

LEARNING LESSONS FROM IMPLEMENTATION OF FLEXIBLE TRANSPORT SERVICES AND GUIDELINES FOR FURTHER INTEGRATION.

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Abstract

Many authorities and transport operators throughout Europe are experimenting with or considering flexibly delivered public transport systems, of which taxis are an integral part. Many such initiatives have been in response to recent developments in transport telematics. The overall objectives of this paper are: (a) to develop an accessible analysis of the provision of telematics-based flexible transport schemes showcasing examples of recent practical experience; and (b) to demonstrate how flexible transport services can contribute to the overall strategy and commitment of statutory authorities to provide citizen mobility within budgetary constraints.

The paper identifies key areas which are relevant for the types of decision that need to be made in either setting up a flexible transport service for the first time, or to make improvements to an existing service. The key areas considered are the decision-making framework for the assessment of viability, the technologies employed, issues in service design, managing multiple services, marketing and promotion and, finally, how these services can be provided sustainably with the use of partnerships.

1. Introduction

Many authorities and transport operators throughout Europe are experimenting with or considering flexibly delivered public transport systems, mainly with a view to improving social inclusion in areas difficult to cover by conventional public transport. Many such initiatives involve taxi services on a shared or single use basis and sometimes as part of a brokerage arrangement which may involve multiple operators from a variety of flexible transport service

providers. This paper considers recent experience derived from an analysis of actual examples of existing flexible transport service schemes and gives recommendations for future service planning. Critically, the need for a broader appreciation of “public transport” and a more integrated approach to the provision of flexible transport services is identified.

The paper is structured as follows: following consideration of the role of taxis in the “interactions” of transport, flexible transport is defined in the context of the overall public transport offer as well as giving a summary of recent, current and future developments of this emerging domain. The paper then identifies key areas which are relevant for the types of decision that need to be made in either setting up a flexible transport service for the first time, or to make improvements to an existing service. The key areas considered are the decision-making framework for the assessment of viability, the technologies employed, issues in service design, managing multiple services, marketing and promotion and, how these services can be provided sustainably with the use of partnerships.

2. Taxis and the “interactions” of transport

Taxis are one of the most immediately recognisable forms of transport worldwide; operating broadly consistent service which is widely understood and implicitly trusted. Given the ubiquitous nature of the mode, it is surprising that it often receives limited attention in both research and policy terms. Sitting somewhere between the traditional domains of public and private transport, the taxi, taxicab, hackney and jitney often appears to sit outside traditional domains of transport analysis.

Cooper and Nelson (2005) note that despite an apparent scarcity of references to taxis in the wider transport literature, and notwithstanding the limited attention given to the mode in much public transport literature, the taxi plays a significant role in the movement of people in most communities. For example, in a recent review of regulation completed for the Department of the Environment for Northern Ireland, taxis ranked third in all individual transport movements, only just behind bus services and significantly ahead of rail.

Taxis, as with other forms of transport serve a role in providing access and in enhancing the actual and perceived quality of life in the urban environment, including social inclusion (Bonaiuto,

2003), and economic well being of a society (Camagni et al., 2001). Moreover, the taxi serves a full cross-section of journey types: premium, leisure and low income.

Although beyond the scope of this paper, questions remain as to what extent the current structure of the taxi industry is appropriate, to what extent restrictions imposed by regulations reduce positive impacts arising from the use of taxis; and to what extent thinking would be advanced if analysis moved away from single issue to multi-impact, multi-solution concepts (Cooper and Nelson, 2005). Potential benefits of such innovative transport thinking are not limited to the urban environment. Rural communities often suffer from transport poverty, lack appropriate public transport facilities, and experience decline in economic development where out of work citizens are unable to reach neighbouring (often not distant) employment opportunities. Shared-use taxis, other flexible transport services, and other innovative responses may be able to facilitate this (Cooper et al., 2006). In the UK, whilst the regulatory framework has been put in place to allow many of these innovations, there is still a significant lack of public transport in rural areas provided by taxis (Mulley, 2007). Thus, the focus of this paper is the role of flexible transport services – of which taxis are an integral part – in enhancing the total transport offer.

3. Understanding the concept and role of Flexible and Demand Responsive Transport

It is important to appreciate the role of flexible and demand responsive forms of transport as part of the public transport offer. Flexible Transport Services (FTS) is an emerging term which covers services provided for passengers (and freight) that are flexible in terms of route, vehicle allocation, vehicle operator, type of payment and passenger category¹. The flexibility of each element can vary along a continuum of demand responsiveness (see Fig. 1) from services where all variables are fixed a considerable time before operation (e.g. a conventional fixed public transport bus route) to services whose constituent variables are determined close to the time of operation (e.g. a single ride taxi).



Fig. 1. The demand responsiveness of public transport (source: Brake, et al., 2006)

The roots of flexible transport services lie with Community Transport and Care Services provision in the form of dial-a-ride services in which the customer has to ring to make a booking usually at least a day in advance of travel. More innovative solutions, enabled by the development of transport telematics allow more flexible transport services in terms of when the booking can be made and the route taken by the vehicle. The significant European R&D in telematics-based Demand Responsive Transport (DRT) over the last 10 years (for both the passenger and logistics sectors) is documented in detail by Ambrosino et al (2004 and 2005) whilst British experience is described by Brake et al (2004).

In a North American context, DRT has been defined as ‘specialised transportation for older persons, persons with disabilities ... also provided to the general public, particularly in areas with lower population densities or lower levels of demand.’ (Schofer et al., 2003). Indeed, there is approaching 40 years experience with dial-ride, shared taxis, ride-sharing, fixed route and route-diversion jitneys, shuttles, paratransit etc. Aldaihani et al (2004) note that with the passage of the American with Disabilities Act (ADA) the growth in demand for DRT systems has been tremendous. Since the ADA sets strict guidelines for service providers with respect to trip refusals and on-time performance, service providers are expected to offer better services whilst experiencing increased usage.

Demand responsiveness can also vary within and between modes in terms of the type of service that is offered. Fig. 2 gives UK examples of these variations, including taxi options, based on the operation of distinctly recognisable standalone services – the way in which transport is generally viewed at present. The most responsive mode is the private car, if it is available, whilst the Post Bus could be considered the least responsive mode for passengers as its route is dependent not on passenger trip patterns but upon the need of the Post Office to deliver and collect mail as efficiently as possible. A detailed example of a British case-study which illustrates the possibilities of bringing together a set of flexible transport services is found in Brake and Nelson (2007).

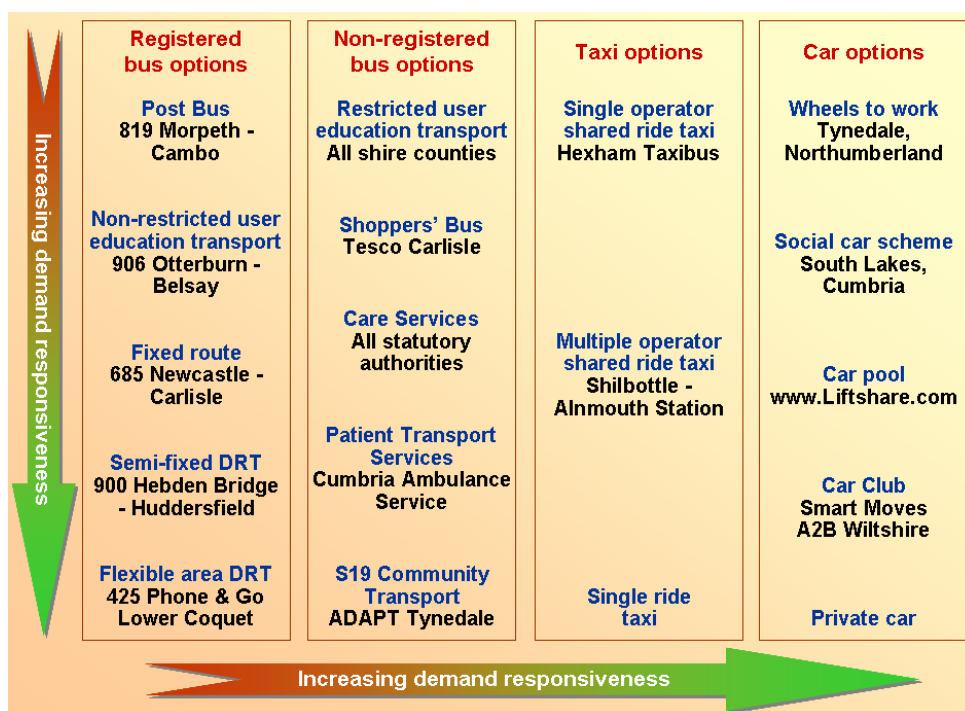


Fig. 2. The demand responsiveness of different modal options (source: Brake, et al., 2006)

A further classification is offered by INTERMODE (2004) which proposes four function-based composite case types, each of which is described by the nature of the DRT service it represents and the market it serves and by whether it is driven primarily by public policy or by commercial objectives. These case types are:

“Interchange DRT” providing feeder links to conventional public transport.

“Network DRT” which enhances public transport either by providing additional services, or by replacing uneconomic services in a particular place or at certain times.

“Destination-specific DRT”, a specialist form of network DRT that serves particular destinations such as airports or employment locations.

“Substitution DRT” which occurs where, instead of complementing conventional bus services, a DRT system totally (or substantially) replaces them.

A further alternative classification is proposed in a report for the Scottish Executive completed by Derek Halden Consulting (2005) which identifies:

Supported Bus Services

Concessionary Fares Schemes

Social Services Transport,

Specialised Home to School transport

Ring and Ride services for specialised needs groups

Non-emergency patient transport schemes

Other community transport schemes

The same report identifies four main markets for DRT:

Premium Value Services,

High Value to Agency Services,

High Care Needs, and

Best Value Public Transport.

The definition separates ‘premium value’ services typified by airport and hotel shuttles with personalised service used occasionally; from more widespread services intended for regular use. High value to agency services and high care needs transport are defined as including an element of public service. Best value public transport suggests that Flexible Transport Services may, in some instances, offer a cost effective replacement to traditional transport operation.

One issue which is prominent in most current debates is the financial sustainability of more flexible services. The US experience is that DRT can work well if matched to markets and resources. Many of the applications do not require public intervention other than for safety measures and some rely on public rather than private subsidy while others break even or make a profit. Aldaihani et al (2007) note that many of the services mandated by the ADA do require high levels of subsidy, hence their interest in operational measures which may reduce the cost of this type of service.

Limited available experience (e.g. in the UK from Angus and Florence in Italy) suggests that whilst in its infancy, the full integration of services and pooling vehicles from all public transport sectors through brokerage at a single “Agency” will be an important step towards achieving sustainable FTS.

Fig. 3 is a model developed and demonstrated in the EC FAMS project (FAMS, 2005) that illustrates how flexible services can be provided via an “Agency”. The classification is helpful because it demonstrates links required for future flexible service options.

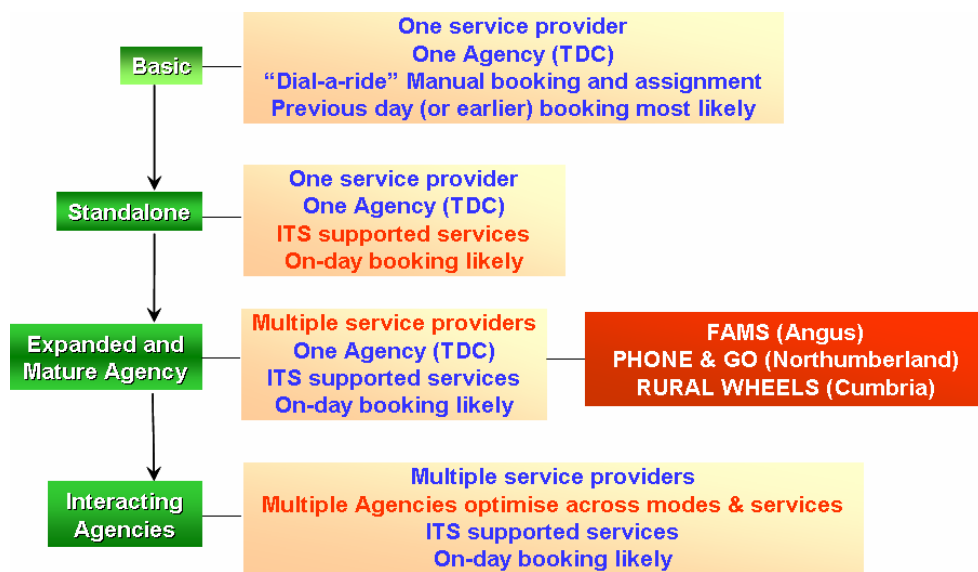


Fig.3. The layered model of service provision (adapted from FAMS, 2005)

The *Standalone layer* chiefly differs from the *Basic layer* (which typifies traditional dial-a-ride) in the level of telematics offered, i.e. services are scheduled and dispatched by software, thereby enabling on-day booking. Software is likely to include reporting functions to assist with planning and financial arrangements and thus can deal with higher demand levels on individual services and more services in total.

The *Expanded and Mature Agency layer* moves into the management of multiple service providers, such as a combination of supported services, voluntary services, taxis, statutory special transport services and voluntary car schemes. These may be managed as a set of independent services, economies of scale deriving from the use of a single Travel Dispatch Centre (TDC) or there may be some integration of services, such as the transportation of the general public and education contract passengers on the same service journey – an option which is being explored in Tyne and Wear, UK (Brake and Nelson, 2007). This layer can take a variety of forms. Thus, the scheduling and dispatching function can still be made manually, but other aspects, such as the use of Smart Cards for payment and reporting using a linked software package can be used, thereby enabling a more precise distribution of revenues from multi-operator passenger journeys.

At this level there are opportunities for non-transport functions to be integrated, such as the use of Smart Cards to pay for the use of leisure facilities. Alternatively, Value Added Services can be provided, such as the use of web searches to give information about public transport access to work and training opportunities, with the option to make a booking for a FTS trip where relevant; this also provides a service planning tool, as requests for access to work or training that cannot be met with existing public transport services will be logged. At this level the use of vehicular resources from different modes can be integrated, but requires information on the availability of vehicle types and their periods of availability, periods of driver availability, operators' prices for providing the transport services and institutional/regulatory conditions of each mode that may affect the management and scheduling functions.

In the future (depicted as the *Interacting Agencies layer*), many resources are likely to be integrated, including the pooling and optimisation of investment capital, vehicles and human resources. It is unlikely that such Agencies can operate without telematics-based scheduling and dispatching functions and telematics-based revenue management systems are probably essential. The highest level of interaction between Agencies involves the use of software that freely enables both geographical and organisational cross-border management, either through a single regional TDC or through a set of TDCs.

The remainder of this paper concentrates on the key areas which are relevant for the types of decision that need to be made in either setting up a flexible transport service for the first time, or to make improvements to an existing service. In terms of guidance for the future, the paper gives recommendations of a general nature, based on actual examples of existing flexible transport

service schemes, both in the UK and elsewhere in the world, alongside knowledge collected from experts, practitioners and operators in this area of public transport planning and operation.

4. Towards good practice in the implementation of Flexible Transport Services²

4.1. A decision-making framework for the assessment of viability

In broad terms, an ‘economically successful’ or economically viable service is often regarded as one where costs and revenues are at least in balance. Unless this is the case, a service will require on-going subsidy. Current experience in the provision of FTS suggests that services are not sustainable without direct subsidy in line with many other transport services where marginal costs are less than average costs. When a gap between revenues and costs persists, a discussion as to whether such a service should continue often revolves around the debate as to whether costs can be shrunk or whether revenues can be grown. It is in this context that an economic framework is relevant to help identify which costs and revenues are appropriate to the decision as to whether a service is viable. An economic framework can provide guidelines although in practice, public authorities who would be responsible for providing the necessary subsidy are unlikely to implement pure economics because transport services exhibit attributes, such as indivisibilities, which make this theory difficult to apply.

In terms of informing decisions, it is important only to understand the notions involved in the establishment of revenues and costs together with the concept of ‘avoidable’ or escapable cost³ and understanding of viability. This allows the sustainability of flexible services to be considered independently in contrast to the very common practice of comparing the costs and revenues of flexible services with a fixed route bus benchmark. Importantly, this approach identifies how decisions need to be influenced by the way in which the flexible service is delivered since the level of avoidable cost will change and thus a potential decision about sustainability

Inappropriate economic provision will ensue if costs are classified simply as fixed costs and variable costs, with resulting decisions based on this classification. The assessment of viability, in the context of the costs and revenues is applicable whenever a decision needs to be made. So that for example, if a flexible service is up and running and an examination of revenues and costs shows that the service is covering more than its avoidable costs then it should continue to operate. If the total revenue does not cover the total system costs, a service which makes some

contribution to the joint or shared costs by more than covering its avoidable costs should continue, at least until further investment is required. If a flexible service is in operation and has only been just covering its avoidable costs and it is time to replace significant investment (e.g. dispatching software) then the service is not long-term viable. To be viable into the long term, a service must not only cover its avoidable costs but make a sufficient surplus to replace elements of cost that are not avoidable in the short term.

Clearly this concept of viability is affected by the relationship of costs to revenues. In this context, revenues will be significantly affected by the level at which the fare is fixed. More pragmatic approaches to fare setting are to look at the avoidable costs of the service and to divide these by the anticipated number of passengers, so as to ensure that the avoidable costs of the service are covered⁴.

4.2. Technologies for flexible transport

Transport telematics offer a wide range of possible technological options for the development of FTS system modules and recent experience, which includes the SAMPLUS demonstrations in Belgium, Finland, Italy and Sweden developed from the mid-1990s, has been documented thoroughly (see for example Iacometti et al., 2004; Mageean and Nelson, 2003; Palmer et al., 2004). Diana and Dessouky (2004) offer a brief review of “technologically advanced” DRT from a US perspective and point to the growing interest in such applications in Europe.

The key decision for potential operators of FTS services is to make the appropriate choice between levels of technology that are available and appropriate for the case in question. The main architectural components of a telematics-based FTS may be summarised as the system control centre (usually known as the Travel Dispatch Centre (TDC)), devices for users (i.e. customers) to access the FTS system and On-Board Units; and the communication network. In the context of technologies there is a clear need to identify the most appropriate type of scheduling system (e.g. between manual and automated scheduling). Practical experience demonstrates that the selection of an Internet or an Interactive Voice Response System (IVRS), both of which have been used widely in the Nordic countries, will have implications for staff costs at TDCs; but can require significant testing time in advance of the service. Institutional factors may influence the solution adopted (e.g. factors underpinning the achievement of multi-operator / multi-authority co-operation). For example, it is easier to distribute funds between operators and local authorities if fares are collected using a technological solution such as Smart Cards.

The level of telematics must be appropriate to the objectives and long-term strategy for flexible services and the eventual choice will constrain the parameters of operation. For example software may only offer manual selection of the operator and/or vehicle from the database, thereby lengthening the pre-booking period required; sporadic mobile phone network coverage can prevent on-day bookings if using on-board units.

It is also crucial to ensure that potential customers of flexible services are made aware of the services available. To take full advantage of existing information services (such as Internet journey planners), flexible services need to be carefully described using agreed data standards as the quality of journey itineraries available from journey planners is dependent on the way that the FTS is described.

4.3. Service design

There is pioneering research on the dial-a-ride problem dating back over 40 years (Diana and Dessouky, 2004) and significant (more practical) contributions have been made in the wider DRT domain by the SAMPO / SAMPLUS projects (Engels et al., 2004). Ideally service design should be completed in collaboration with key stakeholders who will normally include the travelling public, bus (and other) operators, the local authority and the despatch centre manager. Key issues include the willingness to be flexible amongst key actors involved, the need to carry out comprehensive user requirements and an awareness of the constraints involved in service planning.

User requirements are intended to identify the needs of potential users based on investigation rather than preconception and would normally include the definition of appropriate routes, service levels and booking characteristics. User requirements may be approached by making site visits, one-to-one interviews or by holding focus groups. However it is important to determine the budgetary constraints on service design in advance. For example, the integration of social services, education transport and public transport is clearly desirable and environmentally and strategically more sound in terms of use of vehicles, although it is recognised that this is not necessarily the best solution for the general public. This could however be achieved by a vehicle multi-tasking with education/social services during one part of the day and general public during another but it is also possible to accommodate all types of users at all times of day with an appropriately equipped TDC.

Service design can consider fully flexible routes but also relevant are the semi-fixed type of route in which some stop points are obligatory whilst others requiring vehicle deviation from the core route are not (Engels et al., 2004). Additional dimensions include the geographical coverage of the service – either as a corridor or area service – and the proximity of the passenger to the pick up and drop off points – which could be from the door (a non-predefined stop point) or a short walk to or from predefined stop points. Services can be integrated between different modes, such as the use of feeder services to fixed bus routes and the rail network, or they can remain free-standing. Clearly the level of technology impacts on the operation as a telematics-based service offers a more rapid calculation of routes according to the typology defined for each service.

A critical element of service design is the booking criteria. If all passengers must pre-book their journeys (even if they use the fixed timed stop points) then the vehicle only needs to travel if a booking is made and the pick-up and drop-off times can be more certain. However, a negative outcome of this is that casual pick-ups cannot be made and this restricts revenue making opportunities.

4.4. Managing multiple services

The decision to move from a conventional fixed route services to flexible services adds a new level of management as the final route, and in some cases the vehicle, operator and type of passenger as well is selected much closer to the time of travel than with fixed routes. The general expectation is that as the management of FTS becomes more complex, then the level of telematics used will increase in order to cope with these demands. The level of complexity is determined by a range of interacting management decisions. As a starting point for making this decision, two factors are critical: the existing management resources; and the long term strategy for developing flexible services. Both of these factors depend strongly upon the level of co-operation between stakeholders.

The risk and investment required for telematics-based FTS services ensures that commercial operators have been unable to finance the management of such services, leaving this function to fall in the first instance to the statutory authority or to a public authority to support. Given this outcome the natural way of managing flexible services is to match the boundaries of the public authority, i.e. to define coverage *geographically*. However, this will not necessarily match the

desired journeys by passengers. Cross-border consultation is therefore important in the management of flexible services.

From a cost and organisational perspective there is a strong case for regional TDCs rather than numerous local TDCs and this approach is now being taken in Finland where the Ministry of Transport and Communications is currently developing a regional network of TDCs. However, this is at the potential loss of personal dispatcher knowledge which even the most detailed of maps cannot provide. The Finnish case is also noteworthy since many of the current developments in DRT originate from the taxi sector.

In the same way that the geographical area will tend to fall within a single public authority for the reasons advanced above, so does the *organisation* of the services so that the great majority of flexible services are managed in-house. However, there are a number of alternatives for hosting a TDC that have emerged as a result of flexible transport developments in the past including: another statutory entity (either within the statutory authority, e.g. education or social services; or within a different authority, e.g. Ambulance Service); a taxi call centre; a Community Transport organisation; a commercial bus operator; a research organisation; a call centre providing transport and non-transport dispatching functions; and a regional transport-related call centre.

The provision of multiple service provision in the future is crucially dependent on the employment of appropriate telematics since this enables the required level of management information with the possibility of a real-time dimension. The “Agency” approach (Fig. 3) introduced in Section 3 is a promising organisational model.

4.5. Marketing and promotion

The presentation of new initiatives to stakeholders is a key factor in the success of a service from the delivery and patronage aspects. From a delivery point of view the importance of awareness raising is even more critical with new forms of public transport services as an understanding of how their operational principles differ from conventional services is required. Awareness raising is a continuous activity – starting with the assembly of a partnership, followed by pre- and post service installation promotion, together with maintaining the co-operation of the partnership. The target of the awareness raising will therefore change over time.

The more flexible the service becomes the less visible it is to the end user. For example, a sign placed on a bus stop where a FTS service does not necessarily stop can give regular public transport users erroneous assumptions about the service – whilst those who are unable to reach conventional bus stops will not be aware of its availability. The more clearly branded the vehicle is, the more quickly it becomes recognised by the general public. Branding includes the TDC telephone number, a distinctive logo/colour scheme, and a distinctive name that evokes the character of the service. UK examples include the *Wiggly Bus* in Wiltshire, *Phone and Go* in Northumberland, *Call Connect* in Lincolnshire and *U Call* in Tyne and Wear. In Florence the name *Personalbus* is evocative of the service. The use of generic names such as these enables roll out of the concept across a wider area. Thus, whilst conventional marketing techniques are important, they need to be carefully targeted.

One objective is to ensure that all these stakeholders are aware of the service, how it operates and how they may benefit from it. All communication with the public should make use of this branding including timetables, posters and letters. If an Internet Journey Planner is used it should be adapted to clearly signify that FTS cover an area rather than a specified fixed timed route and will require booking through a TDC. Finally, the importance of word-of-mouth from satisfied users should not be underestimated.

4.6. Partnerships

A clear trend in the recent evolution of flexible services has been the emergence of several types of partnership in the movement towards multiple services and this is increasingly seen as fundamental to the future development of FTS. The purpose of developing a partnership is to ensure that the needs of stakeholders are understood and met, such as ensuring in a UK context that commercial services are not jeopardised or that the differing functions/ethos of Community Transport and commercial operations are recognised. For instance, volunteer drivers may be highly focused on the local community and may not wish to become part of a wider transport provision remit; they may also prefer to have minimal technological applications.

Partnerships, defined as co-operative working both inter-and intra-organisations, are also an opportunity to break down suspicions about new forms of transport services, whether from the provider or end user perspective. The principles of partnerships to manage a standalone service or group of services as discussed earlier can be extended to the brokerage of vehicles and staff. Well structured partnerships offer the opportunity to save both marginal and operating costs, for

example through the pooling of education, social services and public transport passengers. The opportunities for reducing total operating costs for everyone in the partnership are very high but can be difficult to achieve if initial effort is not put into the creation of a stable partnership.

In many organisations, funds are allocated for specific purposes or to a particular cost centre and are under the control of the budget holder. In a true partnership, all funds would go into one central 'pot' and this would be used to commission all services (for example, all education, health transport, social services transport). Savings, when they accrue, become the partnership's savings and not a saving to any one budget holder. However, in order for this to work, governance issues need to be clear and based on outcomes and not inputs. The impediments to setting up a true partnership are usually jointly fear and power. To run a true partnership members need to be prepared to cede power to the partnership and also be unconcerned that when the partnership carries out activities the contribution of the individual is lost. Equally, agreement on issues that look simple, for example, how a vehicle should be branded, may take much time and co-operation to resolve if it is of overriding sensitivity to one partner.

5. Conclusions

This paper has sought to analyse the recent experience with FTS by bringing together a collection of material to illustrate good practice in service implementation. A number of key areas relevant to the provision of successful services have been identified and brief guidelines offered for each of: the assessment of viability, technologies, service and system design, the management of multiple services marketing and promotion and partnerships. Future flexible transport services will need to be based on a long-term strategy for sustainability and an appropriate exit strategy following cessation of any pump priming funds. Taxis form an integral part of the FTS offer and have a key role to play in the further integration of the wide spectrum of flexible public transport services.

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Footnotes

¹ The EC CONNECT project collated and disseminated information Europe-wide on the theme of FTS. A continuously updated web-based "Virtual Library", contains information on: operation of transport services; legal frameworks and institutional aspects; system architecture, interfaces, data modelling; supporting technologies; business models, contracts, financing; and evaluation methodologies (www.flexibletransport.eu).

² A detailed expansion of the key areas of good practice identified can be found in Brake et al (2006).

³ Avoidable costs are 'those costs which can be properly attributed to a service, and are outlays which could be avoided if the service or activity is to be withdrawn' and form the basis for decision making within an economic framework. Whilst a simple rule of covering 'avoidable' costs is advocated by economic theory as a way of judging viability it is often complex to apply in practice since some costs are avoidable in the long run but not in the short run; some costs are shared or are joint between a number of activities, some costs are avoidable with small but not large changes in activity and so on. In practice this means that the degree of avoidability can vary with the time period under consideration and also whether the change in service provision under consideration is large or small.

⁴ At the planning stage, this is a useful yardstick for identifying whether fares are too high or too low as it identifies the target number of passengers that will be required to cover avoidable costs and this can be compared with the predicted patronage for the service.