

Session 1.4: Notes

Matching Demand with Supply in Rural Transport

Contents

1. Demand and supply
2. Markets and storage
3. Mobile phones and access

Learning Objective

This session describes the importance of the density of demand to the efficient operation of rural transport systems and how this effects vehicle choice. The greater the size and density of demand, the greater range of loads, distances, route patterns and types of vehicle service. In this variable environment there is a greater possibility to sustain a competitive transport system that will encourage a wide range of vehicle types.

- In areas of low density of demand it is possible to undertake certain interventions to maximise the effective demand for transport services
- To maximise demand it is necessary to look at the wider environment in which transport operates, particularly agricultural marketing
- Existing and new communications technologies may have a role in improving the efficiency of rural transport systems and in some cases taking away the need to travel.

1. Demand and Supply

(Source:TRL, 2001)

The factor that underpins the demand for rural transport is the size and density of the market for transport. The greater the size and density of demand, the greater range of loads, distances, route patterns and types of vehicle service. In this variable environment there is a greater possibility to sustain a competitive transport system that will encourage a wide range of vehicle types.

Previous papers have shown that Asian transport tends to be more competitive, lower cost, with a higher service frequency and, for short distance rural movements is diversified. In contrast African transport, is uncompetitive, high cost and rural transport appears to be undiversified. The one critical difference between the Asian and African countries is density of demand. Undoubtedly a higher density of demand in Asia has helped to provide a competitive operating environment, high utilisation, high service frequency and, for rural transport a diverse range of vehicle types. However, rural areas anywhere in the world tend to have lower population densities and hence have greater difficulty in maintaining viable rural transport services.

The major reason for a low density of demand in the African context is a low population density. For example, Sri Lanka has a population density of 263 per sq. km Pakistan is 150 per sq. km compared to only 66 per sq. km in Ghana, 27 per sq. km in Zimbabwe and 12 per sq. km in Zambia. Therefore in any given area in Sub-Saharan Africa there are less people requiring vehicles to transport themselves, agricultural produce, building materials and household goods.

The density of demand will also be affected by the nature of farming systems which are largely dictated by land pressures. Where there are few land pressures agriculture tends to be low input and low output. Where there are land pressures a more intensive farming system develops which requires more fertiliser, insecticide and other inputs for land preparation, irrigation and animal husbandry. The harvest yield is greater as are any by-products. Again, the greater number of inputs and outputs to the farming system the wider is the scope for specialisation and market agriculture and hence the greater is the demand for transport.

The single largest obstacle to providing reliable, frequent and cost effective transport services to rural areas is the combination of low cash incomes and low population densities. The viability of transport services is reduced by the need to service poor, small and dispersed rural populations. However, there are a number of ways in which effective demand can be maximised:

- Encouraging the use of transport brokers

- Consideration in the planning of the route network to ensure interconnectivity; Improving the flow of information
- Working with other agencies to ensure that complementary investments are being considered
- Improved provision of rural markets and storage facilities

Box 1: Rural markets

Mali

A good example of where rural markets work well is in Mali. Rural transport in Mali is centred around weekly markets. In a given area there will be a village or town which has a market on every day of the week. Each market serves a group of villages who visit this market on the given day of the week. Rural communities are generally within 30km of their nearest market and they transport themselves and their goods by IMTs and headloading (rural Mali has many IMTs including donkey carts, ox carts and bicycles). Where motorised vehicle services exist villagers use these depending on the distance, quantity of goods they have and the quality of the roads. Therefore most rural communities only see motorised services on one day per week; on this one day there may be more than one vehicle that visits the village depending on demand.

The traders use the motorised services to travel between the different markets on different days of the week buying the produce. The daily markets maybe up to 50km apart. In this way the rural transport system works quite effectively. The abundance of markets means that goods can be easily amalgamated for transport by motorised services. The relative proximity of the markets makes IMTs a viable proposition for transport from village to market.

Malawi

The marketing of agricultural products in Malawi has been dominated by the state owned Agricultural Development Marketing Corporation (ADMARC). They buy agricultural produce from farmers at the rates they publish at the beginning of the season, and then transport, store and eventually sell it to both rural and urban buyers. ADMARC is still the largest company in this business but since liberalisation there are new private sector actors competing. ADMARC has the biggest national network of centres, depots and markets, and between April and November they operate 1,300 small seasonal markets. ADMARC has no vehicles on its own but contract most of their activities to local transporting companies (Ternell, 1998).

Zambia

The marketing of agricultural produce in Zambia has historically been dominated by the parastatal marketing boards which organised the collection of agricultural produce and paid the farmers a government agreed rate. In the liberalised economy post 1991, the market was left to take over and as a result many agricultural marketing companies have formed which have taken

over many of the roles of the parastatals. These companies have formed collection points for produce. In some instances the farmers bring their produce to these collection points and in others the companies send large trucks to pick up directly from the farm. However, these collection points are little more than storage areas. Formal rural markets are scarce, distant and usually concentrated at district centres. For example in the high poverty districts of Eastern and Northern Provinces the average distance to markets is nearly 40km.

Honduras

In the Guinope Municipality of Honduras the nearest market was Tegucigalpa the capital city 60km from the district. Although there was widespread use of animal transport in the area, the capital was out of reach to most rural people. As a result they were reliant on the traders or "Coyotes" for the sale of their produce and for hire of vehicle services. The communities felt they were being exploited and set up mobile markets which met periodically and were advertised on the radio. In this way markets were set up within reach of IMT's and allowed direct contact between the farmers and buyers.

The issues that relate to a wider strategy on demand management in rural transport are as follows:

- Where distance to rural markets is large, the creation of more rural markets has the potential for making transport services more viable by encouraging the amalgamation of demand, for both goods and passenger.
- A regular market for agricultural produce and household goods may also increase incentives for farmers to buy IMT's to travel the relatively short distances to rural markets. It would also encourage transport operators and traders from the towns to visit the markets because they can guarantee sufficient demand to warrant the trip.
- If it is considered that rural communities are too dispersed to justify weekly rural markets, it maybe that introducing mobile markets which shift from place to place on a more informal basis are the answer. In this context a market is just a collection of people selling and buying goods and may only take place once a month.
- Storage facilities are important at both the village and district level to allow the amalgamation of goods for subsequent onward movement.
- All interventions in this area need close co-operation with agricultural authorities in the countries involved.

Interconnectivity of rural infrastructure

Where more than the minimum number of links and length of road are present on a road network, the network is said to exhibit redundancy. In

providing accessibility to remote rural communities, road engineers and planners often attempt to minimise their costs by avoiding redundancy. One result of this is that many rural feeder road networks are characterised by dead-end routes. The end of the route may occur at a town or village or at a natural obstacle such as a river or mountain. Sometimes these dead-end routes may exceed 100km. From the transport operator's point of view a major problem with these routes is they pose a higher risk in terms of load factors and revenues and may also involve more costs should a breakdown occur. Another disadvantage is that should the road become impassable, the rural community will become isolated from vehicle traffic.

Where there is an inter-connectivity of routes potential demand for transport services can be maximised. There is less chance of poor load factors and rural communities can respond to a wider range of market opportunities. With through routes traffic volumes will increase both because of greater demand and because operators can travel a route "on spec" with a reduced risk of an empty return journey. With a greater number of transport operators using a route there is then a chance of competition to become established in the provision of transport services.

Matching demand and supply - transport brokers

There are a number of ways in which rural transport operators can find loads. Commonly operators will wait in designated areas such as lorry parks or at bus stands and wait for the passengers and/or load to come to them. In many countries this means a long wait for vehicles and passenger alike as the vehicle will not move until full. Vehicle operators can also seek loads more proactively by travelling along a road looking for passengers or loads. However, this tends not to happen in most rural areas. In less populated areas farmers will walk into the main urban centre to find a vehicle that is prepared to go to the village and pick up the load.

In many countries, particularly around harvest time, there are reports of harvest spoiling on the sides of the road because transporters are unaware as to the location of the harvest. At the same time there can be vehicles waiting in urban areas for days at a time waiting for a load. In this regard transport brokers can provide an invaluable service in matching available demand with the available supply of vehicles.

The introduction of transport brokers, and increasing the role of existing brokers, will improve the matching of goods with available vehicles and hence reducing the need for empty running. For a brokerage service to be most effective it is necessary to have a nation-wide network of brokers who are continually in contact with transporters and clients. A good telephone, or other communication, system is essential for the effective operation of these services. Box 2 provides an example of Pakistan where transport brokers are used as an integral part of an efficient freight transport system. Session 3.2:

Transport Fares and Costs explores the cost comparisons between countries in Sub-Saharan Africa and Pakistan in more detail.

Box 2: Freight forwarding agents in Pakistan

Pakistan has one of the most efficient freight transport systems of any country in the world and a large network of freight forwarding agents supports it. These agents are normally individually owned and operate from a single office. Freight forwarding is their major income source although some also own vehicles and/or warehousing facilities.

About 25% of the agents dealt with general merchandise and the remainder dealt in specialist consignments such as quarried materials, iron or steel. Almost one third of all the consignments were "smalls" (i.e. less than one ton). Agents tended to be used more for longer distance movements and for particular goods such as agricultural produce and manufactured goods.

Charges for the forwarding service varied from 4.8% for long journeys to 11.3% for journeys of less than 50km. It was found that 90% of agents had a working telephone and 96% had a reliable postal service. However, two thirds of all business was generated by personal callers and one third by telephone. This is because the majority of business came from urban centres.

A crucial feature of the survey was the speed in which agents could find a vehicle. For 64% of agents there was usually no delay, 89% could find a truck within one hour and 96% could find a truck within two hours.

Although a transport broker's main role has traditionally been to service the needs of larger vehicles operating on longer distance routes, it is conceivable that they could also have a role for rural transport. For example, rural communities who have infrequent vehicle services could contact brokers as and when they required transport. Rural people could contact brokers whether they needed vehicles for the transport of agricultural produce, people or in an emergency. This would prevent the need for rural people making lengthy journeys by foot or bicycle to find vehicles and speed up the process of vehicle operators looking for loads.

Improved information flows

A major problem for most rural communities is that they have no telephone or radio communications with the outside world. Better communications could improve both the response in a medical emergency and transport services. Efficient transport systems rely on good communications in order that vehicles and loads can be matched. This is particularly true in low demand areas where it is not viable for operators to travel on the off-chance that they pick up a load. In the future the cost of mobile communications devices such as radios and even satellite telephones will be falling quickly. These devices as substitutes for expensive road improvement schemes or

running unprofitable transport services may prove to be very good value for money.

While this technology is unproven in the rural transport context there may be some scenarios where it is applicable. The following are some areas in which communications technology may help the more efficient provision of transport:

- Matching supply and demand i.e. communications facilitating a brokerage service
- Emergency services i.e. communities calling transport services from towns
- As a substitute for travel e.g. speaking to friends and relatives on the phone rather than travelling
- Access to markets and market information. This includes local markets as well as international markets
- Faster transfer of information on technological developments e.g. new seeds and fertilisers

All of the above will affect the demand for transport by increasing the likely returns from travel e.g. choosing to go to the market where product prices are highest.

Complementary investments to rural transport interventions

A number of authors have highlighted the need to combine investments in rural infrastructure with investments in other sectors. After all transport is a derived demand and will only be used if there is a social or economic benefit from doing so. Typically the types of investments that transport sector interventions should support include:

- Health e.g. hospitals or health centres
- Education e.g. schools or colleges
- Agricultural extension e.g. improved information and improved availability of seed and fertiliser
- Industrial investments e.g. agro-industries
- Small-scale enterprise e.g. support to local artisans
- Improved availability of credit facilities e.g. improved banking facilities or small scale credit schemes

The existence of these complimentary investments not only increases rural people's ability to benefit from the interventions but they also improve the prospects for running viable transport services.

2. Markets and Storage

(Source: TRL, 2001)

The importance of an efficient and competitive marketing system has been stressed as a complement to rural transport services and infrastructure in promoting development. However, the presence of markets and/or storage facilities in themselves also constitute a means by which the effective demand for transport can be increased. A market acts as a point where goods and people are amalgamated together and thereby concentrating the demand for transport. Where populations are dispersed markets are also likely to be dispersed with long average distances to market and people less likely to make the trip. These factors also have an influence over vehicle choice.

In addition, one of the most effective ways that farmers have of getting the best price for their produce is for them to sell it themselves directly to final consumers at rural or urban markets, and thus bypass the normal marketing system. Although farmers do not have the economies of scale of travelling wholesalers it is recognised by urban dwellers that farmers often provide the keenest prices.

Where farmers have to rely on travelling wholesalers, traders, parastatals or large private marketing companies they all reduce the farmers bargaining power, and critically, it reduces demand for transport services and the supply of vehicles available for rural people. Box 1 gives some different examples of marketing structures in Africa and Honduras. It can be seen that the marketing system in Mali lends itself to the efficient provision of rural transport services whereas in Zambia and Malawi the demand for transport is very much more seasonal.

Where goods are amalgamated it means the demand for vehicle services increases. The density of demand is of vital importance in determining vehicle choice. The larger the demand the more an efficient and cost effective vehicle can be justified and hence the unitary costs of transport are reduced. The existence of markets and storage facilities are important at any level. For example, at the village level a small grain store may be able to accumulate enough demand from all the farmers to justify the use of a donkey cart for transportation to market. Without the store individual farmers may only be able to justify headloading their surplus produce to market. Similarly, at the district level a market could attract city traders who bring large trucks to transport the produce bought at the market in bulk.

The following are the results of the analysis from case studies in Ghana, Thailand, Zimbabwe, Sri Lanka and Pakistan looking at the provision of transport services and the impact that marketing facilities may have (Ellis, 1996).

The presence of markets and storage facilities play an important role in affecting choice of vehicle. Markets and storage facilities both provide the same role of acting as a place where agricultural produce can be amalgamated. This may be for the purpose of immediate sale or for transportation to the next destination. Access to markets and storage facilities therefore affect vehicle choice in two main ways.

Firstly, the ease of access to these facilities, whether in terms of distance or ability to use the facilities, will dictate the farmer's decision on which vehicle to use. For example, if the storage facility is close he/she may decide to buy a non-motorised vehicle which would have been of no use if the facility was beyond a certain distance. Similarly, if once the farmer had reached the facility he was unable to use it either because of its expense or because of exclusionist type practises, the need for a vehicle becomes redundant, and the farmer's produce may as well be sold to the village trader. The farmer will only demand a more advanced vehicle if it is the perception that the vehicle will enable an effective increase in farm gate prices.

Secondly, where goods are amalgamated it means that the density of demand for vehicle services increases. The density of demand is of vital importance in determining vehicle choice. The larger the demand the more an efficient and cost effective vehicle can be justified and hence the unitary costs of transport are reduced. The existence of markets and storage facilities are important at any level. For example, at the village level a small grain store may be able to accumulate enough demand from all the farmers to justify the use of a donkey cart for transportation to market. Without the store individual farmers may only be able to justify headloading their surplus produce to market. Similarly, at the district level a market could attract city traders who bring large trucks to transport the produce bought at the market in bulk.

The ease with which farmers and traders have access to markets and storage facilities will be reflected in their distribution costs (transport and storage). If distribution costs are low this will effectively increase farm gate prices which will give farmers the incentive to increase production. One of the factors of production in this case would be agricultural and/or transport vehicles.

Table 1 shows the characteristics of market and storage accessibility in the five survey sites. It demonstrates that in the Asian case studies, markets and storage facilities were on average closer to villages than in the African ones. In addition farmers were more able to sell their produce at those markets. In Ghana for example, the multitude of middlemen that are involved in the marketing process means that even if a farmer is able to get to a market he may not have the facilities or contacts needed to sell his produce at reasonable prices. The lack of storage facilities also means that farmers will take lower prices rather than risk not being able to sell their produce.

Table 1: Characteristics of market and storage accessibility in the five survey sites

	Thailand	Sri Lanka	Ghana	Zimbabwe	Pakistan
Typical Dist. to nearest markets or storage	1-25 km's	5-10 km's	> 20 km's	10-100 km's	5-20 km's
Market access to farmers	Good.	Good.	Poor - market women have all marketing contacts.	Good - but must sell to the GMB or CMB.	Good.
Farmer ability to transport own produce	Good - except in hill country.	Good - but sometimes crop too small to justify.	Farmers have very little mobility.	Within 20km's it is good, but poor beyond this distance.	Good - will travel hundreds of kilometres.
Reliance on traders	Very little - except in hill country.	The poorer/ smaller farmers are reliant on them.	Almost complete reliance.	Technically illegal but less accessible villages rely on them.	Very little.

3. Mobile Phones and Access

(Source: Porter, 2012)

Information and communications technology (ICT), principally in the form of mobile phones, now seem to be starting to fundamentally change the organization of travel in many African households. In the context of an increasingly carbon-constrained world and the search for more sustainable transportation, potential interactions between the expanded virtual mobility facilitated by mobile phones and physical transport services are of great importance.

In Western contexts, where there has been considerable interest in examining the interactions between expanded phone (and other ICT) use and trip-making behaviour, Kwan (2006) suggests that, while travel patterns may to some extent be reconfigured in time and space, there is likely to be no reduction in travel, and indeed there may even be an increase, because people need to spend less time at home performing activities or making arrangements that can now be conducted on the move. The potential for

substituting travel to work with tele-working from home (using a variety of ICTs) has been seen as a means of reducing urban traffic congestion in Western contexts but appears unlikely to live up to early predictions of travel reduction, not least because face-to-face interaction remains so important in a business context (Line et al, 2010).

Social networks are vital not only for developing the trust needed for economic interactions, but for a wide range of livelihood-related activities including influencing the political process and building safety nets: they are crucial for poverty alleviation and growth. Urry (2012) argues that much travel involves making new connections and extending or sustaining one's networks. 'Network capital' is presented as a key concept – the capacity to engender and sustain social relations with those people who are not necessarily proximate and which generates emotional, financial and practical benefit. Even in the global world in which Urry's study is set, trust and tacit knowledge still seem to presuppose intermittent co-presence from those often distant.

Face-to-face interaction is of even greater significance in Africa, where personalised relationships are crucial in business. However, when the value attached to personalized relationships is balanced against factors of widespread poverty and irregular, sometimes very dangerous transport, the potential for some mobile substitution for travel may be greater than in Western contexts. Firm evidence is sparse, but when respondents were asked about any perceived linkages between phone use and personal travel in a child mobility study (Porter et al, 2012), many of those questioned, particularly in rural locations, suggested that mobile phones were already – or would in the future- reduce their need to undertake journeys. The cost differential between a phone call and travel was observed by many respondents, though there were also references to other benefits: saved time, effort and avoidance of potential travel dangers. Better distance management through phone use can be expected to be particularly closely associated with populations with very low disposable incomes, and/or whose physical mobility is limited (for instance by disability or infirmity).

Earlier research by Samuel et al (2005) in South Africa and Tanzania also suggests that phones are substituting for travel. They found particularly substantial impact in Tanzania (related to its many poor roads and limited public transport), such that 91% of those surveyed (N=223) said that the phone had impacted on them because they could call rather than travelling to family and friends (compared to 77% in South Africa, where N=252). But even in South Africa, only 4 out of the 10 communities surveyed had a regular bus service to the nearest town: the round-trip journey cost about R15, compared to a typical pre-paid voice call of R5. In Tanzania, 67% reckoned that phone use had made a large saving in travel time and 65% a large saving in travel cost, while in South Africa 52% reporting large time savings and 58% large cost savings.

Similar transport savings have been observed among *aso oke* weavers using mobile phones in Nigeria. Journeys and face-to-face interactions have not disappeared entirely, but perceived savings are expressed in terms of comparing call costs with transport costs (i.e. not including the capital cost of the phone), such that a call rate of N50 (\$0.40) per minute is cheaper than a taxi cost for an average journey of, say, N1,000 (\$8), since calls are normally completed in less than five minutes (Jagun et al, 2008). In Niger, an average trip to a market 65km distant will involve a grain trader in a 2-4 hour round-trip, as compared to a two-minute call. Based on a local daily wage of 500 CFA francs (\$1 U.S.) per agricultural labourer, a mobile phone will reduce search costs by 50 percent as compared with personal travel (Aker and Mbiti, 2010). In rural Kenya, M-PESA's wide agent network and presence in rural areas is also reportedly helping to reduce travel (Morawczynski, 2009). In some cases, respondents in this study observed that, prior to the advent of M-PESA, the travel cost to obtain their cash had amounted to nearly one third of the total sum remitted.

The literature cited above concerning the use of mobile phones in trading and money transfer contexts suggests that travel is made more *efficient* – phones were observed to cut travel costs and time, reducing the number of long, potentially hazardous road journeys on poor roads in badly maintained vehicles, in regions with among the world's highest accident rates and where highway robbery and other types of harassment associated with travel are widespread. Moreover, from observation and anecdotal evidence, mobile phones are also starting to help improve transport service operations in some locations. Samuel et al (2005) cite the example of taxi drivers in Tanzania, who used their mobiles to request additional taxis when there were many people waiting for transport, thus reducing customers' waiting time and increasing their own income. The potential for developing more efficient transport systems through integration of transport with mobile phone communication in Africa is substantial and already taking place.

References

- Aker, J. C. and Mbiti, I. M. (2010). Mobile Phones and Economic Development in Africa. *Journal of Economic Perspectives* 24 (3)
- Ellis, S. (1996). The Economics of the Provision of Rural Transport Services in Developing Countries. PhD thesis, Cranfield University
- Ellis, S. and Hine, J. (1998). The Provision of Rural Transport Services. SSATP Working Paper No.37. Washington D. C.: World Bank
- Kwan, M. P. (2006). Transport Geography in the Age of Mobile Communications. *Journal of Transport Geography* 14 (5): 384-385
- Line, T. Jain, J. and Lyons, G. (2010). The Role of ICTs in Everyday Mobile Lives. *Journal of Transport Geography* 19 (6): 1490-1499
- Morawczynski, O. (2009). Exploring the Usage and Impact of 'Transformational' Mobile Financial Services: the case of M-PESA in Kenya. *Journal of Eastern African Studies* 3 (3): 509-525
- Porter, G. (2012). Reflections on a Century of Road Transport Developments in West Africa and their (Gendered) Impacts on the Rural Poor. *EchoGeo* 20, April/June 2012
- Samuel, J. Shah, N. and Hadingham, W. (2005). Mobile Communications in South Africa, Tanzania and Egypt. *Intermedia*, 33(3), 32-42
- Ternell, A. (1998). Rural Transport Services in Malawi. RTTP case study.
- TRL (2001). Rural Transport Knowledge Base. Crowthorne: TRL Limited
- Urry, J. (2012). Social Networks, Mobile Lives and Social Inequalities. *Journal of Transport Geography* 21: 24-30