collection and efficiency of payment are key, and where the farmer is tending more towards more autonomous rather than group decision
making? Are there planning approaches that can be brought to bear to enable better organised consolidation of produce and coordination of transport services?

Figure 8: Unplanned collection points by the roadside in Kenya

- **Ensuring all weather access to critical food growing areas**: Recognition is made that it is desirable that all areas of a country should have all weather access, regardless of whether they are food baskets zones or not. The challenge we identify here is that in many cases, the high value food products are grown in high rainfall highland areas of in many countries. Heavy rainfall, combined with topographical elevation of highland areas has impacts on costs of road construction and maintenance. A consequence of this is that these “food basket” areas have poor rural road networks which at certain times of the year become completely impassable.

Figure 9: Food growing areas are in highland areas with heavy rainfall and difficult topography for road maintenance.

3 OPPORTUNITIES

3.1 Emerging Markets

The paper has alluded to new emerging markets for fresh produce both within the countries and across regional and international boundaries. Internally within countries, the markets are
being fuelled by rapid urbanisation and the steady growth in the middle class. The “youth bulge” is also part of the food demand dynamics. Other factors include liberalised regional and international trade, steady improvements in road networks and logistics systems and increased use of ICTs. Thus agriculture presents a tremendous opportunity for Africa.

While substantial benefits of these trends may accrue to large and medium scale farming enterprises, there are many cases where smallholder farmers are increasingly becoming part of feeding this demand. For example in Kenya 75% of fruit and vegetables production come from smallholder farmers (Sieber N, 2009). Similarly in Ethiopia, Uganda and Tanzania smallholder farming accounts for about 75 percent of national agricultural production and over 70 percent of employment (Salami A, Kamara A, Broxiova Z. 2010).

3.2 Unexploited land and water resources

Much of the food that African consumers want can be grown locally or regionally, but at present imports are increasing because local production cannot keep pace with rising demand. Africa has land and water that can be brought into production as well as a productivity gap. Africa’s agricultural frontier is thus both extensive, through additional resources that can be brought into production, and intensive, through opportunities to increase yields and labor productivity. The continent’s farmers are acting on the opportunity, bringing new land under cultivation and raising yields.

3.2 Improving access to Markets

The commercial promise of Africa’s agricultural renaissance can be realized only if products actually get to markets. Rural infrastructure, particularly roads and transport services, continues to constrain farm incomes and adoption of technologies. This is despite considerable investment in roads and transport over the years. High costs of transport services adversely affect the cost of agricultural production and the marketing of outputs. People who cannot move themselves and their goods cannot move out of poverty.

The problems created by constraints to access have been well recognized and studied. From the Managing Agricultural Development in Africa (MADIA) six country studies of the late 1980s (See Lele U, 1989) to the more recent 2008 World Development Report on Agriculture and Rural Development, there is agreement that getting agriculture moving in SSA requires, inter alia, better access to markets and more modern market chains. Many of the required approaches are known through past work but have yet to be tested in SSA beyond the pilot scale. Rural households have rarely been the direct focus in designing rural transport interventions in SSA; the continued use of indirect needs assessment may explain the observed inadequacies in available rural access and mobility. Transport specialist and agricultural experts now agree on the need to target smallholders and rural households in light to resurgent interest in agriculture. Specialists in agriculture and transport must work together. Policies, institutions, and budgeting arrangements should recognize the need for multi-sectoral planning and implementation.

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 an early analysis of staple grain crops in nine Asian and African countries (Ahmed, R and Rustagi N. 1989), 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%. Transport explained this huge discrepancy.

4. **SUGGESTED ACTIONS / THE WAY FORWARD**

There is a considerable body of research that shows that significant increase in farm income could be realised with proper management of rural access infrastructure to ensure all weather access. There are three (3) main components to rural infrastructure improvements that need to be considered as support systems to the new small holder farming enterprises. These are as follows:

i. Ensuring all weather motor vehicle access for rural roads going into strategic small holder farming areas. Currently there exists a rural road network management approach that ensures identification of problem spots on a rural road and appropriate technologies for routine maintenance of such problem spots. Transport standards and other technical specifications of rural infrastructures are to be catered for by the central governments. Central government through decentralization and devolution programmes ensures local level planning is carried out by local actors including farmers and civil society. The participation of local stakeholders, from government, administration, private business and other non-government organizations is essential for the sustainability of the plans.

ii. Since it is often uneconomic for transporters/traders to collect produce from each individual farm there is need to develop designated low cost roadside sheds where farmers can assemble and consolidate their produce for collection. Public Private Partnerships are needed in developing grading sheds, local cooling facilities and local warehouses. Through mobile telephony, it now possible for traders to know the exact volumes products available along the collection points on a particular rural road.

iii. To get to the designated collection points, farmers often use poorly maintained and treacherous farm tracks and trials. Currently, with increased use of motorcycles as a means of goods transport in rural areas (bicycles, donkeys etc are also used); the transport efficiency between the farms and the roadside collection point can be improved through joint efforts of farmers and county engineers/road technicians. Improving transport inefficiency between the farm and the collection point can lead to considerable reduction in post-harvest losses.

In terms of a way forward, we propose is the development of a generic planning and evaluation toolkit of commercial smallholder value chains with a specific focus on transport and logistics elements. The toolkit would operate at a local/decentralised level. Its objective is to help local level baseline data collection and subsequently provide an observatory mechanism where trends and interventions can be monitored.
5. **A SMALLHOLDER MONITORING TOOL KIT/ESTIMATED COSTS**

In this section, we do not provide costs of the required interventions to improve the logistical performance of the smallholder farming sector. Such an undertaking is too detailed, context specific and too micro to be presented in a useful fashion. We have presented the range of key issues that need investigation and pilot testing on a case by case basis before ball-park costing of interventions can be proposed.

In section 4, we have indicated a way forward in the terms of developing a transport and logistics planning tool-kit. Such a toolkit would need to be developed using a multi-disciplinary approach to enable alignment of policy and planning responses across various relevant sectors.

A generic tool-kit would contain among others provide methodologies (and illustrative results) for collecting the following information at a local level.

- a. An inventory of what is being produced in an area;
- b. Farm sizes for smallholder farmers;
- c. The volumes being produced in an area;
- d. Total annual value of agricultural produce by smallholders;
- e. The spatial location and spread of farms of where it is being produced;
- f. Location of consolidated points and facilities availability
- g. Perishability of produce/value of post harvest losses per crop type per year.
- h. Availability and reliability of transport services to collect produce;
- i. The quality of transport infrastructure and key trouble spots;
- j. Key market destinations;
- k. Market prices and how they change from time to time;
- l. Market destinations;
- m. Forms of farmers organisations

With better analysis and understanding of how harvest produce is taken to market and the major constraints involved, a comprehensive and integrated approach can be employed to improve the transport efficiency taking into account both rural transport infrastructure, consolidation system and collection services.

IFRTD has the experience to work with other partners to pilot and refine a methodology that would result into a widely applicable toolkit. It foreseen that to develop the toolkit, an initial 4 country study, focussing on 2 districts each, would be a useful starting point.

A ballpark figure of US$85,000 per country is foreseen with work duration of 5 months per country.
6. REFERENCES


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