Transport Research Support

FREIGHT TRANSPORT FOR DEVELOPMENT TOOLKIT:

Rural Freight

Public Disclosure Authorized

DFID Department for International Development

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The Transport Research Support program is a joint World Bank/ DFID initiative focusing on emerging issues in the transport sector. Its goal is to generate knowledge in high priority areas of the transport sector and to disseminate to practitioners and decision-makers in developing countries.

Leapfrogging from Rural Hubs to New Markets

Rural Transport in Developing Countries

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Executive Summary

This paper gives a broad overview of the most important issues of rural freight transport in Developing Countries. Rural transport markets are characterized by a dualistic structure, with a traditional and a modern sector. The first is dominated by inefficient transport operations of food staples on badly maintained roads, while the latter requires sophisticated supply chains and multimodal logistic transport services. Recent developments, generated by the proliferation of supermarkets and high value export products, provide an opportunity for farmers to escape the rural poverty trap. Governments may support the development of supply chains through public funds, government enterprises, state investments and public private partnerships. Regional planning can improve both, the traditional and the modern sector, through the provision of multimodal infrastructures, development of Central Locations that function as Rural Hubs and their related services. If additionally government policy changes are introduced, leapfrogging from rural hubs to new markets is a viable strategy to escape the rural poverty trap.

The main issues addressed in the report are as follows:

- Poverty malnutrition and agricultural growth
- Market access and role of road investment
- Traditional and modern trends in agricultural marketing
- The importance of the first mile in rural transport systems
- Non-road infrastructure and the role of Intermediate Means of Transport (IMTs)
- Comparisons of transport costs for different modes
- Freight transport operations
- The features and requirements of supply chains
- Integrated regional planning
- Planning infrastructure and modern supply chains
- Regulating rural transport markets
- Incorporating smallholders into modern supply chains, and
- Human capacity building

Chapter 1 reviews the connection between poverty, malnutrition and agricultural growth. Road investment is important in improving market access and stimulates agricultural growth. However there are limits on the role of road investment. The availability of transport services and different forms of transport are also crucial. Chapter 2 considers both traditional and modern forms agricultural marketing, including high value export markets and the development of supermarkets. Chapter 3 examines key features of rural freight transport. Because of limited infrastructure, small volumes and the spread out nature of agricultural supply transport for the 'first mile' is crucial to the efficiency of rural transport systems. It is in these initial stages of transport that non-transport infrastructure such as footpaths, trails, footbridges together with intermediate forms of transport become so important. Data on the performance and costs of IMTs and conventional transport as well as ways of promoting IMTs are presented. Chapter 4 reviews conventional transport operations and highlights market imperfections and the high costs of rural freight operations in Africa. Chapter 5 examines the features of modern supply chains. Quality standards, logistics and transport requirements are identified together with ways of promoting smallholder involvement in modern supply chains. Chapter 6 considers integrated regional planning as a tool to promote efficient rural transport. This includes taking an integrated approach to the planning of infrastructure, different transport modes as well as markets and service centers. Chapter 7 provides a summary of the conclusions.

1 INTRODUCTION

Poverty is predominantly rural. Three quarters of the poor live in rural areas of developing countries and 70 percent of the population in least developing countries is engaged in agriculture[1]. Therefore, the main question this paper addresses is how rural freight transport can contribute to the alleviation of rural poverty.

1.1 Alleviation of poverty and hunger through agricultural growth

Agriculture is back on the Development Agenda. The Millennium Development Goals[2] call for halving poverty and hunger before 2015; the Sachs Report[3] (2005, p.28) stipulates a Green Revolution in Sub Saharan Africa; and the World Development Report 2008 highlights the point that agricultural growth provides four times the benefit for poverty reduction than growth in other sectors. Consequently, World Bank President Zoellick has emphasized the need to increase investments in agriculture, since presently only 4 percent of government spending and official development aid goes to this sector.

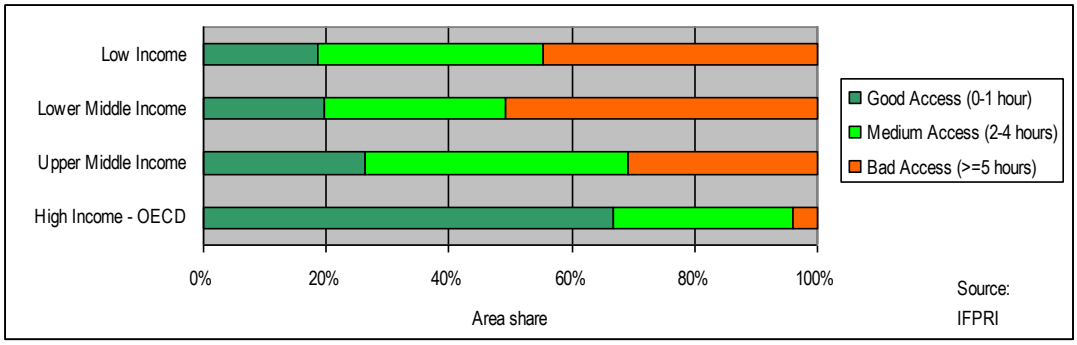
In 2007, the number of people suffering from malnutrition increased drastically due to rising food prices, which increased by nearly 40 percent. The causes of this crisis are multiple: growing world population, changing eating habits in many fast Developing Countries, increasing use of biofuels in industrialized countries and ventures on the international stock exchanges. In order to satisfy the growing world-wide demand, food production needs to double before 2050 (Herren 2009, p.11). However in Sub Saharan Africa, the opposite was the case: in the past 45 years food production could not keep pace with population growth (Staatz and Dembélé 2007).

1.2 Bad market access hampers rural development

If subsistence farmers have no or bad access to markets, they are excluded from the monetary economy and thus will remain in poverty. Access to markets is a 'sine qua non' condition for rural development. Forty five percent of the area in low income countries (LICs) and 51 percent in the lower middle income countries (MICs) are located more than five hours away from the next market. This picture changes if the population is considered: 45 percent of the population in LIC is within one hour from the next market. Remote areas are less populated, agriculture is less intense and transport costs are higher (Ref. figure 1.2.1). About half the agricultural area in these remote regions has good agricultural potential, but lacks the infrastructure to integrate itself into the wider economy (WDR 2008, p.54).

[1] http://www.uneca.org/eca_resources/news/200706unctad_launch-FACTS-aboutLDCs.htm
[2] http://www.un.org/millenniumgoals/poverty.shtml
[3] http://www.unmillenniumproject.org/reports/index_overview.htm

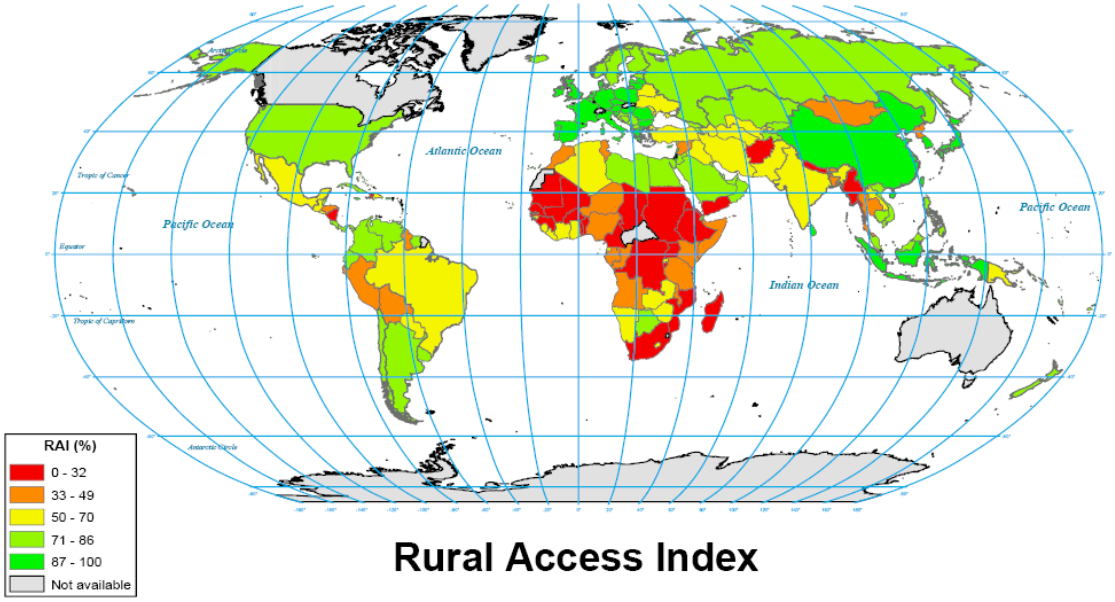
Figure 1.2-1 Market access in rural areas



Only 56% of the rural population in IDA countries had access[4] to an all season road in 2006 (Figure 1-2-2).

It is estimated that nearly one billion of the world's poor remain marginalized without direct access to an all weather road. Accessibility is 57% in South Asia, 34% in Sub Saharan Africa and may reach values such as 17% in Ethiopia and 15% in Nepal.

Figure 1.2-2 Share of population within 2 km of walking distance from next all weather road (Source: World Bank)



Improved access to markets will open up new areas, reduce transport costs and thus increase agricultural production. Improving access to markets encourages rural farmers to modernize with fertilizers, mechanized equipment, and new seed varieties, which, in turn, raises yields, lowers unit costs, and increases demand for inputs and credit. Minten and Barrett (2008, p.817) found that in rural areas of Madagascar with good access, fewer people live in extreme poverty.

[4] Access is defined as less than a 2 km walk to an all-season passable road

Missing or inadequate transport contributes considerably to large macro-economic losses in the agricultural sector. Numerous reports have discussed issues with regard to postharvest losses (See table 1). In India, it is estimated that fruit and vegetable losses are equal to a year's consumption in the United Kingdom.

Table 1 Post harvest losses in Developing Countries

Country	Produce	Post harvest losses	Source
India	Fruit, vegetables	40%	WDR 2008, p. 126
Tanzania	Cotton, Coffee, Maize, Paddy, other	13%-80%	Gaviria 1991, p. 168
Uganda	Cereals	30-40%	CAIIP, in Lema et al. 2008
Tanzania	Agricultural Produce	30%	VTTP, in Lema et al. 2008

Transport inefficiencies that are explored in Chapter 4, entail high transport tariffs, which again depress the prices farmers receive for their products while increasing purchased input costs. Consequently, farmers have fewer incentives to adopt fertilizer and other productivity-enhancing inputs (Staatz and Dembélé, 2007).

1.3 Roads stimulate agricultural production and marketing

A study by the International Food Policy Research Institute IFPRI (Fan and Rosegrant 2008) estimates the total agricultural investment needs to achieve Millennium Development Goal 1 in developing countries at US$ 14 bn, of which 26% should be dedicated to rural roads. In Sub Saharan Africa, where investment needs are highest, it is estimated that half the money should be invested in rural roads. This large share is justified by previous IFPRI research, which revealed that investment in roads was the second most important means to increase agricultural productivity in India and the third in China, after research and education. With respect to reducing rural poverty, the strongest impacts were generated by rural roads in India, while in China, roads were found to be the third most important intervention (Lema et al 2008, p. 23). A mulitude of empirical evidence supports this judgement, some examples are given in Box 1.

Box 1 Examples of road impacts on agriculture

Bangladesh: In Tangail District 130 km of rural feeder roads were rehabilitated and 16 local markets and 16 bridges built. As a consequence, turnover on local markets increased by 115%, farmers were able to stabilise income by year round marketing and diversifying their production (Kandler and Bär, 2004)
Colombia: An improvement of rural roads in areas previously inaccessible to vehicles reduced travel times and transport costs by 80%. Farmers responded by increasing production of goods for market (particularly perishables) by between 50% in one area to 200% for some products in others (Evans 1990).
Ethiopia: Access to all-weather roads in 15 villages in Ethiopia reduced the incidence of poverty by 6.7% (WDR 2008, p.120).
Guinea: In areas where rural roads had been provided, the area sown with crops doubled compared with other areas. Output sold to market for cash almost quadrupled. In areas where no such access improvements were made there was no change: citizens remained locked into traditional subsistence living (République de Guinée, Ministère des Transports 2005).
Madagascar: Simulations suggest that a 50% reduction in travel time per kilometre on roads would increase rice production by 1%. (WDR 2008, p.120.)

[5] Title of a pioneer publication by Barwell and Dawson (1993).

A number of additional factors, such as agricultural extension services, fertilizers, pesticides, irrigation and market information influence agricultural productivity. Recent developments in agricultural markets entail new requirements for logistic supply chain, as described in Chapter 2.2.

1.5 Conclusion

Poverty is predominantly rural and its alleviation can be best achieved through agricultural growth. Since bad market access hampers development, rural roads can generate strong impacts on agricultural production and marketing and thus contribute to poverty alleviation. However, by themselves, roads cannot guarantee development because of their rather permissive character. Therefore, additional measures, such as support of Intermediate Means of Transport, agricultural extension services, investments in modern technology, and human capacity building are necessary accompanying measures.

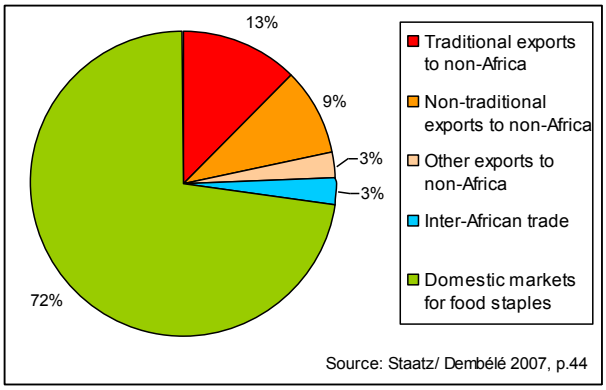
2 Agricultural Markets

The largest share of the demand for rural freight transport is determined by the agricultural commodities produced and marketed. Agriculture may be divided into two sectors: a traditional sector, where subsistence, local marketing and traditional export produce dominate, and emerging new markets, where high value products for export and supermarket consumption exist.

2.1 Subsistence and traditional markets

The traditional sector is characterized by a mix of subsistence production, local marketing and exporting. The larger the share of subsistence economy, the higher the incidence of poverty. In 2006, least developing countries produced around 4 bn tons of primary crops, which is equivalent to roughly half a ton per rural inhabitant[6]. Food staples dominate the agricultural production. Paddy rice, cassava, sugar cane, maize, plantains, sorghum, fresh vegetables and potatoes make up three quarters of the weight produced.

Figure 2.1-1 Share of agricultural value marketed in Sub Saharan Africa 1996-2006



In subsistence economies only a small share of the produce is marketed, predominantly in local markets. Sieber (2006) found that in subsistence oriented villages in Makete, Tanzania only one quarter of the weight was marketed, while in market oriented villages this share tripled. In Ethiopia rural households "undertake a significant proportion of their economic transactions in local market towns. These localities are the site for about half the purchases of inputs used in agricultural production and from a quarter to three-quarters of sales of crops and livestock" (Dercon and Hoddinott, 2005, p.19). The largest share of the produce marketed is sold in domestic markets. In Sub Saharan Africa, 72% of the value is domestic, 24% is exported to Europe, and 3% to other African countries (see figure 2.1-1)

What does this imply for freight transport? If subsistence consumption is taken into account as well, the overwhelming share of transport demand is domestic, local or regional. In subsistence economies the first mile generates the largest transport volumes in terms of tons per kilometer (tkm). Export volumes of LDCs amount to roughly 10kg per rural inhabitant[7], i.e. just two percent of the production figures given above (half ton per capita). Goods transported are often non or semi-processed with long durability and little requirements on the quality of the transport services. However, this picture changes if emerging markets are considered.

[6] Own calculations based on FAO, http://faostat.fao.org
[7] Own calculations based on FAO data.

Table 2 Main traditional export crops in LDC 2006*

Cotton lint	Molasses	Chick peas
Beans, dry	Bran of Wheat	Cocoa beans
Sesame seed	Cashew nuts, with shell	Cake of Cottonseed
Maize	Palm oil	Tea
Sugar Raw Centrifugal	Cottonseed	Rubber Nat Dry
Jute	Coffee Husks and Skins	Rice Milled
Coffee, green	Onions, dry	Rice Broken
Tobacco, unprocessed		

**The products listed add up to 75% of weight exported from LDCs*

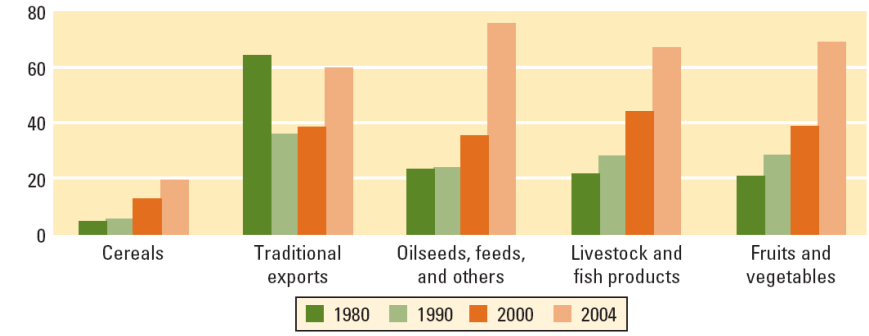
2.2 Emerging agricultural markets

In the past decade new markets for high value produce have proliferated in several Developing Countries. These are changing the demand for agricultural produce and transport. High value products are demanded by overseas exporters and increasingly by domestic supermarkets in developing cities. This is stimulated by an increasing demand for high-value primary and processed products, driven by rising incomes, faster urbanization, liberalized trade, foreign investment, and advancing technology.

2.2.1 High value products for export

Flowers from Kenya, cherry tomatoes from Senegal, green beans from Niger, organic cucumbers from China are offered more and more in supermarkets of industrialized countries. The tremendous growth in world food trade is depicted in figure 2-2.1. Exports of horticulture, livestock, fish, cut flowers, and organic products now make up 47% of all Developing Country exports, far more than the 21% for traditional tropical products[8] such as coffee, tea, and cotton. Additionally, the market for organic produce has grown strongly, with retail sales in Europe and United States amounting to some 23 bn US$ in 2003 (WDR 2008, p. 58). A part of this demand is satisfied by the developing world.

Figure 2.2-1 Rapidly expanding high value exports in developing countries



Billion US$ (2000 price) Source: WDR 2008, p. 61

The export of these high-value products requires efficient logistic chains, particularly domestic transport, handling, and packaging. The new markets demand quality, timely deliveries, improved and innovative upstream and downstream practices, and this poses special challenges for smallholders and transporters. The example of the mango exports from Sikasso, Mali, given in box 2, shows how these challenges may be tackled, even in one of the poorest countries in the World.

[8] There is no contradiction to the previous chapter, since here the monetary values are regarded and not the weights as above.

Box 2 Promotion of mango exports from Mali

The exports of fresh fruits from Mali was hampered by missing export channels to industrialised countries, lack of private capital for investment and local know how on supply chain management. A pilot operation, supported by the World Bank, promoted the production, processing, packaging and shipment of Mangos from Sikasso, Mali.

A supply chain from Sikasso to Europe, including processing and packaging units, cold chains and a multi-modal shipment system was established through the mango export pilot project. It not only proved how feasible, but also how profitable such an endeavour could be, thus demonstrating the relevance of innovative strategies relying on connecting farmers to markets, promoting private investment in rural areas, furthering multiple and cross-border partnerships, while supporting agricultural diversification, and facilitating trade and export logistics.

After implementation of the project, initial shipments of mangos from Sikasso amounted to 220 tons in 2001, 600 tons in 2002; and 1,000 tons could still be exported in 2003 despite a coup d'état in Ivory Coast. In terms of returns, the project made 44,600 US$ of net profit, securing an Internal Rate of Return of 70%. Grower unit prices progressed by 25% and employment in the pack houses reached 150 persons of which more than 60% are women with adequate working conditions and pay exceeding national labour benchmarks. Because of the increased production of mangoes, exported volumes, and farm gate prices, the mango producers benefited from a significant increase in their revenues.

Source: Danielou et al 2003, more details in the annex 5

Even if the high value export markets are rapidly increasing, they are dwarfed in comparison with the increasing size of domestic markets. Domestic food staples remain by far the most important market in Developing Countries.

2.2.2 Supermarkets create new domestic demands

In many developing countries, a rapid rise of supermarkets since the 1980s has determined the structure and logistics of agricultural markets (Table 3). Reardon (2007) distinguishes between three waves of supermarket proliferation. Supermarkets in countries of the first wave have a food retail share that is fairly close to the one observed in Industrialized Countries. The fastest growth rates are in China with 30-40% p.a. Sub Saharan Africa presents a very diverse picture, with only South Africa firmly in the first wave of supermarket penetration, while countries, such as Ethiopia, Sudan, Burkina Faso and Mali are unlikely to follow in the coming decades.

Table 3 Waves of supermarket proliferation

Region/Country	Food retail market share	
	1980s	Early 2000
United States, UK, France	70-80%	
South America, East Asia (ex. China), Northern-Central Europe, South Africa	10-20%	50-60%
South East Asia, Central America and Mexico, Southern Central Europe	5-10%	30-50%
Selected Countries in Africa (Kenya) , Central (Nicaragua) and South America (Peru), Southeast Asia (China), Russia, India	Negligible	10-20%

Source: Reardon (2007, p. 2829)

Supermarkets control 60 to 70% of food sales in Argentina and Brazil, and are expanding rapidly in China, India, and urban Africa (WDR, 2008, p. 135). In Latin America, supermarkets buy 2.5 times more fruit and vegetables from local producers than all the agricultural produce exports from the region to the rest of the World. This implies that future agricultural demand in MIC will be dominated by supermarkets supplying local markets, while in LICs supermarkets are still in their infancy. Reardon (2007, p.2848) emphasizes, that development assistance usually focuses on export markets, but the growth in demand for local produce from supermarkets is much more important.

While in the early stages, the supermarkets product selection is usually dominated by processed foods (canned, dry, and packaged food items) in later stages, product selection gradually expands to semi-processed foods, such as dairy, meat, and fruit products. The last category to be added is fresh fruits and vegetables (WDR 2008, p.126). Changing consumer demand is driving the growth of the food processing and food service industries. Although spending on processed foods is still low in developing countries, it is growing fastest in these countries - 28% p.a. in lower-middle-income countries and 13% a year in LIC (WDR 2008, p.125).

Box 3 Supermarkets in Eastern and Southern Africa

Kenya: Kenya boasts four domestic chains (Uchumi, Nakumatt, Tusker and Ukwala Group). There are also two foreign-owned chains, Metro Cash&Carry (Lucky brand name) and Woolworths, as well as several independent supermarkets.
Tanzania: The supermarket sector began to develop quickly after the liberalisation of foreign direct investment in the late 1990s, and the South African chains Shoprite and Pick 'n' Pay entered the Tanzanian market in 2000. In addition, there are two domestic chains (Imalaseko and Shopper's Plaza).
Uganda: There are two foreign-owned chains Shoprite (South Africa) and Uchimi (Kenya).
Zambia: Zambia is a major destination of foreign direct investment by the South African chain Shoprite (18 supermarkets).

The significant economies of scale associated with supermarket development has led to a concentration in the market power with Carrefour, Ahold and Wal Mart becoming truly global in their reach with a turnover in US$ 2000 of 300 bn and 1.9 m employees. In Central America a single company controls 60% of the chicken purchases (Vorley 2001, p. 5). The market power of global players is affecting forward and backward supply chains, including fertilizer provision, as well as seed supply, processing and marketing.

Since supermarkets have stricter quality requirements for food items, there is a growing demand for:

- High quality produce, regarding taste, appearance and smell of produce;
- Food safety, i.e. free of physical, chemical and microbiological contamination;
- Larger variety and range of produce (e.g. cherry tomatoes, okra, papaya, cabbage, etc.), more combinations for cooking options(stir fry mixes);
- Differentiated and innovative products (e.g. wrapped fruits); and,
- Customized products that meet customer preferences of lifestyle choices (health foods and fair trade products).

Examples for customized products are the organic and ethical food markets. The UK ethical food market was valued at £4.8 bn in 2006. This represents just 5% of the total grocery market but is becoming increasingly important, growing at 7.5 per cent per annum (Battisti 2009, p.18). The increasing importance of consumer demands calls for buyer driven supply chains that require the tracing for food products from 'farm to fork'.

2.2.3 Can smallholders benefit from the new markets?

The new paradigm that has emerged from such developments on the world market is that, if producers are more closely linked to their market, they would increase their revenues and improve their livelihood. This could help reduce poverty, since there is a higher net benefit from selling to supermarkets compared with selling to traditional markets (Reardon 2007, p2846). Participation in modern supply chains can increase farmer income by 10% to 100% as examples from Guatemala, Indonesia and Kenya show (WDR 2008, p.127). In Kenya, three quarters of fruit and vegetable export production comes from smallholders.

However, smallholders are disadvantaged, since they typically face high transaction costs and low bargaining power in factor and product markets. Vorley (2001) describes the proliferation of buyer driven supply chains

as detrimental to smallholder farmers. Reardon (2007, p. 2846) argues that in the processing sector, supermarkets tend to source as much as possible from medium and larger growers So it is not the poorest or smallest farmers who initially benefit from the development of supermarkets. However, governments can improve smallholders' access to modern supply chains through the strengthening of producers'-, marketing-, and traders' associations and cooperatives, as described in Chapter 5.4.

2.3 Conclusion

Agricultural markets in developing countries have a dualistic structure, with a traditional sector focusing on food staples and traditional export products, while modern markets increasingly demand high value products. If the transport volumes are considered, domestic food markets will remain dominant. However, modern supply chains will increasingly gain importance, especially in MIC. Today, the value of agricultural exports is already dominated by high value produce. These developments have severe impacts on agricultural markets, procurement processes, agents involved, warehousing, packaging, logistic chains and on transport. The various implications are described in Chapter 5.

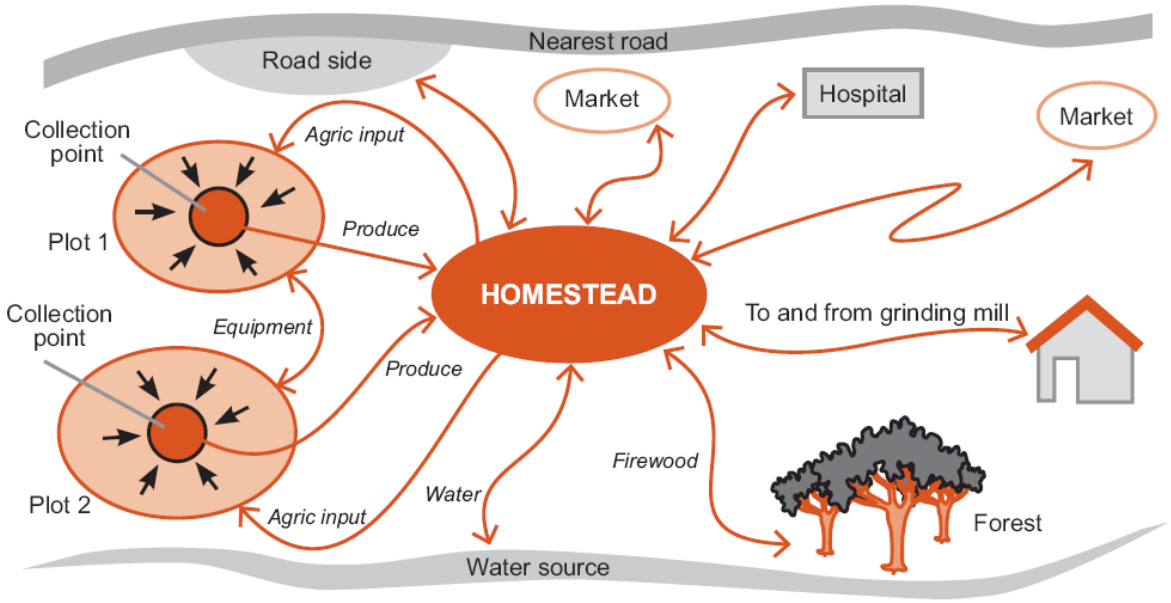
However, supermarket proliferation and new export markets represent an interesting opportunity for rural smallholders to escape the rural poverty trap. This may be achieved through government support to integrate them into modern supply chains.

3 Rural Infrastructure and Freight Transport Modes

3.1 Traditional freight transport dominated by the first mile

From the view of a smallholder farmer, rural freight transport takes place on the first mile as depicted in Figure 3.1-1. Products are collected at the plots, transported to the homestead or storage facility and from there directly to the road side, to buying points or to local and regional markets. The other trips depicted in the figure are not freight transport, since they are related to the subsistence of the household. Transport is undertaken on footpaths, tracks, trails and roads by head loading, using IMT or by motor vehicles.

Figure 3.1-1 The first mile



Source: Crossley et al 2009, p.4

Since there is no common definition of rural transport, Table 4 below may help to determine the terminology used in this paper. The 'first mile' begins at the farm; it ends at the local market or the buying point. This section, consisting of a combination of on-farm and local transport, is the most costly (per tkm) and difficult part of the journey, conducted on infrastructure belonging to the farm or the community. Rural freight transport ends here for the farmer and continues for traders, wholesalers or transport service providers. These start either at the buying point near the road side or at Rural Hubs, both serving for intermodal transfer of cargos. Rural Hubs may have a special function, crucial for the development of the whole area, as explained in Chapter 6. Agricultural produce is transported to regional, national or international markets. A part of the journey might be still called rural transport, but this ends when the cargo passes the regional centre from where interurban transport begins.

Table 4 Terminology for rural transport

Field Plantation	Farmstead/ Storage	Buying Point (Rural Hub)	Local Market or Rural Hub	Regional Market	National Market	Export Market
	on farm	local transport		regional transp.	national transport	
	first mile		medium distance		long distance	
	rural transport				interurban transport	

As shown above, the average agricultural production in LDC amounts to roughly half a ton per capita, which has to be transported from the field. In subsistence regions, where most of the produce is used for own consumption, this type of on-farm transport is most important. A number of studies have been conducted in Sub Saharan Africa that assesses the transport volume of rural smallholder communities. Figure 3.2-1 lists the agricultural transport volumes on the first mile, measured in tkm. Local freight transport is mostly done by head loading, which implies an enormous time requirement, especially during harvesting seasons, where household labor is short. To transport one tkm by head loading, approximately 100km has to be walked[9], consuming four days of labor time.

Figure 3.1-2 The first mile - agricultural transport volume in selected field studies

Location	Tkm per house-hold and year	Source
Kasama, Zambia	6.3	Barwell 1996
Lusaka Rural; Zambia	5.4	Barwell 1996
Mbale, Uganda	6.1	Barwell 1996
Kaya, Burkina Faso	7.2	Barwell 1996
Dedougou, Burkina Faso	0.2	Barwell 1996
Makete, Tanzania	12.2	Sieber 1996

The figure above mainly depicts smallholder farming in Sub Saharan Africa, and thus generalizes rural transport patterns. There is a huge difference, between a smallholder farmer transporting 20kg of maize to a local market by head loading and an employee of a large sugar estate bringing tons of cane by tractor-trailer from the field to the sugar refinery. The main features determining transport are volume, costs, origin/ destination, means of transport, and logistics which are influenced by the factors reflected in table 5.

Table 5 Factors influencing rural transport patterns

Transport Features	Farming Features	Type of Produce	Geographic Features	Markets
TP Volume	Smallholder	Food Staples	Population density	Subsistence
Transport Costs	Medium sized commercial farmer	Perishable produce	Ago-ecological condition	Buying point
O/D Patterns	Large estate	Light/ heavy weight	Farming practices	Local Market
Means of Transport		Processed/ unprocessed		Regional Market
Logistics				National Market
				Export Market

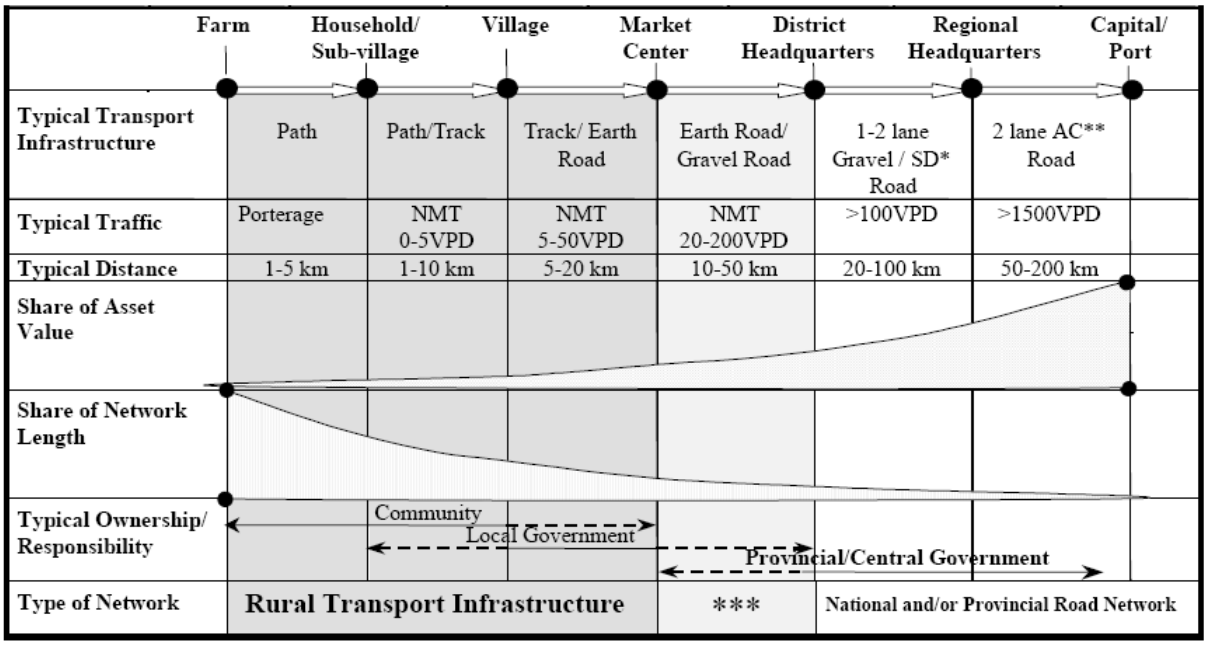
3.2 Transport infrastructure is more than roads

Rural goods are transported on paths, trails, tracks, footbridges, pontoons, earth and sealed roads. Figure3.2-1 gives an overview of rural infrastructures, typical traffic volumes, modes of transport and distances from the farm to the market. On-farm transport not depicted here mainly uses paths belonging to the farm estate. The

[9] Assuming a load of 20kg, a speed of 3km/h and empty return trips to pick up the next load.

remaining part of the first mile is travelled using infrastructure that is usually the responsibility of local communities. Local and regional transport use mainly tracks and roads managed by district or provincial authorities. Quite commonly rural roads account for 80% of the total road network lengths, and carry only 20% of the total motorized traffic, but provide essential access to buying points and markets.

Figure 3.2-1 The farm to market transport chain and rural transport infrastructure



* Surface
** Asphalt Concrete
*** Part of either RTI or the Provincial Network

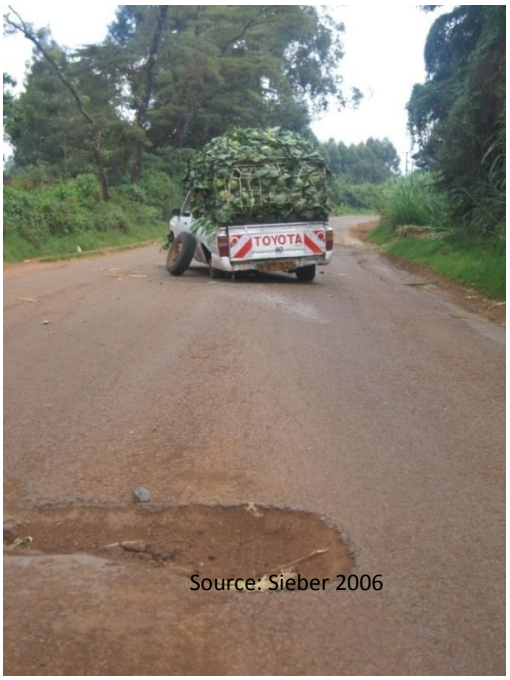
Lebo and Schelling, 2001,

Management and financing arrangements for these roads are often unclear: Rural road administration is fragmented between communities, local governments and the ministries of public works, transport and agriculture. Furthermore, rural roads are often not classified and indexed, so their extent and condition is unknown. For example, about one third of the total road network in Tanzania and more than half of the Kenyan network (Lema et al 2008, p. 25) remain unclassified. This type of infrastructure often does not qualify for allocations of funds from national budgetary resources but is left to be attended by local authorities and communities that tend to have little capacity, skills and resources to manage them. This situation results in a general neglect of road maintenance.

A poor road maintenance regime means an inevitable increase in fares and goods tariffs. In Pakistan, operators, particularly of pickups, are known to add a 50-100 % premium to prices on rough roads to cover increased repair requirements (Essakali 2005, p.7). In the Iringa Region, Tanzania, traders, using a hired vehicle, incur three times the cost for travelling on a gravel track compared with travelling on a paved road (IT Transport 2009). In rural Kinshasa, Congo, transportation is twice as expensive on poor roads as on good quality paved roads (Minton and Kyle 1999, p.494). Consequently, the biggest bottleneck related to rural infrastructure is its poor condition, which hampers all year access to markets and causes excessive vehicle

operation costs. A comprehensive overview on these issues is provided by the Rural Transport Knowledge Base[10].

A large number of publications have been written on the problem of road maintenance, which will not be repeated here. However, the most essential points are briefly highlighted below:



Source: Sieber 2006

Many countries spend just 20–50% of what they should be spending on maintenance of their road network (Heggie/Vickers 1998). For the private sector each dollar saved on road maintenance causes three dollars of higher vehicle operating costs. As a rule of thumb, a fuel levy of 10 US cent/liter is sufficient to maintain the entire road network[11].

Rural roads should be part of a road sector reform that includes features such as: agencies rather than government departments, independent road boards representing user groups, second generation Road Funds and appropriate charging mechanisms such as fuel taxation (Amos 2004). The administration of the road sector in Kenya, shown in Box 4, may serve as an example for the distribution of competencies within the road sector. The ability to raise revenue locally is generally modest, and rural toll roads in China have entailed negative consequences by blocking peasant attendance at marketplaces (Him Chung 2002). This indicates that a cross subsidy from other networks is necessary. Countries allocate on average about 60% to main, 18% to rural and 15% to urban roads (Benmaar, 2006, p. 12).

Box 4 Structure of Kenya's road administration

The Ministry of Roads and Public Works provides policy and strategy relating to the provision of roads. The Kenya Roads Board funds maintenance of all roads, approves maintenance work programmes, and conducts technical and financial audits of works. The Kenya National Highways Authority is an implementing agency to manage and maintain all road works on class A, B, C as well as other rural paved roads. The Kenya Rural Roads Authority is responsible for all rural and small town roads, Class D and below including special purpose roads and unclassified roads. It is also responsible for Forest Department Roads and County Council Game Reserve Roads. The Kenya Urban Roads Authority manages and maintains all road works on urban roads in cities and major municipalities.

It is a common knowledge that in many Developing Countries, women carry the largest share of the rural transport load (Barwell 1996, p.27). It is estimated that 70% of the agricultural goods are head loaded by women in SSA. Many transport interventions become accessible only to men, due to the constraints of credit acquisition, and cultural barriers imposed on IMT use by women. The absence of a gender focus among transport

[10] http://www.transport-links.org/transport_links/rtkb/English/Contents.htm

[11] Benmaar (2006, p. 12) reports that in SUB SAHARAN AFRICA the average fuel levy in US cents/liter is 8 and 7 for petrol and diesel respectively. More information on international fuel prices is given on the GTZ website: http://www.gtz.de/en/themen/umwelt-infrastruktur/transport/10285.htm

technologists and planners is often the result of a low participation by women in the planning and design of interventions and of the 'economic' argument that continues to dominate planning (Fernando, 1998).

HIV/AIDS is of major importance for the transport sector, because the movement of people carries the virus to remote locations. Since drivers and road workers are usually far from their family, the risk of sexual disease transmission is much higher than in other sectors. Therefore, HIV/AIDS mainstreaming needs special attention in transport projects.

3.3 Intermediate Means of Transport widen modal choice

The most common mode used for transporting agricultural produce is head loading, which entails transporting a load of 20kg at 3 km/h. If larger quantities have to be moved, motorized means or intermediate means of transport (IMT) are more suitable. Table 6 shows that IMT can carry larger loads than head loading at higher speeds and can operate on paths, tracks and trails.

Farmers with access to transport find it easier to purchase farm inputs, such as fertilizer. Farmers with carts increase crop production through greater use of manure, they increase animal production by transporting and stocking crop residues and they avoid losses by timely transport of their harvests (Starkey 2002). IMT and transport services are used to transport larger volumes to market. In Makete, Tanzania, studies indicate that bicycles and donkeys generated larger benefits than the construction of rural roads and tracks, mainly through increased marketing and time savings (Sieber 1996, p. 108).

Table 6 Performance of rural means of transport

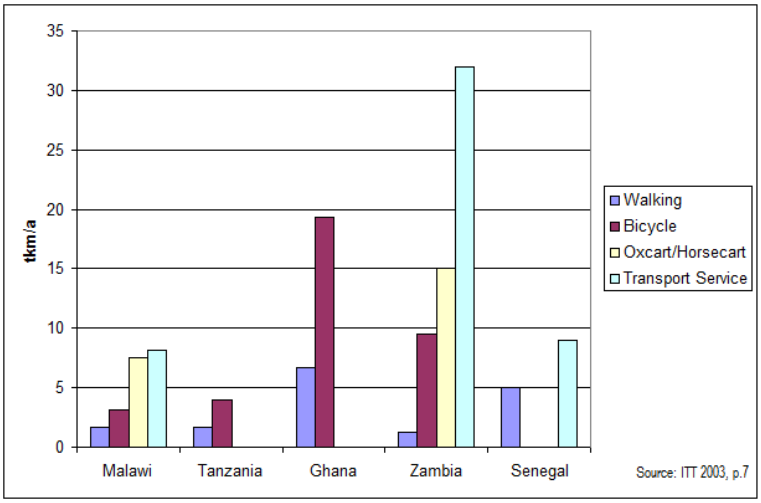
Transport type	*Indicative characteristics*					*SOME IMPORTANT REQUIREMENTS*			
	*Indicative cost price * ($ relative)*	*Indicative load * (kg)*	*Indicative speed * (km/hr)*	*Indicative range * (km)*	*Indicative cost/tonne/km* ($ relative)*	*Foreign exchange*	*Animals and vet services*	*Mechanics*	*Good roads or tracks*
Carrying/head load	0	20	5	10	1.50	Low	None	Low	Low
Sledge	10	100	4	3	0.80	Low	High	Low	Low
Wheelbarrow	30	100	4	1	0.40	Low	None	Low	Low
Hand cart	60	150	4	5	0.35	Low	None	Low	Medium
Pack donkey	60	80	7	20	0.70	Low	High	Low	Low
Bicycle	100	60	10	20	0.60	Medium	None	Medium	Medium
Cycle rickshaw	170	150	8	15	0.45	Medium	None	Medium	High
Donkey cart	300	400	6	15	0.60	Medium	High	Medium	Medium
Ox cart	500	1000	5	10	0.20	Medium	High	Medium	Medium
Motorcycle	900	100	50	50	1.30	High	None	High	Medium
Power tiller trailer	5000	1000	10	15	0.70	High	None	High	Medium
Pickup	12000	1200	80	200	0.70	High	None	High	High
Truck	60000	12000	80	200	0.50	High	None	High	High

* *Notes:*
This table provides order-of-magnitude indicative figures only. The costs, prices, loads, speeds and distances vary greatly with the country, the people, the environment, the infrastructure and the vehicles or animals. It is not uncommon for the transport systems mentioned to carry much greater loads and to travel much longer distances. The figures are simply indications of what is commonly achieved. The costs per tonne-kilometre are very approximate, and highly sensitive to assumptions on costs, loads and distances: they are mainly based on the model of Crossley and Ellis (1999) for 5 km journeys.

Source: Starkey 2001, p.4

The demand for IMT or motorized means is significant if the seasonal transport volume per active household member in transporting produce to market is above 1.2 tkm. If conditions are conducive, the initial demand is likely to be for a bicycle. If the transport volume exceeds about 10 tkm, there will be an increasing demand for means with higher load-carrying capacity. Preference is likely to be for modes that do not require human effort, such as animal-based transport and motorized transport services (I.T. Transport. 2003).

Figure 3.3-1 Average transport volumes of agricultural produce to markets



The conventional transport planner's focus on motorized means is challenged by research in selected remote areas of Sub Saharan Africa conducted by Starkey (2007, Table 7). The study revealed that a large share of the rural vehicle fleet consists of IMT, amounting to more than 96% of the total number of vehicles, and more than three quarters of the vehicle asset value.

Table 7 Size of the transport fleet in selected rural areas of Sub Saharan Africa

	Size of transport fleet [Vehicle numbers]		Investment in transport fleet [USD 000]	
Region	IMTs	Motorized*	IMTs	Motorized*
Luapula, Zambia	80,000	180	8,000	1,700
Iringa, Tanzania	73,000	180	5,000	1,400
Southern, Cameroon	21,000	850	14,300	5,000
Mouhoun, Burkina Faso	220,000	80	34,500	1,500

* Large motor transport: buses, trucks and rural taxis

Source: Starkey 2007, p100f.

Source: Sperling et al 2005, p.110

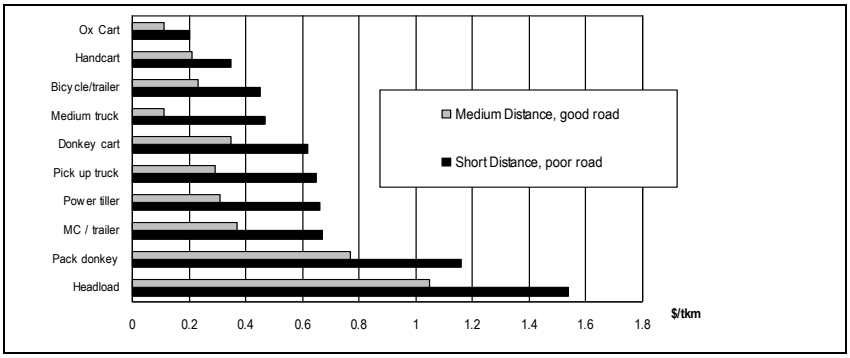
In China, over three million appropriately motorized rural vehicles were produced in 2002, triple that of conventional cars and trucks (Sperling et al 2005). Yet these smaller, simpler, indigenous vehicles are virtually unknown outside China. They now consume one quarter of the diesel fuel in China and play an important role in rural development. The three wheeler, depicted below, has a payload of half a ton, reaches a maximum speed of 48km/h and costs US$ 900. Comparable low cost vehicles, produced in Vietnam, may be used for multiple purposes, including carrying goods, driving water pumps, rice-husking, ploughing, raking, milling, and transporting construction materials (Bach the Dzung 2008).

Figure 3.3-2 shows typical costs per tkm of medium distance transport on good roads and short distance transport on poor roads[12]. Trucks are the cheapest means if operated on good roads over long distances, and have high capacity utilization. Due to small transport volumes, short distances, and bad road conditions, many rural areas are only served by pickups, which are more expensive than ox carts, handcarts or bicycles with

[12] medium distance = regional transport = 50 km; short distance = local transport = 5 km

trailers. Local transport, especially the first mile, is mainly undertaken by the most expensive mode, head loading. These costs can be reduced significantly, if IMT are used: e.g. a shift from walking to donkey cart can reduce costs by 60% and a shift to an ox cart by nearly 90%. These findings were corroborated by a field study in the Iringa Region, Tanzania (IT Transport 2009), which found, that head loading was nine times as expensive as conventional motorized transport on a bitumen surfaced road.

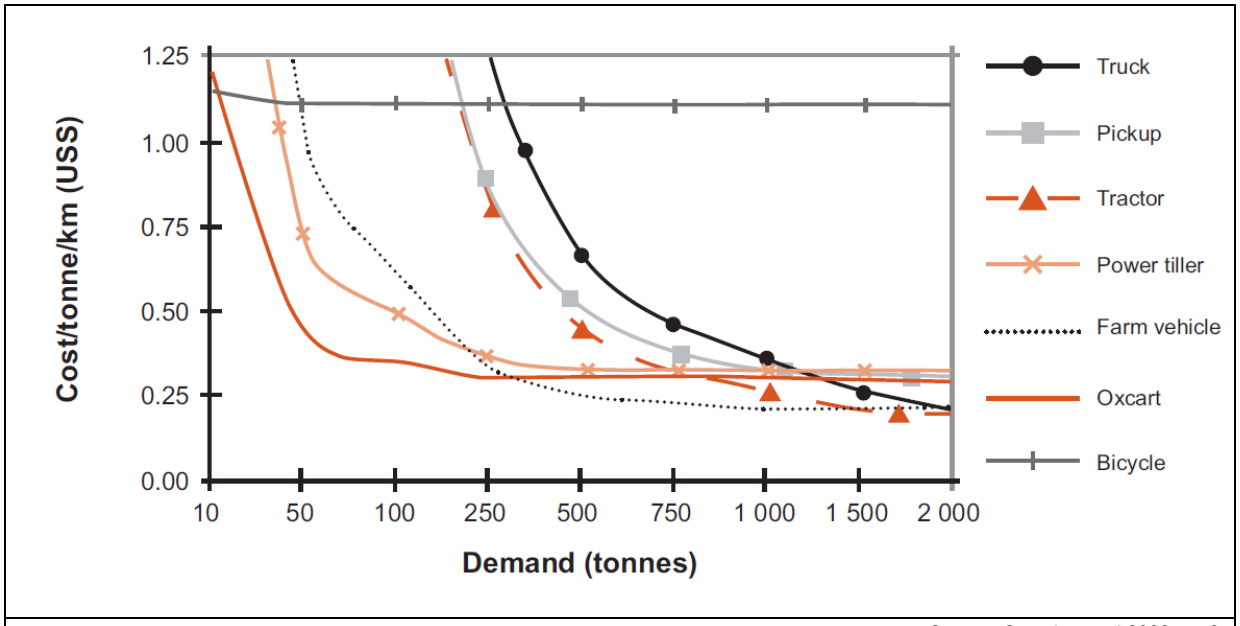
Figure 3.3-2 Transport costs for different vehicles in developing countries



Source: Sieber 1999

Transport costs may also be differentiated according to the volume of demand, where high capacity utilization reduces costs. Figure 3.3-3 shows that for short distances many IMT, especially oxcarts and single axle power tillers operate at a cheaper rate than trucks if the transport demand is below 1,000 tons per year. Bicycles, that have a smaller payload, are only suitable for lower demands. However, even though IMT have advantages regarding performance and costs, apart from bicycles, their use is not wide spread in many parts of the world, particularly in Africa. Therefore, measures may be initiated to promote their use.

Figure 3.3-3 Vehicle operating costs assuming a 10 km distance and varying levels of utilization

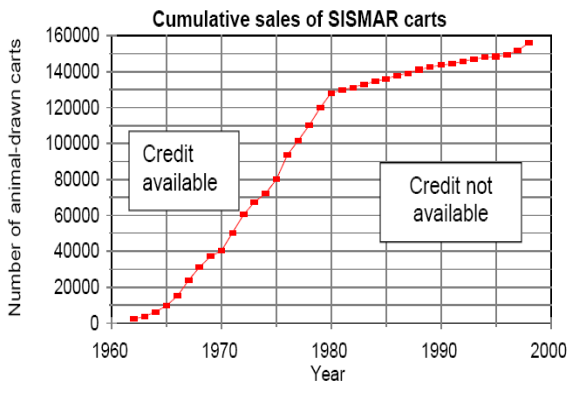


Source: Crossley et al 2009, p.53

3.3.1 Promotion of Intermediate Means of Transport

The promotion of IMT may be done through agricultural extension services, especially if multipurpose means of transport, such as draft animals and tractor-trailer combinations are concerned. Even though IMT are relatively cheap, their affordability is low compared to income, especially in subsistence dominated rural areas. Thus, the availability of credit, is an important factor in encouraging uptake and fostering demand for IMT (IT Transport 2006, p.V). The positive effects of a credit scheme in Senegal are described in Box 5. Successful credit schemes are best managed by commercial banks, accompanied by awareness campaigns and a careful organization and training of user groups on credit use. To ensure and sustain the rural financial system, there is a need for adequate government legislation and regulation relating to small-scale credits (Lema 2008, p.30).

Box 5 Effects of credit scheme for animal carts in Senegal



Prior to 1960, animal-drawn carts were not very common in rural Senegal. In 1960 SISCOMA established a factory at Pout, Senegal, to manufacture a range of agricultural implements and animal-drawn carts. Sales in the 1960s and 1970s were high, boosted by agricultural credit schemes. The sudden termination of credit in 1980, caused sales to plummet and bankrupted SISCOMA. A new company, SISMAR, was formed to take over the factory. It has been selling many carts, although annual sale have not returned to the levels when credit was readily available to farmers.

Source: Starkey 2001, p.50

Another financial incentive is the removal of taxes and duties from bicycles and other intermediate means of transport. Other factors of success are affordable and reliable maintenance and repair services, and therefore supporting the supply side, particularly the locally-based manufacturers and artisans, is important for sustainability (IT Transport 2006, p.V). Additionally, the legislation often needs to be revised in order to allow an effective use of IMT: A study by Rwelamira (2003) revealed that in South Africa there is a need to revise 20 acts in order to promote animal traction.

3.4 Conclusion

Rural freight transport is mainly related to the evacuation of agricultural produce from the fields to domestic and international markets. The first mile, where the largest volumes are transported, takes place on local paths and tracks, mainly by head loading, which is the most expensive means of transport. Local transport costs can be reduced significantly if IMT are used, while trucks can operate cost efficiently for long distances, on good quality roads when fully loaded. Consequently, the solution for the first mile is not to bring trucks to each field, since infrastructure cost would be too high. Instead, a multimodal approach is favored by using the comparative advantages of each mode in the transport chain from the field to the market. For multimodal transport the promotion of IMT is an essential complement.

4 Conventional Freight Transport Operations

Conventional supply chains meet the demands of 'traditional' rural markets. Goods transported are frequently produced products with long durability, and tend to be unprocessed foods and regular export goods such as coffee, cacao and tea. The logistics for these are rather simple compared to the modern supply chains described in the next chapter.

4.1 Informal organization of the rural transport industry

The transport industry in most developing countries can be described as rather 'artisanal', with owner-drivers and small independent operators accounting for more than 70% of the industry's fleet. A typical owner's vehicle fleet consists of 1-5 trucks, rigid 2- and 3-axle, for general cargo with 5-10 ton capacity. Most vehicles are driven for 15 - 20 years and use antiquated technology, consume a great deal of fuel, and pollute the air (Londoño-Kent 2007, p. 13).

In rural areas, the transport situation is even worse. Evacuation of crops is either done by walking farmers, by traders using hired vehicles, or by local freight transport operators. Freight forwarding rarely operates in this market. In Sub Saharan Africa, a great majority of motor vehicles operate in and around the major cities, while, in rural areas, the fleets of transport service vehicles are extremely small, with most vehicles being more than twenty years old, and tend to be second hand bought. Freight transport is conducted by light goods vehicles (LGV), very often pickups (Starkey et al 2007, p.100).

In Sub Saharan Africa, transport services are generally provided by individuals operating within the informal sector and the operations appear to have a low profitability. Surveys conducted by Starkey et al (2007) did not identify any transport entrepreneurs who were investing significantly to build up large fleets of transport vehicles operating in rural areas.

4.2 Imperfect rural freight markets

One of the major constraints is the size of the rural transport market, which largely depends on population densities. In general, Africa has low rural population densities and a less intensive form of agriculture than for Asian countries. Additionally, markets are generally more distant and less accessible in Africa. This has important implications for vehicle choice. In comparison to Asia, loads in Africa will generally be smaller, and distances longer (Ellis and Hine 1995, p. 11).

Even though the rural transport market is rather unregulated and market access is mostly virtually free, the frequencies of the services in rural areas are rather low and service quality is often poor. Especially where roads are in a bad condition and population densities low, the market generates too little returns to give incentives for an improved service. As a consequence, all inputs of the vehicle owners are kept to a minimum, including fuel, repairs and replacements and most operators feel they have to cover their costs on each and every journey. This need to cover all costs prevents operators from keeping to fixed timetables and exacerbates the vicious circle of low transport demand and unreliable transport markets (Starkey 2007 p.100ff).

Box 6 Transport risks in the cotton marketing chain in West Africa

Previously the cotton markets in West and Central Africa were dominated by state owned cotton companies, but this has proven to be costly compared to private transport operators. Some countries embarked on cotton sector reforms, which meant breaking down the vertically integrated monopolies and increasing private sector participation. Even though, this has considerably improved transport efficiency, a number of challenges remain.

Logistics and transport are critical for improving the efficiency of the cotton chain in West and Central Africa, because of their direct costs and the risks they involve. Direct transport costs account for approximately 15% of FOB price. Indirect costs and risks are potentially more costly and damaging for the cotton chain. Inefficient rural transport can seriously impede seed cotton quality, and in extreme cases be a disincentive for producers to cultivate cotton. Additionally, inefficient export transport can lead to delayed deliveries and even missed deliveries and consequently has a high risk to reputation.

Transport is an element of the supply chain with a very specific risk (hold-up risk). If transport is not carried out in a timely manner, honoring the terms of the seed cotton contract and/or delivery of cotton fiber, the ginner can suffer serious penalties. In the event that the ginner is unable to honor his contract with a trader, he risks losing his credibility, damaging his reputation and being asked to reduce prices on future deliveries. In the worst-case scenario - if the client is from the textile industry-, the ginner risks losing the client.

One of the main challenges of cotton transport is low traded and imbalanced volumes. In countries such as Mali, less than 10% of trucks going inland from ports are full. The percentage loaded is consequently very low (< 50%). It is one of the reasons why containerization is so slow to take off. Indeed, out of 11,000 containers going to the port, only 2,000 come back full. Another effect is higher maritime transport costs due to smaller quantities exported from landlocked countries and smaller container vessels.

Private transporters face a number of economic and institutional constraints, such as high unofficial costs caused by legal and illegal tolls, commonly known as roadblocks (see Box 8). Additionally, the current price level per trip offered for rural transport does not adequately compensate transport companies. The main consequence of which is that the least professional transport companies, who do not bear high fixed costs, with obsolete fleets and typically without transport insurance, are the ones who will provide transport service, along with all the potential risks related to quality and reliability of the services.

The following actions could be undertaken to improve rural transport:

- Transporters should increase loads by integrating inputs and seed cotton transport
- Offered transport price should cover parts of fixed costs
- The state should not neglect maintenance of rural roads
- The state should reduce roadblocks costs and border-crossing costs
- Ginners should be flexible when selecting ports
- Ginners should introduce ex-ginnery sales in addition to FOB port sales, and
- Use of medium term contracts to mitigate risk associated with transportation- both farm to gin and gin to export.

Source: Baghdadli et al 2007, p. 38-43

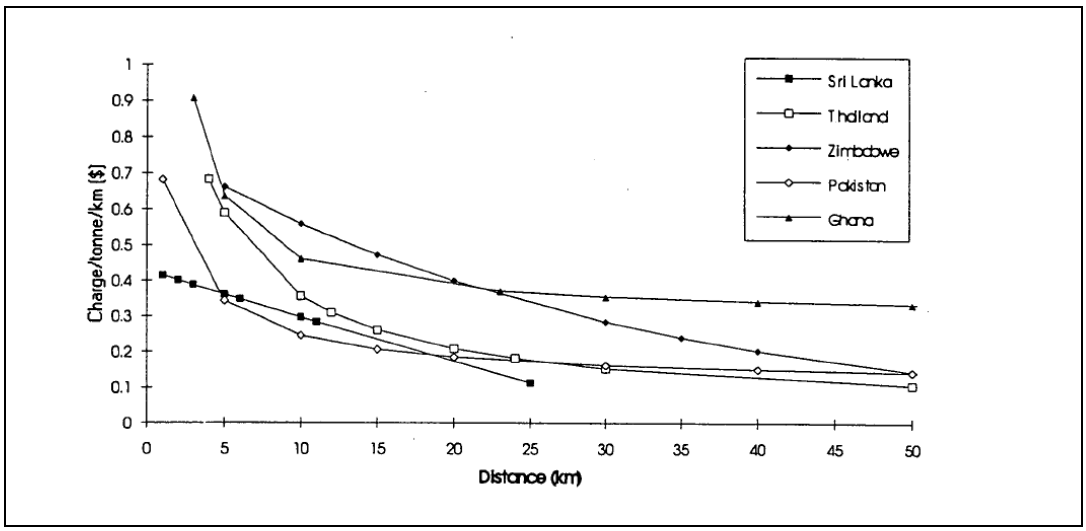
Additionally, often in Africa, a “queuing system” is practiced, that lets the client wait for their transport service until the vehicle is fully loaded. Ellis (2001) reports that operators in Mali use truck parks where they must wait for loads on a first come, first served basis. This means that operators will wait for many days to secure a load. The result is a very old fleet which “only survives since it can afford to because of the system”. This system entails inefficiencies and keeps prices high.

The low density of the rural demand, combined with a small number of service providers, entails monopolistic transport markets that are often dominated by cartels. For example in Ghana, very large commodity price differences in adjacent markets have been found, which cannot be justified by transport costs (Hine 1993, p.13). This may be explained by the existence of transport cartels that operate through rationing of demand at the truck parks and leads to an increase in transport tariffs (Witkiss et al 2001). For example, there is often a heavy union presence which controls membership, pricing, routes, and even queuing for loads. With little competition in this captive market, conventional rural transport operations are rather costly, inefficient and offer low service quality in terms of reliability, frequency and speed (Refer to Box 6 Transport risks in the cotton marketing chain in West Africa).

4.3 Expensive rural freight operations

Since "it is very difficult to present reliable quantitative data for transportation costs", a cost assessment in rural areas is even more problematic. Tariffs vary according to the distance travelled, capacity utilization, type of cargo, road condition, and are dependent upon agricultural production cycles. It is difficult to obtain accurate estimates of running costs and income, partly because many costs are informal and unrecorded (Starkey 2007 p.100).

Figure 4.3-1: International comparison of rural transport costs



Source: Ellis and Hine 1995, p.7

Ellis and Hine (1995) compared rural transport charges in Africa and Asia as depicted in Figure 4.3-1. African countries have transport costs which are generally between two and four times more expensive than in Pakistan. Costs as a proportion of the tariff per kilogram of rice confirm these conclusions. The findings indicate that transport cost decreases with longer distances. In African countries, transport charges in rural areas are at least double for relatively short haul trips. The first mile is not only the most difficult part of the transport chain, but also the most expensive one. This efficiency gap between Sub Saharan Africa and Asia is explained in Box 7.

Box 7 Comparison of transport performance in Sub Saharan Africa and Asia

An international comparison of transport performance in long distance transport revealed, that Africa is at a disadvantage in every aspect with productivity much lower than Asia, particularly Pakistan. The resulting inefficiencies in road freight transport reflected in higher costs and price differences have important consequences for African trade and development. For identical 3-axle Japanese 12-ton capacity trucks, widely used in Africa and Asia, the annual distance travelled is estimated to be 50,000 km in Africa and 123,000 km in Pakistan. The average load in Africa and Pakistan is 14 tons and 20 tons, respectively." The tariff differentials are partially explained by the queuing system described above and the high capital costs for trucks and spare parts in Africa.

The cost gap between Asia and Africa can be explained by the quality of the infrastructure, and the efficiency of the transport services. In Pakistan, trucks run twice the number of kilometres, register less empty trips, and have lower maintenance costs due to low speeds and the responsibility involvement of the driver. While in Pakistan, a competitive environment favours the purchase of cheaper appropriate vehicles, in Africa sophisticated vehicles are bought, which run at low utilisation levels.

Source: Rizet and Hine 1993

A recent comparison of rural transport tariffs by Ahmed et al (2007) corroborates these findings (Ref. Table 8). If the tariffs are adjusted for the purchasing power, costs in Bangladesh are significantly lower than in Ghana and Kenya. High transport costs explain why African farmers get only 30-50% of the final price of products, compared to 70-85% in Asia (Ahmed et al 1987). Trader surveys in Benin, Madagascar, and Malawi find that transport costs account for 50-60% of total marketing costs (WDR 2008, p. 119). In Sub Saharan Africa, farmers receive only 30-50% of the final price of products, compared to 70-85% in Asia. (Ellis and Hine 1995). Other reports (Ellis 2001, Raballand 2007) found that freight rates are not even covering operating costs in Mali, which led to the demise of a number of vehicle operators.

Table 8 International comparison of cargo tariffs

[US cent/tkm]	Tariff 2007	PPP adjusted
Bangladesh	43	21
Ghana	96	41
Kenya	42	42

Source: Ahmed et al 2007

4.4 How to improve efficiency, quality and safety of rural transport markets

The poor performance of rural freight transport in many developing countries is mainly due to market failures. High transport charges occur because the uncompetitive environment sustains a combination of high vehicle and parts prices, low vehicle utilization and high maintenance costs. The low vehicle utilization is a result of many high cost operators being kept in business by the way that the transport cartels control the lorry parks with vehicles sometimes waiting in a queue for days or weeks at a time for a load (Witkiss et al 2001). The existence of transport cartels - on a local, sectoral or national level - are a major impediment for transport efficiency.

What can governments do about this? The main emphasis has to be placed on measures to help bring about an environment in which a competitive and efficient rural transport service may flourish. The removal or weakening of cartels and transport unions might be politically difficult, but will increase efficiency considerably. Additionally, the establishment of transport brokering companies to match empty vehicles with loads; the use of modern communications to order transport services and transfer information; and the

establishment of IMT as alternative freight modes will increase competition (Witkiss 2001). Additionally, the vertical disintegration of state owned monopolies has positive effects on transport efficiency, as the example of cotton marketing in West Africa shows (Box 9).

Ultimately, the government can control fare and truck tariff levels in order to keep prices low. However, this needs to be handled carefully, since posted fare levels have also been used as a way to collectively prevent operators from accepting lower fares levels. Excessive regulation in transport markets is widely criticized. Instead, adjustment of taxes and duties, and elimination of price fixing and licensing constraints are strategic measures through which governments can promote better transport services. Another approach is the subsidization of vehicles and credit, particularly in tractorisation projects (Ellis and Hine 1995, p.13).

In many countries, public transport services also carry small loads, and are subsidized in order give incentives for services on non-profitable routes. The results are not always effective. Tendering for the bidder with the lowest subsidy might reduce these inefficiencies. Cross-subsidization for low volume areas can be achieved if profitable and non-profitable bus routes are tendered as a bundle.

Fleet renovation can be prohibitively expensive in many countries because imports of trucks and spare parts are difficult due to government import policies and licenses given to exclusive dealers. New, larger, and technologically advanced trucks are very costly in these countries, and capital is scarce and expensive. Hine and Rizet (1993) propose bulk buying policies by governments, aid agencies, or larger commercial firms, through which the prices of new vehicles could be substantially reduced. Additionally, exclusive dealerships which make the prices of spare parts very expensive should be abolished.

When truck drivers in Mali were asked about the main obstacles of freight transport, 49% complained about police harassments (see Box 8), 41% about road quality and 21% mentioned sector organization, while fuel costs, tariffs and taxes had relatively little importance, only around 10%. Corruption is one of the main impediments to efficiency in rural freight transport. Starkey (2007, p 104) observed, that operators considered that 'bribe' barriers accounted for up to one third of their operating costs, a figure comparable to their fuel costs. The causes, impacts and measures to fight corruption are not discussed here, since considerable material is provided on the website of the Global Transport Knowledge Partnership[13] and the Global Infrastructure Anti Corruption Centre (GIACC)[14].

Box 8 Police harassment and road blocks in West Africa

In West Africa, inter-regional roads are plagued by informal, mostly illegal, tolls. These so-called roadblocks are the number one complaint of transport companies. This important fact is corroborated by the results of interviews conducted with private operators in Mali, which show that they rank administrative harassment as the largest constraint affecting their operations. In 2003, a pilot study was undertaken to quantify the impact of roadblocks along the main transport corridors of West Africa. Sixty-one drivers took part in the survey. This sample of drivers was stopped more than 2,900 times, which means an average of 48 stops per trip. Drivers had to pay, on average, more than US$200 and waste more than 7 hours at roadblocks each trip. Along the Lomé-Niamey corridor, drivers were stopped 82 times which represents almost one stop every 10 kilometres. Consequently, the average speed of transport vehicles along this corridor can be as slow as 10 kilometres per hour.

Source: Baghadadli 2007, p. 41

[13] www.gtkp.com
[14] http://www.giaccentre.org/

Another issue is the safety of rural transport operations, which poses an enormous risk in many developing countries, if the number of accidents is compared to industrialized countries. Some measures could help, such as i) vehicle inspection and maintenance, ii) revised traffic regulations, iii) improved police enforcement, especially against overloading, iv) safety oriented infrastructure planning, v) improved safety regulations to facilitate combined passenger and freight services, and vi) training for operators, drivers and mechanics. More about this issue may be found on the website of the Global Road Safety partnership[15].

4.5 Conclusion

Inefficiencies dominate rural transport operations in many developing countries, especially in Sub Saharan Africa. Low quality and unreliable services, monopolistic markets and high charges are the biggest problems. In a survey among 500 companies, logistics was identified as the area where the greatest opportunities existed for enhancing trade efficiency with low and middle income countries.These improvements are essential if high value products are to be marketed. With rural transport markets being dominated by cartels, the promotion of competition by private enterprise is essential to enhance the efficiency and quality of freight transport services.

[15] http://www.grsproadsafety.org/page-knowledge_base-10.html

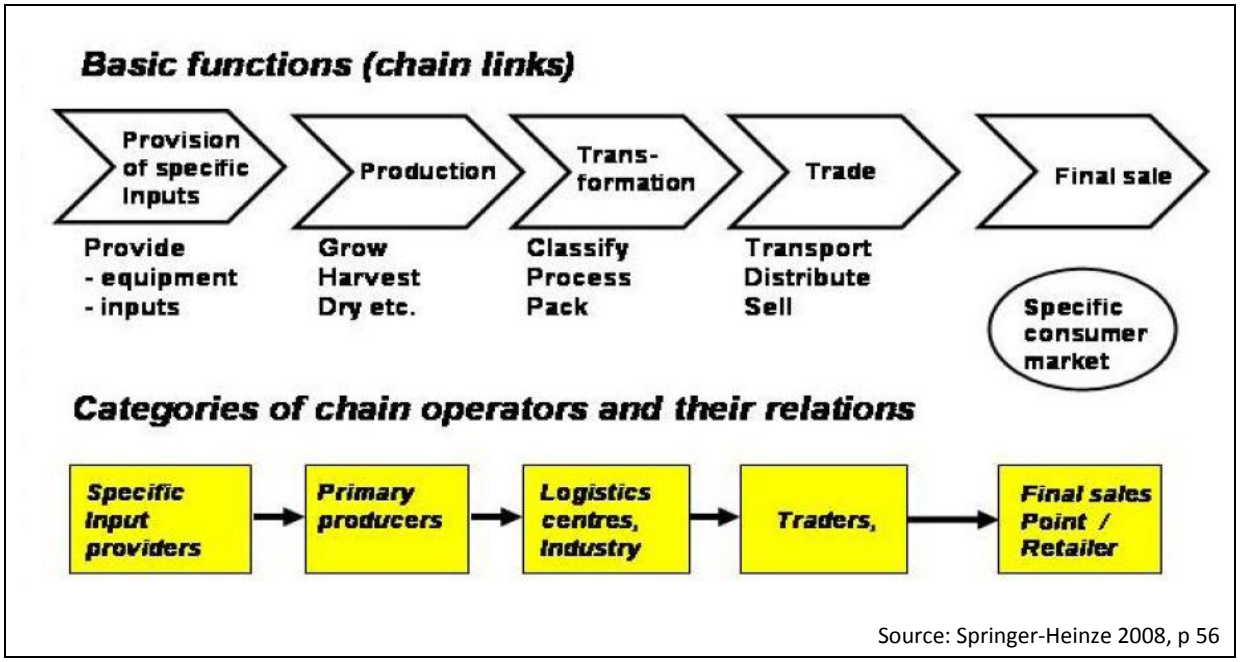
5 Modern Supply chains

Even though food staples remain, by far, the most transported good, new development opportunities crop up with the rapid proliferation of new high value products, as already described in Chapter 2. However, the new products have much higher requirements regarding organization, transport, logistics, management and financing.

5.1 Features of modern supply chains

Modern supply chains, as depicted in Figure 5.1-1, "views the production and marketing as an economic system that involves several actors, grouped in a chain[…], who carry out a sequence of activities which lead to production of the goods that eventually reach the final consumer" (Battisti 2009, p. 158).

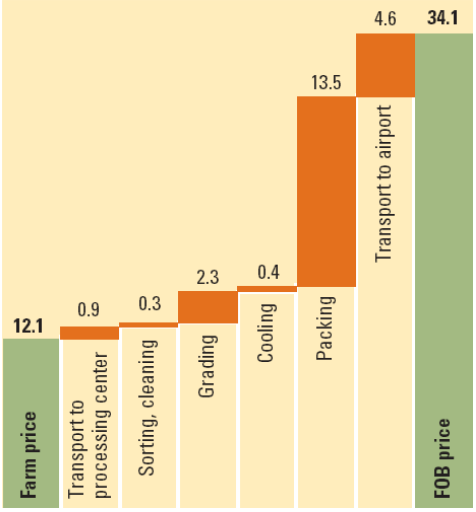
Figure 5.1-1 Basic features of an agricultural supply chain



Source: Springer-Heinze 2008, p 56

The new markets create diversified opportunities for developing countries, not only to supply high value produce, but also to carry out value-added processes such as washing, pro-packing, mixing, labeling and bar-coding. Consequently many new economic activities are carried within developing countries and thus increase rural value. In Bangladesh, more value is added when exporting French beans through transport, handling and packaging than by farming activities . (See Figure 5.1-2 below)

Figure 5.1-2 Cost of French bean export in Bangladesh [US$ per 100 kg]



The new markets entail a number of innovations with respect to marketing organization and infrastructures, which have their specific demands for logistic transport services. Marketing entails i) centralized procurement, ii) involving specialized wholesalers, iii) new contracts with suppliers and iv) quality and safety standards. New processed and fresh food items require new logistic services, such as packaging, cold chain management, container handling, establishment of distribution centers and warehousing. The example of Mango exports from Mali is used again to explain the operations and the supply chain in box 9.

Box 9 Supply chain for the export of mangoes from Mali to Europe

For exporting mangoes from Mali to Europe, a modern supply chain had to be established. A multi- modal transportation system connects the production unit in Sikasso directly to Rotterdam. This was made possible because of the newly renovated railway line from nearby Ferkessedougou to Abidjan, Côte d'Ivoire, from where the mangoes are exported to Europe. The products are conditioned at their point of origin with no modification before their final arrival. The conservation of the fruit is guaranteed by a cold chain management system relying on containers fitted with 'gensets', i.e. clipped generator units required to keep the refrigeration going. These containers are sent from Abidjan to Ferkessedougou, where they are transferred to a Malian platform truck, which takes them to the Sikasso pack-house where the mangoes are waiting in cold storage. When the containers arrive, the pallets are transferred from cold storage directly into the container. Once loaded and closed, the container is not opened until it reaches Rotterdam. After loading, the containers are sent back to Ferkessedougou, from where they are carried by rail to Abidjan in 15 hour-time. The containers are, then, put on the reefer ship deck until they are discharged in Antwerp and trucked to the Dutch importer in Rotterdam.

The operation succeeded after different multi-modal commercial tests preliminarily identified the cost and logistic delay parameters to be taken into account. This logistical innovation managed to reduce the transportation time two-fold and shipping delays were brought to 10-12 days into Northern Europe, which represents half the usual transit time and amongst the lowest in the world for mangoes. Additionally, administrative hassles and delays which have an adverse effect on quality, perishability and profitability were considerably reduced.

Source: Source: Danielou et al 2003, p10f, more details in the Annex

5.2 New procurement structures and quality standards

National, regional, and global supply chains are bypassing traditional markets where smallholders sell to local markets and traders. Procurement for high value produce takes many forms; it can involve centralized procurement, which shifts from fragmented per-store purchases to operating a distribution centre. It can also involve shifting from purchases in traditional spot wholesale markets to relying on specialized or dedicated wholesalers and logistics firms or to direct contracting (WDR 2008, p.126, 135).

Another feature of modern supply chains is contract farming, through which smallholder farmers may access high value markets for their produce, inputs on credit, new technology, and training in farm management (Vorley and Proctor 2008, p22). The Turkish retailer MIGROS contracted a whole village near Antalya market to

grow 1,000 tons of tomatoes during the summer (Reardon 2007, p.28-39). This might include as well direct or indirect assistance to farmers to make investments in human capital, management, input quality, basic equipment and extension services (WDR p.128, Reardon 2007).

Since the mid 1990s, a large number of standards have been developed by multiple chain supermarkets and other private-sector companies that are increasingly important in developing countries: sanitary and phytosanitary standards address food safety and agricultural health risks associated with pests, food-borne and zoonotic diseases, and microbial pathogens and other contaminants[16].

A prominent example is HACCP[17], a food quality standard used at all stages of food production and preparation processes, which is included in the international system ISO 22000. Additionally, groups of firms and business associations in the European Union have also developed private standards[18]; the most widely applied being the Global GAP standard, which provides for the use and application of pesticides and chemicals and the environmental impact of farming systems, and labor standards (Korsten 2008, P. 27). In 2005 GlobalGAP's European supermarket members made certification obligatory for suppliers. These food related quality standards are supplemented by ethical and environmental standards on child labor, labor conditions, animal welfare, environmental protection and organic farming[19], which require a 'farm to fork' certification.

While these standards are mostly introduced by the supermarkets or private exporters, public standards are often missing or are not adequate. Thus the control of the standards is often the task of the private actors and not the state. Compliance with the standards necessitates the development of technical and infrastructure capacities in order to manage information flows within horticultural chains and to implement quality and safety management systems effectively.

Quality issues represent a considerable risk for small-scale producers being excluded from the market. Vorley and Proctor (2008, p 28) and Battisti et al (2009, p22) claim that existing standards may not fit to smallholders. However, those who can afford to meet the standard requirements welcome the range of benefits from preferential market access. Henson et al (2005), using the example of horticultural producers in Zimbabwe, showed that mechanisms can be put in place that permit small-scale producers to make the changes and investments necessary to comply with enhancing strict food safety and quality standards and achieving levels of compliance at least equal to those of large scale producers.

5.3 Logistics of modern supply chains

In order to satisfy the demand from customers and adhere to quality standards, the produce has to undergo a number of processes, such as pre-cooling, pack line operations, ripening, de-greening or labeling. A well-equipped and hygienically maintained infrastructural base is a pivotal support element of the chain. The technological level must be appropriate to the needs of the target market and the length and complexity of the chain. For simple chains, such as where the producer is within hours of the market, a simple infrastructure base consisting of packing and well ventilated transportation facilities is adequate. For longer, more complex chains, packing houses, cooling systems and logistics infrastructure, such as refrigerated transportation, storage/warehousing and containerization, supported by appropriate logistical operations are required. A

[16] Fruit flies, foot and mouth and mad cow diseases, mycotoxins and pesticides.
[17] http://www.haccpalliance.org/sub/index.html
[18] see as well Hanson/Reardon (2005)
[19] http://www.ifoam.org/about_ifoam/standards/index.html

large number of detailed and practical instructions on supply chain Management for horticultural production are given in Korsten (2008). Box 10 gives an example of the procedures needed for cold chain management of horticultural produce.

Box 10 Cold Chain management for horticultural produce

Harvest	Minimize delays before cooling Cool the product thoroughly as soon as possible
Cooling	Store the produce at optimum temperature
Temporary storage	Practice 'First in First out' rotation storage Ship to market as soon as possible
Transport to market	Use refrigerated loading area Cool truck before loading Load pallets towards the centre of the truck Put insulating plastic strips inside door of refrigerated truck if it is to make multiple stops Avoid delays during transport Monitor product temperature during transport
Handling at destination	Use a refrigerated unloading area Measure produce temperature Move produce quickly to the proper storage area Transport to retail markets or foodservice operations in refrigerated trucks Display at proper temperature range
Handling at home or food service outlet	Store produce at proper temperature Use the produce as soon as possible

Source: Korsten 2008, p.170

Pre-cooling prior to shipment is needed to prevent quality loss and wilting of produce. Amongst the various cooling technologies, explained in Korsten (2008, p. 123ff), appropriate cooling technologies[20], such as the solar assisted cooling chamber, as depicted in figure 5.3-1, might be a low-cost solution in poor areas. This evaporative cooler can prolong the life of fresh fruit by two to three weeks.

Figure 5.3-1 Solar assisted evaporative cooler for storage of fresh fruit

[20] See as well http://practicalaction.org/practicalanswers/product_info.php?products_id=240

Source: Korsten 2008, p.127

Packaging is used to:

i) Protect produce from mechanical injury, contamination and disease,
ii) Display produce and therefore facilitate marketing and,
iii) Increase the efficiency and ease of handling, transport, storage and distribution. Pack line operations include dumping, pre-sorting, cleaning, washing, sizing, and waxing.

Farm to fork traceability provides an important element of quality and safety assurance. Data systems are needed that allow for following the flow of information up and down the supply chain and facilitating the tracking and tracing of produce between the producer and the market. Records must be kept at every step of the chain, i.e. in the field, at the packing house, at the supplier, the retailer and during transit between each of these points.

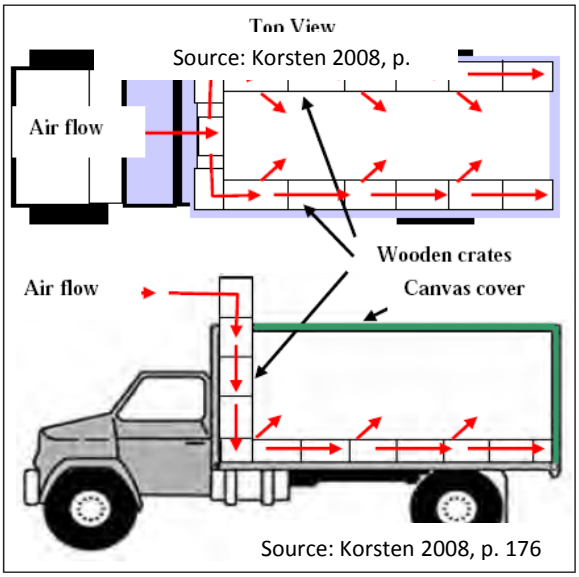
5.3.1 Transport requirements of modern supply chains

For most of the developing world, a much higher quality of transport is required to meet the needs of modern supply chains than is presently provided by conventional rural transport services. The main requirement for transport is to complement an almost friction-less logistical interface between the producer, the processing unit, the warehouse and the market. This requires high reliability of transport services ensuring an on-time delivery.

Distance and time to market are critical considerations in supply chain management, given that fresh produce progressively deteriorates with increasing time between harvest and consumption. For example a mango needs to be delivered to the packing house no longer than 12 hours after harvesting. Therefore, little or no private investment in supply chains will be undertaken, if frequent disruptions of the transport chain, caused by poor infrastructure, are expected. Thus, all year quality road access is indispensable for modern supply chains. How this may be achieved, especially for the first mile, is discussed in Chapter 6. Fresh produce must be properly protected during transportation in order to minimize mechanical damage, temperature abuse, taint and contamination by food-borne pathogens. It is the responsibility of the transport provider to ensure that the transport vehicle is well maintained and is in a hygienic condition (Korsten 2008, p. 153).

For the shipping of high value goods, adequate loading and transport facilities are needed, tailored to the requirements of the products: perishable goods require cold chains including refrigerated trucks; frozen food items, such as fresh fish, need HGV with deep freezing equipment; other goods necessitate vehicles with palette standards; and long distance or export products call for container handling facilities. However, high-tech solutions are not always imperative, as the truck ventilation system, depicted in figure 5.3-2, shows. For example, the system of wind catchers and ducts, which are constructed using wooden crates or galvanized iron, increase the airflow in non-refrigerated trucks.

Figure 5.3-2 Truck ventilation for non refrigerated vehicles



Source: Korsten 2008, p.

Source: Korsten 2008, p. 176

One of the main features of the new markets is rapid containerization (Pedersen 2001, p.87). This presents a huge challenge in many developing countries, since container handling is often very inadequate (Reardon 2007, p.2836). Containerization and palletization require not only special loading equipment, but also good knowledge and experience. The high requirements for transport logistics calls for professional management with experience and knowledge of logistics. Thus, in modern supply chains, a tendency of outsourcing to specialized transport firms can be observed. For example, in Thailand, Ahold's distribution centre for fruit and vegetables is operated in partnership with the international logistics provider TNT. Pedersen (2001, p. 97) observes in Africa "a new integration between the logistic and production chains, based on strategic alliances and long run contracts instead of ownership". This is accompanied by outsourcing transport to professional logistics companies and an increasing vertical integration between the modes in the logistic chain.

5.4 Good governance to facilitate modern supply chains

Governments may play a significant role in establishing or enhancing modern supply chains. The examples from China and India, given in Box 11, show how the state may support the development of supply chains through public funds, government enterprises and state investments. Policy makers may support the establishment of modern supply chains by giving attention to regional procurement networks and building institutional and organizational capital. Governments need to address this with investment in infrastructure in poor rural areas to improve the level of information and communication technology, and transport and energy supplies necessary for firms and farmers to invest and operate successfully. This includes an enabling environment, including infrastructure and land tenure, appropriate technology generation, technical and business advisory services, and upgrading traditional and wholesale markets (Vorley and Proctor 2008, p 29). Governments can support the marketing of high value products by building 'country brand images' and national quality seals that promote the export of products.

Box 11 Government support to supply chains in China and India

China reported the establishment of a special agricultural vertical integration fund to support 'dragonhead' enterprises, which are established by government authorities with both commercial and regional development objectives. The companies contract with farmers to procure produce with specific attributes, often providing seed, fertilizer and other inputs, as well as operating loans and technical expertise. The company processes the raw materials and sells them under a brand name often associated with the locality. One such enterprise is Fujian Sunner Development Co. Ltd, which is located in a very poor region of Fujian, without modern industry and very small land holdings averaging less than 0.5 ha. The company has grown out of a small chicken operation to one with a turnover of US$ 190m, supplying restaurant chains and hotels. This case shows how even in isolated areas farmers can mobilize to participate in modern agri-food systems.

In India**,** the state is investing in 'mega food parks' – a central government initiative, through which six parks are established, each spreading over 50 hectares at an initial cost of US$ 40 million. The land is provided by government and the private sector provides the investment in infrastructure and equipment. These mega parks are commodity collection, grading, storage and processing points. Farmers can enter into individual contracts with the private sector and sell their products.

A selective protection for the benefit of smallholders was done in the Indian dairy sector, which is typically small-scale producer led. In the 1950s–70s, there was a shortage of milk production. Instead of importing cheap raw material, policy makers invested heavily in processing and marketing in rural areas to bridge the gap between producers and consumers. They created infrastructure and provided input services to support production. Today about 13 million farmers are members of the cooperatives that were set up.
Source: Vorley et al (2008)

When establishing modern supply chains, the private sector plays a pivotal role. This is described in Box 12 using the example of the previously mentioned Mango supply chain in Mali. Essential for the success is the establishment of public private partnerships, which include identifying private partners, initiating collaboration, strengthening private business linkages and associations, brokering vertical collaboration between supplier and buyer, fostering horizontal collaboration of value chain operators and business matchmaking. Additionally, business development support services may be provided, including banks that make available loans, companies that offer market information, equipment hire services, logistics companies that transport and store produce, training and technical assistance, to mention a few.

Box 12 Private sector involvement in setting up the Mango supply chain in Mali

The success story of the mango supply chain in Sikasso, Mali is described in boxes2 and 9. The private sector has been involved from the incipient phases of the project as an important stakeholder: providing resources, managing pack-houses, organizing the exportation, but also giving technical assistance, ensuring proper pesticide use, and introducing innovations at all levels of the supply chain.

The export of mangoes relied specifically on the involvement of an Ivorian fruit exporting company and of a Malian pack-house. Both operators have brought along their capital, experience and competence in the export sector, especially regarding supply and quality requirements. They have been active in the task of securing crop financing and getting a vested interest in technological transfer to enhance quality, such as traceability, supply base management, integration, as well as streamlining logistics and monitoring markets.

One of the most important and innovative features of the project was that financing did not rely on banking sources. All the capital was raised by the private operator, without any commercial credit, through his internal resources and its 'trust-equity' network with its supply chain partners.

Source: Danielou et al 2003, more details in the Annex

A public private partnership requires that public activities are closely coordinated with the private sector. Supply chain planning is an iterative process that involves investors, planners, local decision makers and

producers, rather than a top down planning approach. Additionally, modern supply chains need an interdisciplinary planning approach, which includes knowledge not only on transport and logistics, but as well on agriculture and business development. A hands-on-manual on planning of value chains, published by GTZ (Springer-Heinze 2008), determines the following planning steps:

- Determining the scope of supply chains to be promoted
- Conducting and supporting market research
- Setting priorities across alternative value chains
- Supply chain mapping
- Quantifying and analyzing supply chains in detail; and
- Economic analysis.

The GTZ manual determines the salient criteria for the development of supply chains as reflected in Box 13.

Box 13 Lead questions and criteria for the development of supply chains

Is there a market and how can it be characterized?

- Types of products in demand (e.g. varieties and seasonality as well as product quality and packaging as preferred by the processing industry and/ or final consumers)
- Market size and trends (e.g. volumes traded, consumption of different consumer groups)
- Seasonality of market supplies (e.g. periods of over- and undersupply), demand peaks
- Product prices (e.g. maximum & minimum prices, price trends, fluctuations, price range)
- Requirements of buyers in terms of quality, price, volume and reliability.

Who are the competitors and how do they perform?

- Competing producers/ value chains (e.g. imports, supplies from other regions)
- Performance of competing market participants (e.g. price, quality, market shares)
- Competitive advantages of competitors (e.g. market distance)
- Competing products (e.g. products used as substitutes).

What are the conditions of market access?

- Existing distribution channels (e.g. industry, export or end consumer markets);
- Power of market participants (e.g. monopolies);
- Infrastructure of roads and market places (e.g. rural/ urban markets, storage facilities);
- Product standards (e.g. laws/ regulations on product safety, labeling or packaging);
- Tax and tariff regimes (e.g. customs tariffs on inputs, levies on road transport);
- Service offers facilitating market access (e.g. financial and information services).

Source: Springer-Heinze 2008, p.36

5.4.1 Policies to include smallholder farmers in modern supply chains

Modern supply chains favor medium sized or larger farmers and tend to exclude smallholders, as discussed in Chapters 2.2 and 5.2. In countries with a dualistic farm structure, buyers seek out large suppliers and also seek out areas that are already favored by agribusiness, for example those already engaged in export production. This might entail the exclusion of whole regions from modern supply chains (Vorley and Proctor 2008, p. 29).

To include smallholders in modern supply chains, the International Federation of Agricultural Producers (IFAP) demands: i) to have a more inclusive business model, especially procurement systems which buy from small-scale farmers; ii) actions to help subsistence farmers become small-scale entrepreneurs; iii) actions by governments to give a higher priority to agriculture and iv) programs to help small-scale farmers organize themselves in the market (Vorley and Proctor 2008, p23). The key success factors are: farmers who are trained, organized, empowered to deliver quantity and quality, a public sector with a conducive business environment including infrastructure, contract enforcement mechanisms, financial intermediation; and a receptive business sector. Additionally, "necessary policy reforms include both improving the ability of wholesale markets to meet the new demands of supermarkets and modern agribusiness, and allowing farmers, processors and retailers to trade directly without an obligation to trade through local government-controlled wholesale market monopolies" (Vorley and Proctor 2008, p. 30).

Box 14 Growers' organization for the Malian Mango supply chain

An important success factor for the improvement of specific supply chains is the involvement of growers' organizations and intermediaries. The producers' associations worked closely with the marketing agency APROFA at every step of the supply chain by pooling production, negotiating contracts, and also providing training and technical assistance, such as, for instance, organizing production planning, conducting field level diversification experiments, and supplying quick alert information on crop performance.

Intermediaries, such as field-men, middle-men and collectors, form an important part of the supply chains by performing the financial connection between commercial agents and growers. Although they are often looked down upon because of their usurious practices, they can be a strong vector of transmission, especially for the transfer of technical skills to the growers - as a means to adapt the production to the market needs. Because of their strong presence as vectors of information dissemination, these intermediaries got involved in the project from the design stages.

Source: Source: Danielou et al 2003, more details in the Annex

The Malian Case Study (Box 14) may serve again as an example of how smallholders gained access to the Mango supply chains. The answer is 'modern cooperatives', functioning as producers'-, marketing-, and traders' associations. They act collectively to provide market access, and can help correct some of the market imperfections, such as high transaction costs and missing credit markets. In this way they can help improve coordination and fill in important gaps in the supply chain. They are better able to obtain necessary information, reach quality standards and operate on a larger scale when they pool financial and labor resources (Markelova et al 2009). They can be responsible for configuring its members with market requirements including training, extension, technology acquisition, provision of commodity inputs and co-coordinating harvesting-delivery schedules (Rottger 2004, p.17f). Associations may be used as well to organize, acquire or even provide own transport services.
It is estimated that 250 m farmers in developing countries belong to farmer's associations (WDR 2008, p.154).
Governments and international co-operation can assist these organizations, by recognizing them as partners in decentralization, and providing a legal framework covering oversight of contracts and provision of bank credit (Vorley 2001, p 6). Shepherd (2005, p 41) gives a number of additional hints for governments, on how to support traders' associations.

Two examples of successful associations in China and the Philippines are given in Box 15. It has to be added, that in China funds for vertical integration of smallholders were dispersed through local government units. Numerous other examples of farmer to market linkages are given on the FAO website[21]. In the developed world, several attempts are undertaken, to push transnational retailers towards a pro-poor procurement within their supply chains[22].

Box 15: Examples of linking small farmers to high value chains

In the Philippines, a multi-stakeholder association is supplying vegetables to the fast-food industry, supermarkets, and vegetable processors. In December 2003 it started Normincorp, a marketing company that links the farmer directly to the buyer, in exchange for a 6% facilitation fee. The farmer, liable for the product, retains ownership over it all along the chain. Normincorp forms production clusters: a group of 10 small farmers allied with a commercial lead farmer who helps jump-start quality production. The clusters commit to undertake a common production and marketing plan for a particular product for an identified market. The lead farmer coordinates the production processes of the cluster farmers and is responsible for training them to ensure the quality specified by the market. Normincorp has become the preferred supplier for several clients thanks to its ability to respond to changes in market requirements.

In China, a group of small-scale growers registered the brand "Yulin" for their watermelons, with production standardized through coordinated planting, quality inspection, and packaging. They formed a watermelon cooperative to ensure their proprietary techniques and expand their marketing network. The cooperative sells directly to wholesalers, supermarkets, and retailers, which buy from the cooperative because it can deliver large volumes on a regular and timely basis and ensures food safety and quality standards. The "Yulin" watermelon high-quality brand image commanded a higher price than other watermelons.

WDR, 2008, p. 129

5.4.2 Human Capacity Building

Deficiencies in knowledge, trained personnel, experienced managers and general implementation capacity are often the reason for poor public and private planning. Inadequate human capacity is a serious constraint on rural development. It limits the effectiveness of the decentralization of local administrations, and prevents the development of small scale businesses, and the establishment of effective farmers' associations. Also, it reduces the efficiency of transport businesses, and thus constrains the development of modern supply chains. Again, the Malian Mangos example demonstrates how technical assistance and training can help to establish an effective supply chain.

Box 16: Technical assistance and training to establish Mango Marketing Chains in Sikasso, Mali

Most essential for the success of the Mali Mango export scheme was capacity-building and the transfer of know-how to the private sector through information networks, training, specialised technical assistance, and study tours.

Additionally, technical assistance intervened in the operation at several levels:
i) development of contractual frameworks between the partners; ii) defining the multi- modal logistics parameters and costs; iii) establishing the commercial and financial feasibility as well as cash-flow projections; iv) brokering the contract scheme between APROFA and the Ivorian exporter; v) providing outside assessment of the reliability of parties to the importers resulting in actual cash advances; vi) establishing pack-house management systems adapted to the specific Malian product sourcing system: inventory management, cold chain protocol, hygiene practices, payroll management, financial summaries; and vii) development of quality reports.

Source: Danielou et al 2003, more details in the Annex

[21] http://www.fao.org/ag/agS/subjects/en/agmarket/linkages/farmer-t.html
[22] The Chatham House Initiative in the UK is one example:
http://www.chathamhouse.org.uk/research/eedp/current_projects/procurement/

Thus, for many developing countries government support in training is likely to be essential to help improve rural freight transport and establish modern supply chains. Since there is a vast training need, only some examples from very different areas are presented here:

- Governments can help players develop new competencies for participation in modern supply chains, such as managerial capacity or meeting quality standards[23]
- Farmers need to improve their capacities in entrepreneurship and farm management
- In the process of decentralization, local administrations need training in various fields of local and regional planning
- University curricula of transport and logistics planning need to be updated and students enabled to gain practical experience before entering into the profession
- For road works, technical training needs to be given to contractors in maintenance practice (see example in Box 17) and to mechanics providing vehicle backup services; and
- Coaching, capacity building and on-the-job-training for the private sector may be included in road tenders through piggy backing of local road contractors[24].

Box 17: Contractor training for road maintenance in Kenya

In Kenya, local small scale contractors are trained within the Roads 2000 Programme in order to conduct road maintenance works. Suitable building contractors are trained at the Kisii Training Centre on practical, organisational, management and financial issues for labour based road works. After successful termination, the emerging companies receive a small contract, where on-the-job training is conducted.

Only after successful completion of the contract, i.e. meeting all technical maintenance requirements, the companies receive a certificate that makes them eligible to participate in the tendering process for other road works.

5.5 Conclusion

The emerging agricultural markets have high requirements for the development of modern supply chains. These cover upstream processes, such as the provision of inputs, as well as downstream transport logistics from the producer to the final consumer. Consumer driven demands entail new procurement structures and the need for strict quality standards. Therefore, modern supply chains require not only adequate facilities and good roads, but also, profound knowledge and efficient management. If these requirements are met, modern supply chains can provide remarkable opportunities for rural development, from which smallholders might profit as well, if adequately addressed through government policies. However, a 'sine qua non' condition for sustainability is human capacity building.

[23] Examples are given in Reardon (2006) p.499.

[24] Piggy-backing means the participation and training of local contractors through the successful tenderer. This has to be laid down in the TOR for major road construction works.

6 Integrated Regional Planning

Regional planning is important for rural freight transport, since the interventions are implemented on local and regional levels. For the planning of conventional and modern supply chains, a number of disciplines are involved, such as transport, agriculture, manufacturing, logistics, financing, business development and communications. Therefore, an interdisciplinary regional planning approach is imperative. This chapter shows, how, at the regional level, conventional and modern transport chains may be planned using the approach of basic access provided by multimodal transport, embedded in the concept of central locations and combined with modern communication infrastructure.

6.1 Basic access through multimodal transport

The most important question in rural transport is how rural access may be provided at a minimum of public and private costs. This can be achieved through multimodal transport, which increases cost efficiency by using the comparative advantages of various transport modes. It implies an intelligent combination of transport modes and their respective infrastructure. For the first mile goods may be transported by IMT, which, for small volumes, have a cost efficiency comparable to motorized means (compare Figure 3.3-2), but have far lower requirements for infrastructure. From the fields and plantations produce can be transported to buying points, to village storage facilities, to local markets or directly to rural hubs (compare

Table 4), using infrastructure that is inexpensive to introduce and may be maintained by local manpower. From the buying points or rural hubs, the goods can be transshipped onto conventional goods vehicles, which operate on superior rural roads allowing higher speeds at lower costs. Thus, the main idea is a combination of low cost infrastructure that provide access by IMT to rural areas and rural roads that efficiently link rural buying points and hubs with the rest of the world.

For rural infrastructure planning, the concept of basic accessibility (Schelling/ Lebo 2001) provides reliable access to as many of the rural population as possible. Thus instead of providing expensive roads for few farmers, low cost access to a larger production area is favored. The methodology implies:

- The development of low cost standards for rural roads
- A definition of core low volume road networks that are affordable and serve the majority of the population and,
- The application of spot improvements to gradually enhance the reliability of the network.

All year access is provided on low cost roads, for motor vehicles and paths and tracks that serve for IMT. Sieber (1996) shows, that investment in non-motorized infrastructure may reap returns on investment that are comparable with traditional roads.

In many developing countries, especially within Africa, there are still large areas of good agricultural land which lie a long way from vehicle access and may be developed. Hine (1993) found that, in Ghana, the conversion of a footpath into a road entailed benefits to the order of hundred times greater than the benefits of road upgrading. Opening up isolated rural areas, gives subsistence farmers access to the monetary economy and has strong impacts on poverty alleviation.

6.2 Planning Tools

For the prioritization of road works the following economic rational is essential. First maintain existing infrastructure, then rehabilitate deteriorated roads and - if funding is still available - open up new high potential agricultural areas[25]. In any case, new infrastructure should not be built unless it can be adequately maintained in the future. The 'Road Costing Knowledge System' (ROCKS)[26] is a databank and tool which can help transport planners in estimating cost of design and implementation of rural road investments.

Since rural road investments can often not be justified through conventional transport investment appraisals[27], the Producer Surplus approach (Carnemark et al 1976), which assumes an agricultural production increase, might be considered. However in practice, the estimation of producer surplus is related to high uncertainties. For example, it is particularly difficult to predict how agricultural output will alter, or how traffic levels will develop, given how many factors can begin to change all at once. (Van de Walle 2002).

[25] As a rule of the thumb, the Economic Rate of Return for maintenance is 40%, for rehabilitation 20% and for new construction 10%.
[26] http://go.worldbank.org/ZF1I4CJNX0
[27] Vehicle operating cost savings are generally too small to justify low volume road investments. Additionally, transport investment models, such as RED, are requiring sophisticated inputs, that are rarely available in the rural planning reality (Lema et al 2008).

Another planning option might be Integrated Rural Accessibility Planning (IRAP)[28]. However, the tool is focused on general rural development, while freight transport comprises only a minor component of this. Nevertheless, the strong participative involvement of local actors is a key lesson to be learned from IRAP.

Additionally, simple cost-effectiveness calculations[29] might serve as planning tools. Ratios such as the cost of road investment per farmstead served, or per hectare agricultural area opened up, can help when prioritizing investments. For this purpose large scale access maps produced by GIS, depicting the transport time from the farms to the next roads, combined with the agro-ecological potential, will enable planners to identify new investment opportunities.

6.3 Communication is essential for marketing

Next to rural roads, the exchange of information is becoming increasingly important in rural areas. An example from the Iringa Region, Tanzania, shows how time consuming and costly the collection of information for a local trader may be (Box 18). The mobile phone has already improved information distribution in rural areas. Short messages give essential information, for example, about the arrival of traders and current prices, while fax messages allow for the sending of signed contracts. The use of internet may serve as an information basis on a word-wide level.

Box 18 Information collection process of a Trader in Tanzania

In the Iringa Region, Tanzania, a trader reported his difficulties to collect information from his clients. For collection of agricultural goods from the local countryside two trips are required. Firstly, the trader travels by bus to make contact with various farmers and agree on prices and collection times and places. He then hires a vehicle on an agreed day and travels to collect the agricultural produce. The typical range is 50 kilometres each way and only one round trip per day can be accomplished. Although it is troublesome for the trader to go to collect the goods, he said that the farmers often face more difficulties than he does in bringing their goods to the buying point. Usually they had to head load the goods to the buying point.

Source: IT Transport 2009

In Senegal, Manobi, a business that provides local farmers with up-to-the-minute market prices for their crops through their portable telephones, has won two major African information and communication technology awards[30]. Farmers in remote areas of Senegal were provided with Wireless Application Protocol (WAP)-enabled cell phones that allowed them to connect to the Internet to check strategic market information and compare competing local buyers' offers for produce. Subscribers have secured, on average, about 15% higher profits for their farms after having paid net costs, including the price of Manobi's service.

Box 19: A website to trace back mangos produced in Mali

In Mali, Fruiléma, a business venture consisting of five mango producers had been certified by GlobalGAP, a certificate that guarantees insights into the origin of the product. One of the preconditions for the certification was the ability to trace back the mango production from mango producers to the end-consumers. Therefore Fruiléma launched a web platform that enables potential buyers to follow the whole production chain, right from where and how the mango was grown to as far as the company that is offering them for sale. Thanks to this platform, the fruits sold by Fruiléma can be compared with the quality criteria defined by GlobalGAP.

Source: http://www.manobi.sn/sites/sn/?M=6&SM=25&IDCommunique=10

[28] http://www.gtkp.com/sectors.asp?step=4&contentID=426
[29] Compare Schelling/Lebo (2001) and Liu (2000)
[30] http://www.idrc.ca/en/ev-68430-201-1-DO_TOPIC.html

In Kenya a service provided by KACE[31] harnesses modern Information and Communication Technologies ICT to empower farmers with low-cost reliable and timely market information to enhance the bargaining power of the farmer for a better price in the market place. Services are:

- Information kiosks located in rural markets
- District-level market information centers which have internet connectivity
- Mobile phone short messaging service SMS for information delivery to farmers
- Interactive telephone services which uses voice mail or pictograms for information delivery and,
- A data based website that allows various associations and small traders to place their offers of produce for sale.

6.4 Leapfrogging from Rural Hubs to Central Locations

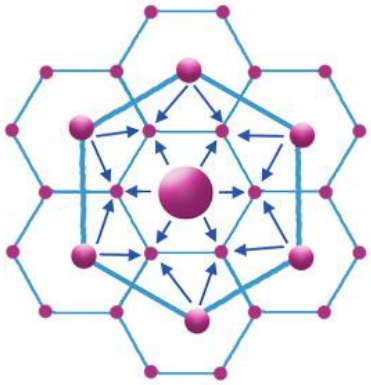
Multimodal basic access and rural communication infrastructures may be best combined within the hierarchy of central locations that function as development nodes and rural hubs. According to geographic theory, towns form a three-level-hierarchy of central locations, distributed on a hexagonal grid as depicted in the left part of Figure 6.4-1. Each level of the hierarchy provides specific goods and services for its catchment area. In order to serve as a development node, adequate facilities have to be allocated. A master plan, developed by central governments, defines the endowment of the centers and is used as guidance for regional or local planning.

For transport purposes, central locations serve as rural hubs that connect to other locations through spokes, as depicted in the right part of Figure 6.4-1. Starkey (2007, p.97ff) provides more insight into the functioning of Rural Hubs in Sub Saharan Africa. He classifies the rural hubs into village, market town and regional towns.

[31] http://www.kacekenya.com/

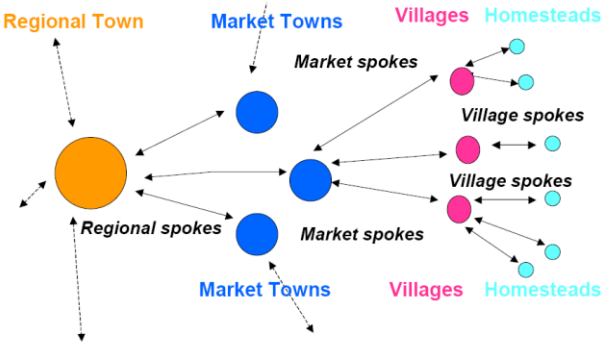
Figure 6.4-1 Central Locations, Hubs and Spokes

Central Locations



Christaller 1933

Hubs and Spokes



Source: Starkey 2007, p.13

The specific functions of rural hubs may be best explained by using the example of the South African Master Plan for rural areas (Rwelamira 2003) as given in the map of Figure 6.4-2 Central Locations in the Master Plan of South Africa:

1. The lowest level of the hierarchy is a *satellite centre,* which serves as a local hub and provides basic services to the communities around. They can be accessed through paths, tracks and low volume roads that are mainly used by IMT, pickups and other LGV. Since the satellite centre is used as a hub for transshipment from IMT to HGV/LGV, it is endowed with facilities to load and unload vehicles. For conventional supply chains short storage facilities should be implemented, while for modern supply chain s, the establishment of pre-cooling facilities (figure5.3-2) may be of importance. These facilities will increase the density of demand, attract more traders, and thus generate a more competitive environment that can help to reduce transport costs. The satellite centers supply telephone and fax services that provide information and communication for the rural farmers.

2. The next level is a *Multi Purpose Rural Service Centers* MPC, which is a local market, operates as a rural hub and provides extended service functions. All services of satellite centers, such as loading facilities may be provided as well. Additionally, goods storage capacities, agricultural extension services, and Internet facilities can be located here. A logistics procurement and coordinating agency can offer transport services, and can make available multi-use tractor-trailers, agricultural traction and other means of transport. For modern supply chains, processing and packaging units as well as cooling/refrigeration and container handling facilities may be located here. A precondition for their operation is the existence of electricity and water supply. Between the hubs combined passenger-freight services may operate and provide market access, if necessary on a periodic basis.

3. The highest level of the rural hierarchy is the *Major Rural Service Centre*, which serves as district market, major service centre and superior transport hub that is connected to the other centers via rural roads

used by all forms of vehicle transport. Next to the services provided in the smaller centers, here transport brokering services – possibly in the form of a toll-free public transport call centre can be established.

It is the task of the regional planner to:

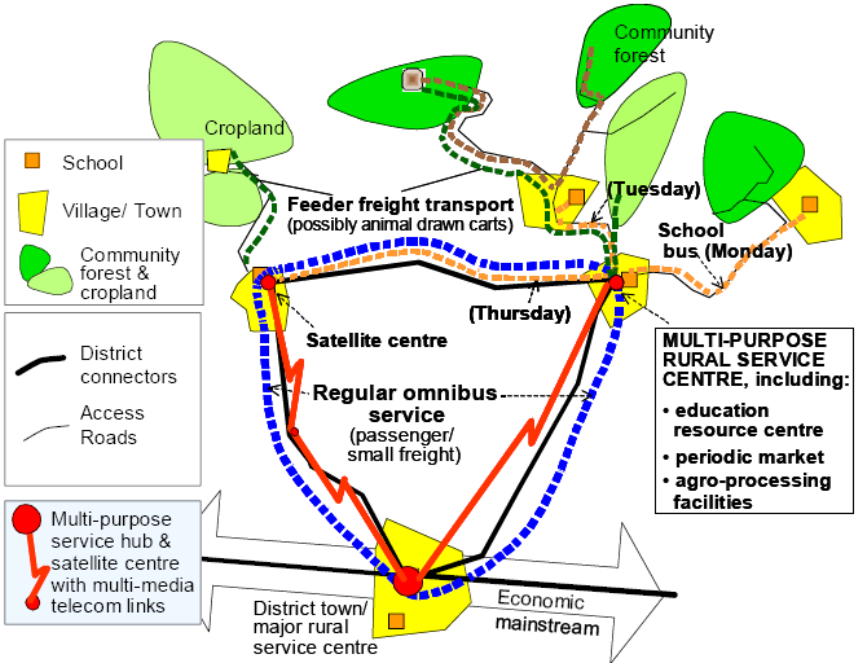
- Identify Central Locations and Rural Hubs
- Compare existing facilities with pre-defined endowment in the above master plan and,
- Plan adequate investments and other improvements.

Table **9** gives an overview on the function and possible endowment of central locations as foreseen in the Master Plan for South Africa.

Table 9: Function and endowment of rural centers in the Master Plan of South Africa

Central Location	Function	Facilities for Traditional Supply Chains	Facilities for Modern Supply Chains	Communication Facilities
Satellite Centre	Buying point Transshipment hub	Short storage facilities Loading facilities	Pre-cooling facilities	Telephone Fax
Multi Purpose Rural Service Centre	Local market Transshipment hub	Storage facilities Loading facilities Agricultural Extension Services Logistics Procurement Agency	Processing units Cooling and Refrigeration facilities Packaging houses Container handling	Telephone Fax Internet
Major Rural Service Centre	District market Transshipment hub	Additional to the above: Transport brokering service		

Figure 6.4-2: Central Locations in the Master Plan of South Africa



Source:Rwelamira, Miranda, 2003,p1

Central governments may support regional planning through the compilation of an integrated rural development strategy. Again the South African Rural Transport Strategy may serve as an example. Box 20 defines a number of policy actions to achieve the goals of the strategy. Another essential document is a Regional Master Plan, which may provide guidance for i) the endowment of Central Locations, ii) their goods and services offered; and iii) the quality of the transport links connecting the

centers. Additionally, transport standards and other technical specifications of rural infrastructures should be provided as well by central governments. By comparing the 'as is' situation in the planning region with the standards laid down in the Master Plan, investment needs may be derived.

A precondition for local planning is the consequent decentralization and devolution of central government functions. Additionally, the participation of local stakeholders, from government, administration, private business and other non-government organizations is essential for the sustainability of the plans.

Box 20 Policy actions of the South African Rural Transport Strategy

Joint interventions to develop multipurpose nodes and linkages
Development of feeder or access roads associated with key nodes and linkages
Development of sustainable road maintenance and off-road spot improvement programmes
Facilitation of transport brokering and special needs transport services
Piloting of combined passenger and freight transport services
Containerisation and logistics support for rural freight operations
Development of appropriate rural public transport and subsidisation options
Development of infrastructure for non- motorised transport, and
Promotion of animal-drawn carts and other intermediate means of transport.

Source: Rwelamira 2003

6.5 Conclusion

At the regional level conventional and modern transport chains may be planned using the approach of basic access provided by multimodal transport, embedded in the concept of central locations and combined with modern communication infrastructures. Central locations form a system of rural development nodes that serve as rural hubs for transshipment. The first mile is transported by IMT using low cost tracks and roads. In rural hubs, cargo are transshipped onto motorized goods vehicles, from where they may use well maintained rural roads. The rural hubs are placed in central locations that function as buying points or local markets and provide information, communication technologies (ICT) services for rural producers. In these central locations facilities for cooling, refrigeration, processing and packaging may be provided for modern supply chains. Superior centers may additionally provide transport hiring services. For regional planning an interdisciplinary approach and the involvement of stakeholders, especially the private business sector is a must.

7 Summary: Leapfrogging from Rural Hubs to New Markets

Poverty is predominantly rural and its alleviation can be best achieved through agricultural growth. Agricultural markets in developing countries have a dualistic structure, with a traditional sector focusing on food staples and traditional export products, and modern markets - through export and supermarkets, which demand increasingly high value products. If transport volumes are considered, domestic food markets will remain dominant. However, modern supply chains will increasingly gain importance, especially in middle income countries. These represent a considerable opportunity for smallholders to escape the rural poverty trap.

Presently, rural freight transport is primarily related to the evacuation of agricultural produce from the fields to domestic and international markets. The first mile is conducted on local paths and tracks, mainly by head loading, which is the most expensive means of transport. Inefficiencies presently dominate rural transport operations in many developing countries, especially in Sub Saharan Africa. Poor roads, low quality and unreliable services, monopolistic transport markets and high charges are the most important problems.

Since poor market access hampers development, rural roads can generate strong impacts on agricultural production and marketing and thus contribute to poverty alleviation. However, roads cannot guarantee development because of their rather permissive character, and thus transport services and the characteristics of different modes have to be taken into account as well. Intermediate Means of Transport (IMT) can reduce transport costs significantly, if multimodal transport chains are used. While IMT can efficiently carry small quantities on local infrastructure, trucks can operate cost efficiently for longer distances, on good roads when fully loaded. The multimodal approach uses the comparative advantages of each mode in the transport chain from the field to the market. Thus, the promotion of IMT for multimodal transport can often be essential for the improvement of rural freight transport.

Governments should first ensure that rural transport infrastructure is kept in a usable condition. This is best achieved within a framework of a road sector reform. When rural transport markets are dominated by cartels and monopolies, the promotion of competition is essential to increase the efficiency and quality of freight transport services.

Emerging agricultural markets for high value products entail substantial impacts on marketing, procurement processes, quality control, warehousing, packaging, logistic chains and on transport. For these products modern, supply chains are necessary to cover upstream processes, such as the provision of inputs, as well as downstream transport logistics from the producer to the final consumer. Thus, they call for high quality transport services that require major investments in facilities, transport equipment and management capacities.

Governments may support the development of supply chains through public funds, government enterprises, state investments and public private partnerships. They provide remarkable opportunities for rural development, from which smallholders might profit as well, if adequately addressed through government policies. This may be achieved, amongst other methods, through the support of ‘modern cooperatives’, functioning as producers’-, marketing-, and traders’ associations. A “sine qua non” condition for sustainability is human capacity building.

Planning of modern and traditional supply chains calls for an integrated regional planning approach, which encompasses disciplines such as agriculture, logistics, manufacturing, transport, and business development. At

the regional level conventional and modern transport chains may be planned using the approach of basic access provided by multimodal transport, embedded in the concept of central locations and combined with modern communication infrastructures. Central locations form a system of rural development nodes that serve as rural hubs for transshipment. For the first mile, goods can be transported by IMT using low cost tracks and roads. At rural hubs, cargoes can be transshipped onto motorized goods vehicles, from where they can use well maintained rural roads. The rural hubs are placed in central locations that function as buying points or local markets and provide communication and agricultural extension services for rural producers. In these rural hubs, facilities for modern supply chains may be provided, such as cooling, refrigeration, processing and packaging. Superior centers may provide additional transport hiring or brokering services. For regional planning an interdisciplinary approach and the involvement of stakeholders, especially the private sector is required.

Multimodal basic access combined with telecommunication, the development of central locations and modern supply chains, enables poor rural farmers to leapfrog from rural hubs to new markets and thereby escape the poverty trap.

8 Annexes

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8.2 Internet Links

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Animal Traction	http://www.animaltraction.com/
Animal Traction Network of Eastern and Southern Africa ATNESA	http://www.atnesa.org/index.html
DFID: Rural Transport Knowledge Base:	http://www.transport-links.org/transport_links/rtkb/English/Contents.htm
FAO: Linking Farmers to Markets	http://www.fao.org/ag/agS/subjects/en/agmarket/linkages/farmer-t.html
Global Infrastructure Anti Corruption Centre (GIACC)	http://www.giaccentre.org
Global Road Safety Partnership	http://www.grsproadsafety.org/
Global Transport Knowledge Partnership	http://www.gtkp.com/
IFRTD has developed a toolkit for promoting sustainability of RT infrastructure	http://www.ifrtd.gn.apc.org/toolkit/index.htm
ILO: employment intensive works	http://www.ilo.org/public/english/employment/recon/eiip/about/index.htm
International Conference on Agri-business Solutions, 26-27 Nov 2008, Cairo	http://www.agribusiness-solutions.org/
International Federation of Organic Agriculture Movements (IFOAM)	http://www.ifoam.org/
International Forum for Rural Transport and Development	http://www.ifrtd.gn.apc.org many links can be found here
International Fuel Prices	http://www.gtz.de/en/themen/umwelt-infrastruktur/transport/10285.htm
International HACCP Alliance	http://www.haccpalliance.org/sub/index.html
Procurement for Development Forum	http://www.chathamhouse.org.uk/research/eedp/current_projects/procurement/
Regoverning Markets	http://www.regoverningmarkets.org/

Road Costs Knowledge System (ROCKS)	http://go.worldbank.org/ZF1I4CJNX0
Sub Saharan Africa Transport Program SSATP	http://go.worldbank.org/5GT0JCEDK0
The Food Retail Industry Challenge Fund	http://www.frich.co.uk/
World Bank, Rural Transport	http://go.worldbank.org/MFIRHYKPC0

8.3 List of abbreviations

FAO	Food and Agricultural Organisation
FOB	Free on board
GIS	Geographical Information System
GLOBALGAP	Global Food Safety Initiative
HAACP	Hazard Analysis and Critical Control Points
HACCP	Hazard Analysis and Critical Control Points
HGV	Heavy Goods Vehicles
ICT	Information and Communication Technology
IDA	International Development Association (World Bank Group)
IFPRI	International Food Policy Research Institute
IFRTD	International Forum for Rural Transport and Development
IRAP	Integrated Rural Accessibility Planning
LDC	Least Developed Countries
LGV	Light Goods Vehicles
LIC	Low Income Countries
MIC	Middle Income Countries
MoT	Means of Transport
NMT	Non motorized transport
P.a.	Per annum, per year
SSATP	Sub-Saharan African Transport Programme
Tkm	Ton kilometer
TOR	Terms of Reference
UK	United Kingdom
VPD	Vehicles per day
WDR	World Development Report

8.4 Checklist for Critical Data

Feature	Unit	Source/Remarks
Agricultural Production		
Agricultural production	Tons/year, €/year	Agricultural statistics
Agricultural marketing		
Potential Marketing		Assessment of potential if transport conditions were optimal
Potentials for high value production		Expert assessment which high value produce might be introduced
Accessibility		
Access maps	GIS map	Access to next road / all weather road (walking or distance)
Road conditions	GIS map	Good/fair/poor/very poor
Local accessibility	Hours/trip, km, Means of Transport	Travel time and distance to next buying point
		Travel time and distance to next market
	No of days where access is interrupted	Seasonal access to buying point and market
Connectivity with higher level networks	hours/trip, km or bee line speed[32] Means of Transport	Travel time and distance to next regional market
		Travel time and distance to District Centre
		Travel time and distance to next all weather road
Regional Planning		
Appropriateness of the Regional Development Plan	Yes/no	Comparison of facilities given in the Regional Development Plan with endowment listed in Table 9 or with government manual on Central Locations
Endowment of Central Locations	Yes/no	Comparison of actual facilities with Regional Development Plan (compare Table 9)
IMT available in the area	No IMT/ hh	Average number of IMT per household

[32] $V_{Bee} = D_{AB} / T_{AB}$, with V_{Bee} Bee line speed, D_{AB} = Bee line distance from A to B, T_{AB} = Travel time from A to B.

Availability of credits for IMT	Yes/no, conditions	Interest rate, speed of credit supply, repayment conditions, collateral, funds available, etc
Availability of freight transport services	No vehicles, conditions	frequencies, means of transport, vehicles available, quality of service
Transport Charges	€/tkm	Regional differentiation of transport charges
For hire vehicle service	Yes/no, conditions	Conditions, charges, availability of vehicles,
Road Investment Prioritization		
Spot improvement, bottlenecks, emergency repairs	B/C ratio	Value of agricultural produce with no/bad access to markets per € investment
Benefits and costs of road investments	B/C ratio	€ expected marketing increase in the catchment area per € road investment
Cost effectiveness of road investments	ha/€	Agricultural catchment area made accessible by road investments per € road investment
	Inhabitants/€	Inhabitants in the catchment of the new road per € road investment
Effects on rural poverty	No poor inhabitants	Number of inhabitants below poverty line within the catchment area of the new road
Implementation capacities on District Level	Government funding of maintenance, trained District administration, trained local contractors, availability of equipment, quality of tendering processes, classification of the road network, clear division of maintenance responsibilities	
Implementation Capacities of Community Level	Options for community contracting, local knowledge on road works, level of communal organization, equipment available	
Modern supply chains		
The most essential questions for the development of modern supply chains are listed in Box 13.		

8.5 Case Study: Supply Chains of Malian Mangos to Europe

8.5.1 Constraints for Mango Exports from Mali

Mali is can be described as one of the poorest countries in the world, land-locked and with two thirds of its territory covered by desert. High value export commodities are some of the priority areas of Mali's poverty reduction strategy. The region of Sikasso, in the South, is the most important centre of horticultural production of the country. However, despite the good agro-climatic conditions, the sub-sector is still little known and developed. The lack of organization of the production impacts heavily on the productivity with an estimated 50% of the production lost every year.

Mali's specificity, with regards to mango cultivation, is the large share of smallholders in the production, with the majority of the plantations representing less than five hectares. These growers are part of a trade network comprising village associations and traders intervening in the production, collection, packing and shipment phases of the commercialization towards external markets.

Even though a reform towards market liberalization and privatization has been accomplished in Mali, the involvement of private operators, willing to invest, has been timid. Besides the lack of private capital for investment, the development of agricultural exports has been hindered by the existence of informal commercial networks disrupting the setting up of streamlined distribution channels for local and cross-border trade, and lobbying for the maintenance of high levels of subsidies. This has restricted the range of crops produced, especially for the export market, and ignored the demand requirements not only in terms of commodities but also in terms of compliance with regulations and certification, especially quality and safety standards.

Mali did not manage to improve its infrastructure and logistics to be able to develop an efficient supply chain for fresh produce exports. Sea shipment logistics for the exportation of its mangoes, as practiced in South America and Cote d'Ivoire, was not considered, and thus constrained the exportation of mangoes to the small market of air-freighted fruit. Additionally, producers lacked organization, extension services were nonexistent, and no incentives to private operators were given.

For the previous ten years, Malian mangoes had been exported through Ivorian middlemen, who processed the fruits in Cote d'Ivoire and exported them through Abidjan to Europe. Little or no technical assistance was given to the farmers. Full payment was often haphazard. This arrangement resulted in little investment in the horticultural sector and thus current yields were estimated to represent only 20% of the export potential.

8.5.2 The Project

The first objective was to improve the supply chain for the export market at the local level, involving the farmers in the export process, and, thus, strengthening the linkages between the small producers and the local and international markets, with a particular focus on local- level private entrepreneurship. The second objective was to capture or 'repatriate' the returns from value-added production to Mali by developing new communication channels for trade exchanges, in particular sea-freight logistics. The third objective was to encourage crop diversification in Mali through introduction of high value crops for small farmers. The last objective was to prove that the operation could be profitable and by this demonstrate a case that could later be used as an example for operations in similar environments.

For the promotion of mangoes, a government agency APROFA[33] was founded that set up operation at two levels: upstream, assisted small growers in developing an efficient supply chain; downstream, the agency facilitated the creation of a joint-venture with an Ivorian private operator to resume the activities of a closed packing-house, and manage the export process through the Ivory Coast to Northern Europe. By setting up a multi-modal logistical system and a cross-border partnership, shipping delays between Sikasso and Northern Europe were halved (from 25 to 12 days). As a result, grower unit prices increased by 25% and employment in the packing-houses reached 150 persons.

Mango packing in Sikasso

The operation has highlighted that an important success factor for the improvement of specific supply chain s is the involvement of growers' organizations and intermediaries. The producers' associations worked closely with APROFA at every step of the supply chain by pooling production, negotiating contracts, and also providing training and technical assistance, such as, for instance, organizing production planning, conducting field level diversification experiments, and supplying quick alert information on crop performance. Intermediaries, such as field-men, middle- men and collectors, form an important part of the supply chains by performing the financial connection between commercial agents and growers. Although they are often looked down upon because of their usurious practices, they can be a strong vector of transmission, especially for the transfer of technical skills to the growers - as a means to adapt the production to the market needs. Because of their strong presence as vectors of information dissemination, these intermediaries got involved in the project from the design stages.

The private sector has been involved from the initial phases of the project as an important stakeholder: providing resources, managing packing-houses, organizing exportation, but also giving technical assistance, ensuring proper pesticide use, and introducing innovations at all levels of the supply chain. The export of mangoes relied specifically on the involvement of an Ivorian fruit exporting company and of a Malian packing-house. Both operators have brought along their capital, experience and competence in the export sector, especially regarding supply and quality requirements. They have been active in the task of securing crop financing and getting a vested interest in technological transfer to enhance quality, such as traceability, supply base management, integration, as well as streamlining logistics and monitoring markets.

Most essential for the success was capacity-building and on the transfer of know-how to the private sector through information networks, training, specialized technical assistance, and study tours. Additionally, technical assistance intervened in the operation at several levels:

- Development of contractual frameworks between the partners
- Defining the multi- modal logistics parameters and costs
- Establishing the commercial and financial feasibility as well as cash-flow projections
- Brokering the contract scheme between APROFA and the Ivorian exporter
- Providing outside assessment of the reliability of parties to the importers resulting in actual cash advances

[33] Agence pour la Promotion des Filières Agricoles (Agricultural Trading and Processing Promotion Agency)

- Establishing packing-house management systems adapted to the specific Malian product sourcing system: inventory management, cold chain protocol, hygiene practices, payroll management, financial summaries
- Development of quality reports.

In a joint- venture with an Ivorian export company the risks were split along the Malian-Ivorian border. APROFA would guarantee a fixed price to the Ivorian importer. This latter would then bear the logistic and commercial risks associated with exporting the product. If average selling prices exceeded a fixed amount, the differential would equally be split between APROFA and the Ivorian company. The Ivorian firm secured the financing of the fruit purchase to the growers, packaging material, forwarding and inland logistics. One of the most important and innovative features of the project was that financing did not rely on banking sources. All the capital was raised by the private operator, without any commercial credit, through his internal resources and its "trust-equity" network with its supply chain partners.

8.5.3 Essential elements of the supply chain

The improvement of the supply chain is considered the main success of the operation. An efficient supply chain embraces not only the ability to produce and commercialize a product through value-adding operations, but also ensuring a sustainable investment climate and innovation cycle, which are also part of the process of benefit distribution as developing values and increasing competitiveness. This improvement meant putting in place a number of services for the small growers to be able to respond to the requirements needed for the chain to function efficiently, on the production and commercialization sides.

The **agricultural production** was enhanced through various measures, such as training and technical assistance on farming methods, collection of data, support for the establishment of producers' organizations, adaptation to demand requirements, quality control and certification, and amendment of national regulations. Organic produce play an important role, the certification of the fields was essential.

Marketing of mangoes was improved through the organization of the primary marketing actors and their active participation into the collection stage of the chain. Additionally, training in export standards application was provided on selection and conditioning of the mangoes and quality control. A strong focus was laid on logistics improvements through identification of transportation subcontractors, packing to reduce the losses, container shipment and dialogue with local customs and regulatory authorities. Operations were financed through a local bank, and partnerships with specialized export companies were established.

The export of perishable food products is an activity that requires mastering a whole set of **standards and methods** imposed by the importers to maximize shelf- life, such as phytosanitary, quality, aspect of the product, fruit maturity stages, and pre-cooling protocols. Exporting fruit to the European Union is a particularly risky business because of the levels of compliance required for the products to enter the market. **Quality control** was enhanced through training of producers, middlemen and packing -houses staff: timing for harvesting (ripeness levels), information on the market (sizes, varieties, presentation), and transportation requirements (time lapse, storage). A set of internal control systems was put in place on the collection and processing sites.

The second major field of intervention of the project was the establishment of the **multi- modal transportation system** to connect directly Sikasso to Rotterdam, which was made possible through the newly renovated railway line from nearby Ferkessedougou to Abidjan, Côte d'Ivoire, from where the mangoes are shipped by an Ivorian exporter to Europe. The products are conditioned at their point of origin with no

modification before final arrival. The conservation of the fruit is guaranteed by a cold chain management system relying on containers fitted with 'gensets', i.e. clipped generator units required to keep the refrigeration going. These containers are sent from Abidjan to Ferkessedougou, where they are transferred to a Malian platform truck, which takes them to the Sikasso packing-house where the mangoes are waiting in cold storage. When the containers arrive, the pallets are transferred from cold storage directly into the container. Once loaded and closed, the container is not opened until it reaches Rotterdam. After loading, the containers are sent back to Ferkessedougou, from where they are carried by rail to Abidjan in 15 hours. The containers are, then, put on the reefer ship deck until they are discharged in Antwerp and trucked to the Dutch importer in Rotterdam.

The operation succeeded after different multi-modal commercial tests that had preliminarily identified the cost and logistic delay parameters to be taken into account. This logistical innovation managed to reduce the transportation time by half (from 21 to 12 days), not only by reducing the transportation delays but also limiting considerably the administrative hassles and delays that have an adverse effect on quality, perishability and profitability.

8.5.4 Impact of the project

Initial shipments of mangos amounted to 220 tons in 2001, 600 tons in 2002 and 1,000 tons in 2003 could still be exported despite a coup d'état in Ivory Coast. In terms of returns, the project made US$ 44,600 of net profit, securing an Internal Rate of Return of 70%. Shipping delays were brought to 10-12 days into Northern Europe, which represents half the usual transit time and amongst the lowest in the world for mangoes.

Grower unit prices increased by 25% and employment in the packing houses reached 150 persons of which more than 60% are women with adequate working conditions and pay exceeding national labor benchmarks. Because of the increased production of mangoes, exported volumes, and farm gate prices, the mango producers benefited from a significant increase in their revenues. They were able to reinvest in orchard production and diversify their sources of income from cotton to mango, and subsequently to other crops such as sweet potatoes, melons and tomatoes. This crop diversification has a number of benefits, especially in terms of financial sustainability, spreading the risks by having multiple forms of cash crops. The organized producers, through their entities, became the direct partners to the commercial operators in charge of the packing and exportation. The growers' association independently negotiates the prices of the commercial services provided by private operators. Credit schemes are now available to the farmers for the importation of quality seed stock. Gradually, the operation is contributing to the creation of an out-grower model between the growers and the packing-house.

Source:

Danielou, Morgane, Patrick Labaste and Jean-Michel Voisard (2003): Linking Farmers to Markets: Exporting Malian Mangoes to Europe, the World Bank, Africa Region

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