MOBILSERVICE

Vernetzung der Aktiven im Mobilitätsmarkt

Mobilitätsdienstleistungen: Wegweisende Untersuchung zu den strategischen Rahmenbedingungen

Vor dem Hintergrund der Debatte über das Potenzial von Mobilitätsdienstleistungen hat das „Institute for European Environmental Policy“ IEEP in London einen wegweisenden Zwischenbericht publiziert. In „Mobility Services: Setting the Policy Framework“ wird eine Übersicht über den derzeitigen Stand und einen Ausblick auf die Zukunft gegeben. Im Bericht erfolgt unter anderem eine Analyse der praktischen Erfahrung (z.B.: Car Sharing, Bicycle Pooling, Kombinierte Mobilität etc.). Zudem wird untersucht was unter dem Begriff „Mobility Services“ verstanden wird. Das primäre Ziel des Projektes ist es aufzuzeigen, wie Mobilitätsdienstleistungen - im weitesten Sinne – zu einer nachhaltigeren urbanen Mobilität führen können.

Dieses Dossier ist auf Englisch.

Weitere Informationen:
Institute for European Environmental Policy IEEP http://www.ieep.org.uk

Prestations en matière de mobilité: un rapport anglais définit un cadre stratégique

Dans le contexte des débats sur le potentiel de l’offre en matière de mobilité, l’IEEP (Institute for European Environmental Policy), à Londres, a publié un rapport intermédiaire définissant un certain nombre de lignes directrices. Le but du rapport est de montrer de quelles manières les prestatations en matière de mobilité peuvent contribuer à instituer en ville une politique de mobilité durable. Le chapitre intitulé « Mobility Services : Setting the Policy Framework » propose un état des lieux et esquisse des perspectives. Une réflexion y est engagée sur le concept même de « prestations en matière de mobilité ». Le rapport met également en exergue des expériences concrètes (car sharing, bicycle pooling, mobilité combinée, etc.).

Pour plus d’informations (en anglais):
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05.07.2004

Unterstützt von: energieschweiz

Mobilservice
c/o Büro für Mobilität AG
Hirschengraben 2
3011 Bern
Fon/Fax 031 311 93 63 / 67

Redaktion: Julian Baker
redaktion@mobilservice.ch
Geschäftsstelle: Martina Dvoracek
info@mobilservice.ch
http://www.mobilservice.ch

Mobility Services: Setting the policy framework

First Year Project Report

A Review of Experience

Ian Skinner
Dawn Haines
Luisa Senft
Catherine Bowyer
Malcolm Fergusson

Institute for European Environmental Policy
28 Queen Anne's Gate
London SW1H 9AB

Correspondence:
iskinner@ieeplondon.org.uk

March 2004

The project is funded by a Small Project Grant from the Volvo Research Foundations.

The authors would like to thank the following for their contributions:

Peter Hjerp (IEEP);
Astrid Ladefoged (IEEP); and
Mark Tuddenham (IEEP French-based Associate).

MOBILITY SERVICES: SETTING THE POLICY FRAMEWORK

REPORT OF YEAR 1 OF THE PROJECT

A Review of Experience

1 Introduction

1.1 Background to the Project

In industrialised countries, car ownership and use continue to grow, and with these, individual expectations of a high degree of personal mobility. However, road space and parking space in traditional urban centres in particular are extremely limited, resulting in traffic intrusion and congestion as widespread problems. At the same time, it is acknowledged that there are people who live in urban areas, particularly in poorer areas, who have problems of accessing jobs and facilities, and therefore whose access needs to be improved. Hence there often appears to be a contradiction in resolving the problems of urban transport between the need to reduce congestion and improving access to services. One element of the solution to these problems could be a new and broader approach to mobility management which seeks on the one hand to improve the space- and time-efficiency of personal trips, and on the other, in some cases even to seek alternative forms of access which avoid the need for some trips altogether.

For these reasons there is a developing debate about the potential of 'mobility services'. At the same time, a range of developments in 'smart' vehicle technology and ICT capabilities are greatly improving the possibilities for a range of such services to deliver individual access, even within the constraints of a range of sustainable transport objectives (OECD, 2000). Reflecting this, existing transport and environment research programmes are paying increasing attention to mobility services (eg the CarLink II Research Team based at the University of California, Davis; a national research programme in Switzerland) and programmes in the EU have undertaken a significant amount of work that includes aspects of mobility services (eg MOSES, which aims to develop innovative mobility services based on car sharing). There are also a number of pilot and existing schemes for mobility services, especially car sharing (eg Mobility in Switzerland).

However, most of this work focuses on the implications of specific types of mobility services on society and the transport system and the elements of success for these services. Few studies have been undertaken of the broader potential of fully integrated services, or of the roles of policy instruments and the various elements of the transport and related industries in this. Where the former have been undertaken, policy instruments were assessed primarily at the local scale. As an example, the UK's Commission for Integrated Transport report on car sharing looked at the role of the government in providing the appropriate policy framework.

1.2 Aim and Objectives of the Project

While car sharing is the most widely-quoted example of a mobility service, it is only one of a number of mobility service models that is discussed in the literature. Hence, there is a need to look at the potential role of mobility services in a broader sense in resolving the urban transport problem. One possible vision of an urban future could be where the development of integrated mobility services has improved accessibility, but reduced the amount of travel, for example, through the use of sophisticated internet and associated technologies.

The primary aim of this project, therefore, is to consider how mobility services in their broadest sense could deliver this vision of improved access and reduced travel by examining existing trends and future possibilities, along with the policy instruments, social and other changes that could help to achieve this goal.

The research objectives of this project are to:

- Identify the potential for the full range of services currently encompassed by the term 'mobility services';
- Identify their potential role and contribution to a future urban sustainable transport system; and
- Identify the potential role of the policy community and various elements of the transport-related industries in the development of more comprehensive and sustainable mobility services.

1.3 Scope and Methodology of the Project

Initially, the scope of the project was set so that it was relatively broad to ensure that nothing that could provide an important insight for the project was excluded. Hence, the starting point was to take the term 'mobility services' in its broadest possible sense, ie services that enable mobility. However, this definition was refined as the project developed (as discussed further in Section 3.3).

It was also recognised that the increasing prominence given to the development of services within the transport/mobility sector is mirrored in other sectors and that the project could not ignore such developments. These were potentially important from two perspectives. First, insights from the development of services in other sectors could be beneficial with respect to the development of mobility services. Second, theoretical models and typologies developed for other sectors might be more developed than any applied in the transport sector to date, and therefore could offer insights into the development of the typology of mobility services. Hence, the project was broadened to include other sectors, at least in the first stage (as reviewed in Section 3.1 and 3.2).

The role of various stakeholders in the delivery of 'mobility services' was also examined. A range of transport-related industries have developed some aspects of mobility services in certain areas, but this process has not yet reached anything like its full potential or extent.

To give one example, car manufacturers have in recent years been increasing their interest in mobility services, although this has, to date, manifested itself only in the form of taking more control of aftersales services, where there are more profits and less risk for the industry. Manufacturers and other companies in the automotive sector evidently have a potentially important role to play in the development of mobility services, and benefits to gain from becoming mobility service providers rather than simply makers of cars. Car sharing schemes, for instance, are a potential means of introducing new technology as they provide a sustainable, low-risk market that can be controlled by the service providers.

There has also been an increasing debate in policy circles about the potential for mobility services. UNESCO has identified mobility services as a potential element of sustainable consumption behaviour, while the OECD and the EU institutions have held workshops or supported research on the subject (OECD, 1999; MOSES, 2002). In some European countries such as Germany, the development of mobility services has been supported by the government through direct funding or relevant policy approaches, such as promoting the idea of car-free cities. As a result, mobility service schemes, such as car clubs, have been reasonably well developed in some countries, where a national framework has facilitated the development of networks of schemes – which is obviously beneficial for some transport services. In contrast, similar schemes have failed to take off elsewhere, for example in the UK, where the government has not been involved in the development of such schemes. In this context, policy-makers can be argued to have an important role to play as well as the transport-related industries which seek to provide services, and identification of this role is critical for the future of mobility services.

With this discussion in mind, the main stages of the project are:

- Review of experience and literature, to include:
  - International experience with mobility services;
  - Approaches being taken by transport-related industries and policy-makers towards mobility services;
  - Theories of services and sustainability; and
  - Review of the development of services in other sectors.
- Identification of the potential role and contribution of these services to a future urban sustainable transport system.

Broadly, the former is the objective of the first year's work, and the latter the objective of the second year's work. The identification of the role and contribution of mobility services to a future urban sustainable transport system will be undertaken through a number of more focused projects, which were identified in the course of this work.

1.4 Content and Structure of this Report

This report focuses on the first year of the two-year project, which broadly equates to the first stage of the project as listed in the previous section, ie the review of experience and literature. The literature review has had two foci: a review of experience and literature to do with mobility services; and a review of the theory and practice of services in other sectors. First, in relation to mobility, it sought to identify the range of services currently

encompassed by the term mobility services through a review of international experience. This examined both practical experience as well as academic literature on mobility services and material posted on the internet. Second, the literature review examined experience of service development in other sectors, through looking at concepts such as eco-services and product service systems (PSS). This aspect of the work has also covered practical experience with the development of services.

The report is structured as follows:

- Chapter 2 outlines the problem of urban transport in some more detail and reviews the literature in order to identify whether there are any definitions of mobility services and/or what types of service are generally encompassed by the term.
- Chapter 3 looks more broadly at the potential role of services in a more sustainable society and looks at any commonalities or implications for the development of mobility services. It does this by reviewing the theories behind services and sustainability, models of services and practical examples of the development of services for sustainability in other sectors.
- Chapter 4 reviews international experience with mobility services.
- Chapter 5 reviews the role and motivation of the principal stakeholders in the provision of mobility services.
- Chapter 6 summarises the main findings of the report and briefly outlines the focus of the work for the second year of the project.

2 Mobility Services: A Solution to the Urban Transport Problem?

2.1 The Urban Transport Problem

In the urban context, the principal adverse environmental impacts of transport are the emission of pollutants, noise and the use of land. The emission from motorised transport of pollutants such as volatile organic compounds, the oxides of nitrogen and particulate matter, contribute to poor air quality, which is recognised as having adverse impacts on human health and the wider urban environment (EEA, 2003). Also, although carbon dioxide is not a local pollutant, it is relevant that the slow or stop-start driving that is typical of urban centres gives rise to particularly high levels of CO_2 emissions.

Noise from motorised transport disturbs everyday human activity particularly in urban areas, and has consequent social and economic impacts, for example through sleep loss and loss of productivity. Owing to its location and ubiquitous nature, road transport in particular is generally the major source of noise nuisance, and ongoing EU requirement for the compilation of noise maps is serving to highlight this point. The European Environment Agency estimates that 30 per cent of the EU population are exposed to noise from road, and 10 per cent to noise from rail, at levels that interfere with the quality of their lives and potentially damages health (EEA, 2003).

Whereas in rural areas, land take is an issue in relation to the damage of habitats and eco-systems, in urban areas, it is more a question of making the most effective and efficient use of valuable and scarce land in the face of competition from other potential uses. Consequently, in urban areas, the amount of land space used for car parking, both on-street and private, is as much of an issue as the land used by other transport infrastructure, such as roads and rail. For example, figures for 1990 in the UK suggest that roads cover 3.3 per cent of the country's land areas, while railways occupy about 0.2 percent (RCEP, 1994). Comparable figures for the EU put road as occupying 1.3 per cent of land and rail as occupying 0.03 per cent (CEC, 1992)[1].

In the social context, transport enables mobility allowing access to jobs, goods and services, but this benefit is not experienced to the same extent by all members of society (Social Exclusion Unit, 2003). Transport routes can also lead to barriers to movement developing. For example, the heavy use of urban roads can result in severance, ie the roads act as barriers to certain pre-existing patterns of mobility, thus changing mobility patterns and potentially restricting access for some of those affected. From an economic context, access to jobs, goods and services results in economic activity, which benefits the local economy. However, increasingly congested travelling conditions on the roads of many cities result in economic costs in terms of lost time and the inefficient use of resources. Time wasted in congested conditions restricts the amount of time that can be dedicated to other, more economically-beneficial activities. For individuals, these costs do not appear on any balance sheet, but for businesses, they do, as time wasted in congestion leads to real economic losses and congestion can also result in the need to use more resources, eg in terms of

[1] The figures for the percentage land take by a certain land use are not widely-reported, as these are difficult to calculate and vary depending on what has been taken into account. For example, the RCEP (1994) reports that figures for roads vary depending on whether the roadside verges are included or not.

delivery vehicles. Congestion on roads also results in direct economic losses in terms of wasted fuel and economic losses for society in terms of an inefficient use of roadspace.

It is apparent that the current pattern of urban transport is unsustainable in terms of environmental, social and economic factors. Much of the problem relates to the heavy use of, or some would argue an excessive reliance on, private road transport, and particularly the private car, even when public transport is readily available. However, an acceptance for change is being recognised and is mirrored by the increasing number of papers from policymakers on this subject, eg white and green papers and moves to legislate on transport issues (for example, UK (DETR, 1998) and EU White Papers (CEC, 2001)). Accordingly, the need for sustainable transport solutions is advocated by many as a means to move away from the problems associated with the current transport system.

2.2 Towards a Sustainable Urban Transport System

The context of this work is the identification of the potential contribution of mobility services to a future urban sustainable transport system to address the issues set out in the previous section. The need for a USTS is reflected in the current undesirable and unsustainable path that the current transport system is following (see, for example, EEA, 2003). However, a universal or agreed definition of a sustainable transport system does not yet exist[2], and in view of the many definitions and theories afforded to issues concerning sustainability, nor is one likely to in the near future. What is fundamental to the achievement of a more future urban sustainable transport system is for both future and current policies to take into account the three pillars of sustainability; that is the recognition of environmental, social and economic factors. The various environmental, social and economic considerations that need to be taken into account in the development of a sustainable transport system have been well documented (eg Skinner and Fergusson, 1999; OECD, 2000).

Moreover, the need for a more integrated approach is also essential. One of the main failings of the current transport system is that too often a reductionist approach is adopted (as set out in, for example, DETR, 1998). For instance many actors have responsibilities relating to areas that impact on transport either directly or indirectly. The lack of integration between such actors can often result in detrimental affects. For instance strategies carried out to improve traffic flow can often result in the degradation of cycling facilities. More generally, it is clear that an urban sustainable transport system might, as discussed above encompass inter alia land use management, improved communications, reducing the need to travel and mobility services. Some advocates see technological innovations as the way forward. For instance the emissions of pollutants that contribute to air pollution and noise from vehicles are being reduced by technical developments[3]. However, problems would remain in relation to reducing congestion where there are competing demands on a limited

[2] There are definitions by the OECD's Working Group on Transport (OECD, 2002) and the Commission's Expert Working Group On Transport And The Environment (CEGTE WG1, 2000). Interestingly, both papers referred to environmental sustainability in their titles, however this should not lead to conclusions that the environmental aspects of sustainability feature more prominently in the guidelines than the other two pillars of sustainability; economic and social.

[3] It is worth noting that while this is true, poor air quality resulting principally from transport emissions, particularly the oxides of nitrogen and particulate matter, is, and will continue to be for at least the next decade or so, a problem in many cities (eg CEC, 2000).

supply of land, while at the same time enabling access to jobs, goods and services that have social and economic benefits. Conversely, others see the need to actually reduce travel as an important component of a USTS. Consequently, in the congested cities and towns of western Europe, policies to reduce the need to travel are being developed (see review in Banister and Marshall, 2000). Elsewhere the advent of Integrated Communications Technologies (ICT) that enable teleworking and teleshopping is being seen as a means of reducing travel, while innovative marketing techniques are resulting in less travel in cities such as Perth in Australia (RAC, 2002; Brog and John, 2001).

However, to date, there are few policies that actively address ever-increasing car ownership, which is, if not the root of the problem, then one of its principal drivers (eg Keles, 2002). However, these do exist. Car sharing, for example, addresses car ownership through enabling access to the benefits of car ownership (ie flexible availability of a car), without requiring direct personal car ownership. Such schemes may help to bridge a 'gap' between conventional car ownership patterns on one side, and taxis and public transport on the other. These are increasingly put forward as an answer to the problems of urban transport (eg OECD, 1999; AIGT, 2002) and are often included under the umbrella heading of 'mobility services'.

2.3 In Search of 'Mobility Services'

In the literature, few authors attempt to put forward a definition of mobility services, whereas several authors put forward examples of mobility services without explicitly defining the term. One of the few examples is from the UK's Automotive Innovation and Growth Team[4], which defined mobility services, in rather broad terms as:

> 'comprising a variety of transport arrangements which allow people to enjoy the benefits of car-based mobility while doing away with the need to own a vehicle'
>
> (AIGT, 2002, p 17).

It is noticeable that the AIGT's definition focuses on providing car-based mobility without the need for car ownership, hence they suggest further investigation of the potential of car sharing, although they also considered more innovative leasing schemes and car pooling. AIGT's definition is narrower that that given by Klewe (1999), who makes a distinction between the term *Mobilitätsservice* and *Mobilitätsdiensleistung*, both of which can be translated into English as 'mobility services'. Klewe argues that *Mobilitätsdiensleistung* is a generic term for:

- The pure transport provided by a transport company (eg a bus service), as well as the temporary option to use a car (eg one that belongs to a car sharing company); and

[4] The AIGT was set up by the UK's Department of Trade and Industry. It consists of stakeholders and aims to identify the key issues that will shape the future of the industry and to identify how the UK should respond to the competitive challenges that it faces.

- The service enabling the use of these transport options (eg public transport information system, combined ticket for public transport and car sharing).

In contrast, *Mobilitätsservice* are the non-physical services and management of transport. Other authors do not attempt to provide a definition of mobility services; rather they give either implicit or explicit examples of the services that might be encompassed by the term. In 1999 the OECD hosted a series of workshops entitled 'Innovation for Environmentally Sustainable Transport: Mobility Services and Logistics for Passenger and Freight Transport'. The workshops aimed *inter alia* to explore practical ways in which mobility services can support more environmentally sustainable travel, review the technological options available for mobility services and explore best practice. Whilst participants looked at mobility service providers, 'door-to-door' mobility packages and mobility centres, an actual definition of what constituted mobility services was not discussed. Similarly, Hörmandinger discusses mobility services in depth, however does not offer a definition at any point. Rather, he discusses the conditions under which they developed and how various schemes work. He also looks in detail at the impact of mobility services on the motor industry and the future role and possibilities for the motor industry becoming involved in such schemes (see section 5.2).

The European Platform for Mobility Management (EPOMM), which is an international partnership that aims to promote and further develop mobility management in Europe, discusses mobility services in the broader context of mobility management. It describes the core of mobility management as using 'soft' measures to enhance the 'hardness' of measures, such as changes to infrastructure and sees mobility services as one of the major components of the soft approach. EPOMM believes that mobility services are a tool to convince people to make sustainable travel choices and that to do this effectively, the services need to be adapted to the particular needs and demands of the clients. EPOMM distinguishes six broad types of services, these are:

- information and advice;
- consultation;
- organisation and co-ordination;
- products and services;
- sales and reservation; and
- awareness and education.

The EU project 'Mobility Services for Urban Sustainability' (MOSES), in spite of its name, does not give an actual definition as to what mobility services are. MOSES' objective is to facilitate developing the concept of car sharing across Europe, which seems to prescribe car sharing as a mobility service without questioning what such a service is or should entail. As seen from the other studies above it would seem that this is commonplace with only a handful of studies attempting to offer a definition.

In order to attempt to gain a clearer understanding of what the term 'mobility services' might actually cover and how these might contribute to a future urban sustainable transport system, it is also worth reviewing the broader services for sustainability literature and to

review experience in other sectors. In the sustainability literature, particularly that relating to sustainable consumption, much attention has been given to the potential role of services in the 'dematerialisation' of the economy (eg Weizsäcker *et al*, 1998). There are also a number of programmes exploring the potential role of services in a future sustainable economy, eg the EU Thematic Network SusProNet (eg Tischner, 2003) and, in the UK, the Green Alliance's Service Innovation for Sustainability project (eg Willis and Oldham, 2003). These, and others, will be reviewed in Chapter 3.

3 *The Potential Contribution of Services to Sustainability: Theory and Practice*

In order to identify the potential role of mobility services in a future transport system, it is important to undertake a review of the theory and practice in other sectors to identify any useful insights that these provide for transport. This is the aim of this chapter. It begins with an overview of the theory underlying the potential role of services in a future sustainable economy (Section 3.1), followed by a review of some practical examples of services and their contribution to sustainability (Section 3.2). Section 3.3 concludes the chapter with a discussion of how the theory and practice in other sectors might be relevant for transport.

3.1 Services for Sustainability: An Overview of the Theory

The interest in the role of services in a future sustainable economy derives from the fact that, on average, services are less resource-intensive than manufacturing. Less use of resources in turn implies less need for primary extraction industries, less waste disposed, and in general fewer environmental impacts as a result. Thus a shift towards a more service-orientated economy is considered by some to be a crucial component of a move towards a more sustainable economy. In this context, the economic and social benefits of services are enhanced by a reduction in their environmental impact. In industrialised countries, the contribution of services to the economy has been increasing at the expense of manufacturing, and estimates suggest that services contribute 75 per cent of total GDP in the US and around 50 per cent in Europe (Tischner, 2003). However, this increase has happened for commercial and broader economic reasons, rather than widespread recognition of the potential contribution of services to a future sustainable economy.

The development of services as a contribution to a future sustainable economy is part of a broader debate on the 'dematerialisation' of the economy, which effectively means a reduction in the materials intensity of economic activity (Heiskanen and Jalas, 2000). The scale of the dematerialisation necessary to achieve a sustainable economy is the subject of much discussion. Weizsäcker *et al* (1998) take as a starting point for their book the need for an improvement of a factor of four, to be achieved by doubling wealth while halving resource use. Schmidt-Bleek (1994) and others talk of the need for an improvement of a factor of 10, based on the argument that global consumption needs to halve and that consumption in OECD countries is already five times the global average. Others (eg Vergragt and Jansen 1993, Weterings and Opschoor 1992) argue for an improvement by a factor of 20, based on the assumption that by 2050 the global population will double, average wealth will increase fivefold and that there is a need to halve the environmental burden caused as a result. In all cases, however, a very substantial improvement in the efficiency of the use of materials is envisaged.

While increasing the role of services in an economy can contribute to such a scale of dematerialisation, this is not a sufficient condition for such an economy to be sustainable. Many authors point out that it is not correct to see a service economy as essentially an environmentally-clean economy (eg see discussion in Heiskanen and Jalas, 2000; Young & Charter, 2001; Tomiyama, 2001). White *et al* (1999) argue that a service economy should be seen as 'a value-added layer resting upon a material-intensive, industrial economy' (p 1). They argue that services will only contribute to a greener economy if they change the way

in which products are manufactured, used or disposed of, or if, in some cases, they actually replace a product. Behrendt et al (2003) demonstrate this point by discussing possible environmental advantages and disadvantages of services (see summary in Table 3.1).

Table 3.1: Potential Environmental Benefits and Disadvantages of Services

Potential Benefits	*Potential Disadvantages*
A reduction in the number of purchased goods	Exposure to a wider range of products might result in more eventual purchases
More intensive and efficient use of products	Products wear out quicker
More intensive and efficient use of resources	Increased transport requirements, eg delivery of a rented product compared to an owned product which may be continuously at hand
An ability to use more expensive goods that have a higher environmental performance	An ability to use more expensive goods that do not have a better environmental performance
An incentive to produce more durable products that can be maintained, refurbished, re-used and recycled	Easier replacement of products
Improved maintenance, as the service provider has an interest in increasing the lifespan of the product	Decrease in product responsibility on the part of the user might lead to irresponsible use
More possibilities for environmental chain management (including recycling and re-use)	Stimulation of additional demand resulting in higher material flow
The earlier introduction of cleaner technologies	Earlier product obsolescence

Source: Based on Behrendt et al*, 2003*

The recognition that services are not necessarily beneficial to the environment has resulted in a number of attempts to conceptualise the relationship and potential contribution of services to sustainability (see Table 3.2). The definition of an eco-service (or an eco-efficient service) as being a service that is beneficial to the environment is a logical development from this recognition, but the definitions quoted in Table 3.2 generally go further than this. For example, in attempting to define eco-services, Behrendt *et al* (2003) emphasise the substitution of tangible components by intangible components, in addition to the services having a positive impact on the environment. White *et al* (1999) suggest that we are seeing a blurring of the distinction between the activities of the manufacturing and traditional service sectors, and implicitly, between products and services. Other authors, eg Meijkamp (2001), Tischner (2003) and UNEP (nd), shift the focus to providing for the needs of the consumer rather than on the selling of the actual products or services, themselves[5].

In order to understand better the potential implications of these ideas, it is necessary to discuss further the definition of a service and its relationship to a product. The basic distinction between a product and service is that the former is tangible and the latter is intangible, although possibly connected to a tangible product. Behrendt *et al* (2003), in

[5] The exception in Table 3.2 is the WBCSD's definition of eco-efficiency, which does not necessarily entail the development of services, rather it focuses on reducing the unit environmental impact of products. However, the WBCSD does note that increasing service intensity, through sharing and selling results, is one aspect of eco-efficiency (see WBCSD, 2000; DeSimone and Popoff, 2000).

common with other authors (eg White *et al*, 1999), define services according to the framework given in Figure 3.1. They identified use- and result-orientated services (the shaded areas in the diagram) as the two categories of service on which to focus in their discussion of eco-services, as they considered that these were encompassed within their definition of eco-service (see Table 3.2).

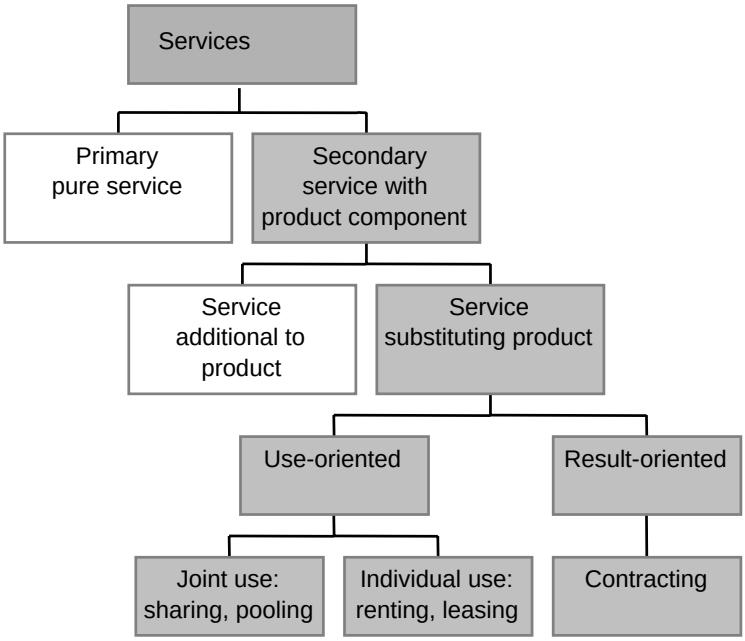
Table 3.2: Services and Sustainability: Relevant Concepts

Concept	*Definition (source)*
Eco-services	'those intangible service components that partially or completely substitute for tangible components, resulting in a positive effect on the environment' (Behrendt *et al*, 2003)
Eco-efficient services (based on the concept of eco-efficiency)	'being achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, to a level at least in line with the Earth's estimated carrying capacity' (WBCSD, 2000)
	'all kinds of commercial market offers aimed at fulfilling customer needs by selling the utilisation of a product (system) instead of providing just the hardware for these needs. Eco-efficient Services are services, related to any kind of hardware, of which some of the properties rights are kept by the supplier' (Meijkamp, 2001)
Product Service Systems (PS systems or PSS)	'a competitive system of products, services, supporting networks and infrastructure. The system includes product maintenance, parts recycling and eventual product replacement, which satisfy customer needs competitively and with lower environmental impact over the life cycle.' Key idea behind PSS is that 'consumers do not specifically demand products, per se, but rather are seeking the utility these products and services provide' (UNEP, nd)
	'consists of tangible products and intangible services designed and combined so that they jointly are capable of fulfilling specific customers needs' (Tischer, 2003)
Servicizing	'The emergence of product-based services which blur the distinction between manufacturing and traditional service sector activities' (White *et al*, 1999)

The various categories of services shown in Figure 3.1, and their relative relationship to products, is sometimes also represented as a continuum (see Figure 3.2). This representation highlights the increasingly blurred distinction between products and services, as highlighted by White *et al* (1999; see Table 3.2). It also demonstrates the fact that services and products can be combined to different degrees, and better conveys the potential for shifting from one type of product-service combination to another, which fits in with the concept of product-service systems (or PSS; see Table 3.2). Effectively, therefore, the concept of eco-services and PSS are comparable, as demonstrated by the fact that both Figures 3.1 and 3.2 contain use-and result-orientated services, and the 'services additional to products' of the former could be seen to be equivalent to the product-orientated PSS of the latter. Other authors, such as Hockarts (1999), Meijkamp (2001) and Young and Charter (2001), give similar categories of services that are consistent with these. The concept of PSS, as presented in Figure 3.2, has the advantage over the idea of eco-services, as presented in Figure 3.1, as it conveys better the dynamic nature of the product-service relationship. Hence, for the remainder of this chapter, we will refer to the categories of PSS set out in Figure 3.2[6].

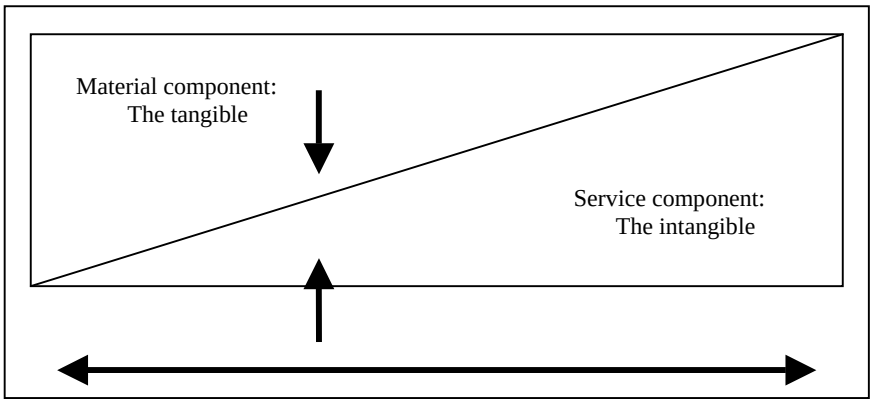
[6] It is worth noting that PSS is also the concept used in the EU Thematic Network SusProNet, hence the concept has broad support among a range of practitioners.

Figure 3.1: Framework of Services



Source: Behrendt et al, 2003 (amended); eco-services are shaded

Figure 3.2: The Tangible and Intangible Components of a Product-Service System



	Pure product:	Product-orientated PSS:	Use-orientated PSS:	Result-orientated PSS:	Pure service:
Example	Buying a car	Leasing a car with a maintenance contract	Using a car sharing system	Using a mobility card for several transportation means	Using a taxi[7]

Source: Diagram from Behrendt et al (2003); categorisation and examples from Tischner (2003)

[7] Tischner's examples are included to give an idea of the type of service represented by each category of PSS. However, it is worth noting that the classification of taxi services as pure services is not consistent with the views of other authors (see discussion of Behrendt *et al*'s work in the next section). This will be explored in more detail in Section 3.3.

Tischner (2003) further elaborates on the three categories of PSS, as follows:

- Product-oriented PSS – the product is owned by the user/consumer and includes, for example:
  - A new service is added to an existing product (often initiated through the availability of new technology, eg a modem for a computer);
  - Product extension service (eg the value of an existing product is increased through an additional service, eg upgrading, repair, or guarantees); or
  - Vertical integration (eg a modified delivery strategy to supply products to customers where the retailer and/or customer gets directly involved in the process of production, eg production on demand).
- Use-oriented PSS – where the product is owned by the service provider, who sells its function instead of the product, eg through sharing, pooling and leasing systems.
- Result-oriented PSS – where the product is owned by the service provider, who sells the result rather than the product or its function, for example:
  - Product Substituting Service (products are substituted by new services, often driven by new technologies, eg virtual answering machine instead of product, pest control service instead of pesticides); or
  - Demand Side Management/Facility Management (supplier gives incentives for the customer to consume more efficiently, eg by using modified payment systems, eg contracting).

It is worth noting that a common characteristic of use- and result-orientated services is that the service provider, rather than the product-user, is the product-owner. Clearly this requires either the creation of a service provider or potentially a broadening of the role of the manufacturer to becoming a service provider either instead of, or in addition to, its manufacturing activities. By extension, this change also relies on the product-user, or consumer, accepting that they will not be the product-owner, which in turn requires a shift in attitude on the behalf of the consumer from focusing on the advantages of owning a product to the benefits of non-ownership. While consumers are already, to some extent, prepared to rent selected products, eg videos, or share the use of others, eg washing machines in launderettes, these examples are outweighed by the range of products that consumers choose to buy outright. In addition, it could be argued that the use of some of these services, such as launderettes, are associated with low levels of disposable income, and therefore are not necessarily indicative of a willingness to share products. However, if the development of more services is to contribute to a future sustainable economy, then rental or shared use of more products is likely to be necessary, as well as the development of more innovative PSS than are currently available. However, this clearly requires a cultural shift from the prevailing paradigm on the part of both the service provider (or manufacturer) and the product user.

However, it not only the role of the provider and consumer that must change in order for such a transformation to occur. In a broader discussion on policies for achieving sustainable patterns of consumption, Jackson and Michaelis (2003) argue that active government intervention is also required to put in place an appropriate policy framework to enable more sustainable consumption. They argue that current thinking that governments cannot change consumer behaviour is not supported by research evidence, as governments play a fundamental role in shaping the cultural context within which individual choices are made.

Hence, Jackson and Michaelis assert that one of the roles of government in relation to attaining a more sustainable economy would be to contribute to changing consumer behaviour. Similarly, they argue that the presumption underlying much government policy that the market provides for consumers' needs is also not supported by research. They suggest that consumers often find themselves locked in to unsustainable consumption patterns, which require government intervention to change. While the sustainable consumption debate is clearly broader than the development of services for sustainability, the emphasis that Jackson and Michaelis put on the need for government intervention is worth noting due to the fact that the development of more services also requires changes to consumer behaviour.

This section has provided an overview of the current theory relating to the potential role of services in a future sustainable economy. It underlined that services, while being of economic and social benefit, are not necessarily of environmental benefit. Various attempts at conceptualising the potential role of services to a future sustainable economy were presented and it was concluded that these approaches were broadly compatible. However, the concept of PSS was identified as particularly useful in the context of this study, as it demonstrates the potentially dynamic nature of the relationship between products and services. The section also underlined the need for a change in the role of the various actors, if the role of services in a future sustainable economy is to attain its full potential. The ownership of the product itself is fundamental to this, as this need not necessarily be transferred to the user, rather it could remain with a service provider. For such an approach to gain wide acceptance, a change in the culture surrounding the relationship between those involved is necessary, ie a manufacturer/consumer relationship needs to develop into a service provider/user relationship. It was also suggested that the role of government in relation to facilitating such a shift needs to become more active, as policies do affect the way we consume. While this section has looked at the theory, the next section will look at the practice with respect to the development of PSS in other sectors in order to investigate whether these reflect the theory.

3.2 Services for Sustainability in Practice

The aim of this section is to review the discussion in the consumption literature to highlight the range of services that are being discussed in the context of developing services to contribute to the attainment of a future sustainable economy. It does not attempt to give a comprehensive overview of all types of services, although it does, to some extent, cover 'traditional' services, as these can be environmentally-beneficial, even though they have often been developed for economic or social reasons. Section 3.2.1 presents an overview of the practical examples of possible services that are given in the literature, while Section 3.2.2 is a discussion of the issues raised.

3.2.1 Overview

In the course of reviewing the state of play of, and the potential for, the development of eco-services, Behrendt *et al* (2003) review experience with services in four countries: Netherlands, Germany, Austria and Spain. This covers experience with traditional leasing, renting, pooling and sharing, as well as that which could be considered to be undertaken for environmental reasons. They conclude that cars are already by far the most common rented goods, even though the use of rental cars is a very small proportion of total annual car

mileage. The rental of other vehicles – vans, bicycles, special vehicles, etc – is also common. The purchase of cars through leasing arrangements is increasingly popular; for example, in Germany one in four cars is purchased in this way and leasing has become the most important means of financing purchases. However, eco-renting or eco-leasing is not as yet that well developed, although they do not elaborate on what the latter might entail. They note that there appears to be little recognition that renting can be environmentally-beneficial in that it requires fewer products to be produced compared to if the products were owned rather than rented. Other examples of rental or leasing services that are also common, but which have generally developed for economic and social reasons rather than environmental ones, include the rental of domestic and commercial property, video rental and libraries (eg see Vercalsteren and Geerken, 2003). However, there are some examples of leasing schemes that are being considered specifically for their environmental benefits, eg a company in the Netherlands was considering the possibilities of sofa leasing, which offers environmental benefits, as these are refurbished after a number of years (Goedkoop, 1999).

Behrendt *et al* (2003) conclude that there is a large potential for the further development of services in relation to the rental or hiring of DIY and gardening equipment. They conclude that the reasons for this not happening at the moment are financial and pragmatic, as well as a lack of knowledge, rather than any strong preference against hiring. Their analysis suggests that the development of such services would be environmentally-beneficial for infrequently used items, but that this benefit disappears the more an item is used as a result of the additional transport involved. They also examined the case of sports equipment and concluded that hiring is common, but that this is undertaken for financial rather than environmental reasons, even though the environmental benefits are clearer than those in the other sectors they examined.

Elsewhere, there are examples of rental services for computers and photocopiers to business. White *et al* (1999) discuss IBM's move from being a supplier of hardware to a deliverer of IT business solutions, which involves *inter alia* the rental of PCs. While the change was driven by commercial and not environmental concerns, the leasing of PCs has necessitated an IBM product take-back programme, which is supported by IBM Materials Recovery/Recycling Centres. Similarly, Xerox's approach to the rental of its photocopiers, which entails the take-back, recycling and remanufacture of cartridges and photocopiers, is effectively the provision of a service rather than a product. This approach had environmental benefits initially, as photocopiers were reengineered rather than being disposed of, but as environmental issues have risen up the company's agenda, new approaches to product design aimed at extending its life have also been developed (DeSimone and Popoff, 1997).

In relation to pooling and sharing, the most obvious examples Behrendt *et al* (2003) identified are in relation to mobility, eg car sharing and pooling. Apart from these, other sharing and pooling schemes that they identify include launderettes, videos, gardening tools, nappies and even ducks[8]. Pooling and sharing are well developed in Germany and the Netherlands and the environmental benefits of car pooling and nappy cleaning initiatives are recognised as part of their attraction. They also examined in more detail the potential for the development of eco-services with respect to washing. They concluded that communal laundry and washing facilities could have some environmental benefit, as long as these were

[8] A company in northern Austria has a poll of ducks available to householders to enable them to control populations of garden snails.

located in the neighbourhood or building, thus not necessitating a car journey. They proposed that the development of professional laundry services in communal areas serving single person households is the way forward. They acknowledge that the financial benefits of communal laundries are low, given the trend towards cheaper washing machines, but conclude that more professionally-run services might be attractive. Another example of a washing service developed for environmental reasons is a nappy provision and washing service in the Netherlands, which was developed to counter the waste problem of disposing of three million nappies, annually (Goedkoop, 1999).

Charter and Clark (2003) identify examples of IT-based result-orientated PSSs, such as virtual answering machines, email and web-based directories, which replace answering machines, fax machines and telephone directories, respectively. Behrendt *et al* (2003) look at the latter case in more detail and concluded that, even though there is an environmental benefit of an online book, the internet's limitations, including speed, the cost of telephone calls, etc, limits the current potential. However, in the long-term, they conclude that there is potential for the development of these and other online services that could be environmentally-beneficial. They also note that environmental benefits are already realised as a result of the internet, as sending an email is a more environmentally-friendly way of communicating than sending a letter or a post-card.

Joore *et al* (2003) review experience in the food and retail sector and identify a whole range of PSS, some of which had environmental benefits and added value for the customer, and some of which did not. The clearest examples of services that added value for the customer and had an environmental benefit were those, including some provided by cooperatives, that provided organic products to customers. There was a whole range of other services in the sector where the environmental benefit was not clear. This included internet food shopping, meal delivery services and ready-to-eat meals, the environmental benefits of which depended on whether the transport or cooking undertaken by the supplier is more efficient than that which would have been undertaken privately.

To date, however, the most sophisticated result-orientated PSS are present in the business to business market, rather than between business and the public. Frazão *et al* (2003) list some examples, including chemical management services, renewing and recycling of solvents, integrated pest management, renovation of office buildings, paint on demand systems and supply chain management. Chemical management services (or CMS) were pioneered by General Motors and their suppliers in the US in the late 1980s. Many chemical suppliers in the US are now offering CMS and some companies, of which the largest is Haas TCM, now only offer CMS rather than chemicals. A study by NGO Chemical Strategies Partnership (CSP) has estimated that the potential market for CMS in the US is between $10.5 and $13 billion, or one tenth of the total US chemicals market (Westervelt, 2003).

The CSP acts as an intermediary between chemical companies and potential clients, particularly those in the aerospace, automotive and microelectronic industries, to help set up partnerships to develop services. For example, these partnerships could arrange for cleaning, painting and lubricating services to replace the selling of solvents, paints and oils (Willis and Oldham, 2003). Various case studies suggest that the benefits of such services include a reduction in the amount of chemicals used, improved data and inventory management, reduced chemical costs and reduced hazardous waste (eg Oldham *et al*, 2003). The Austrian government commissioned two studies to assess the development of and

potential for CMS in the country. This concluded that 4000 companies in the country could introduce some form of chemical leasing model, which could reduce waste from these companies by one-third and increase their net income by an average of 10 to 15 per cent (Federal Ministry for Agriculture, Forestry, Environment and Water Management, nd). While CMS are now being promoted for their potential environmental benefits, case studies suggest that in the past they were a response to customers' demands (eg see the case study on Castrol in White *et al*, 1999).

For some companies, however, the move towards the provision of services instead of products is part of a strategic move to make the company and its operations more environmentally sustainable. In 1994, Interface, the world's largest manufacturer of commercial carpet tiles, made the strategic decision to become the 'prototypical company of the 21st century' by reducing its emissions and waste, sourcing non-renewable resources from recycled material and increasing the use of renewable resources, including energy. This approach included moving to provide services instead of products, as this was the best way to reduce the environmental impact of the company's products. As a result, Interface changed their business to leasing floor tiles, managing their use at their clients' offices and taking them back at the end of their lease period or useful life. However, this vision had to be bought into by the whole company, especially the sales people, who had to sell the idea to their customers. In addition, the company has had to convince its customers that the new approach to their business will also be financially beneficial to them (Wales, 2002; Willis and Oldham, 2003).

One example of a PSS involving chemicals and relating to the domestic sector is the home delivery of detergents used in house-keeping (Manzini and Vezzoli, 2001). The system, called Casa Quick started in 1998 to deliver detergents in a mobile van direct to homes. Users fill up containers, which are provided by the service provider, with the amount of product they want to buy. Environmental benefits are gained by the optimisation of packaging and delivery.

Behrendt *et al* (2003) classify heating and lighting services, along with public transport, including taxis[9], as result-orientated PSS. They identify the means of providing such services as some form of contracting. As an example, in relation to energy services, they identify three forms of contracting: plant contracting, ie providing energy through an energy plant; performance contracting, ie developing an energy saving plan; and delivery of energy uses, eg the consumer receives an end-use energy service, such as heat or light. In relation to households, Vercalsteren and Geerken (2003) suggest that a range of PSSs already exist, including the provision of drinking water, electricity and gas, telephone and cable television services. Mont (2001) argues that market liberalisation, fierce competition and low profit margins have encouraged utility companies to find new business models to make more profits and attract more customers and that these models seek to exploit the functionality of their utilities. The application of such a functional approach depends on the characteristics of the utility, eg waste water needs to be treated, whereas for other utilities there is currently no such end-of-life requirement. For example, an electricity company could sell a function, eg keeping the house at 20°C, rather than selling units of electricity. Macklon (2000) suggests that a typical energy services package might consist of: 'duel fuel energy supply; free home energy efficiency audit; provision and project managed installation of

[9] In contrast to Tischner (2003), above.

energy efficiency measures; finance for these measures; and ongoing advice and promotion of energy efficient appliances and practices' (p6).

3.2.2 Discussion

The previous section gave an overview of the type of service that could be developed to contribute to a future sustainable economy. From the services mentioned, it is clear that by no means all services have been developed on the basis of their potential environmental benefit. In fact, many of the services identified by the work undertaken within the context of the SusProNet Thematic Network (eg Joore *et al*, 2003), one of the aims of which is to identify examples of good practice, were not even necessarily environmentally-beneficial.

In evaluating the 'dematerialisation through services' debate, Heiskanen and Jalas (2000) review the work of a number of authors that criticise the simplicity of the debate. For example, one study quoted by Nørgård (1995) suggests that while it is true that the direct energy intensity of the service sector is lower than that of the manufacturing sector, the total energy consumption (including indirect use) of private services (eg hotels, transport) is comparable to that of manufacturing. The study argues that only public services, such as health and education, have a lower total energy intensity. However, as these could not significantly increase their contribution to the economy, it argues that the widespread introduction of services could not significantly reduce energy use. Others suggest that while services might be less environmentally-damaging, as they have a lower demand for materials, their materials intensity is growing, as a result of more self-service and more capital-intensive forms of service provision (eg Welford *at al*, 1998). Other concerns relate to the fear that the service sector generally pays little attention to its environmental impacts (eg White *et al*, 1999) and the lack of applicability of life-cycle assessment techniques to the service sector to enable its true environmental impact to be identified (eg Charter, 1999). However, there is a relative consensus that services can play a role in the attainment of a more sustainable economy.

In addition, when a service is implemented and has environmental benefits, these may be undermined by so-called 'rebound effects'. These are unwanted side effects, where an environmental saving for a particular act of consumption does not necessarily lead to a net environmental gain. Heiskanen *et al* (2001) identify two potential types of rebound effect. In the first instance, if, for example, a consumer saves money on energy as a result of energy services, the net environmental impact will depend on how they spend the money saved. The second perspective relates to the way in which any time saved is used. For example, restaurant services, which are more eco-efficient in terms of economic value than cooking and eating at home, free up time for additional consumption activities.

The potential environmental benefit of services may also be undermined by increased use of transport in their provision. For example, the rental and hiring of products requires their initial collection (or delivery) and return, which incurs additional energy use if motorised transport is used (UNEP, 2002). The frequency of use will determine whether the net effect of the rental service is beneficial (see, for example, the examples noted in the previous section). The shifting of ownership from the product-user to service provider may also result in more irresponsible use of the product and advanced telecommunications could increase mobility and thus resource use (eg Manzini and Vezzoli, 2003).

UNEP (2002) suggests that the main barrier to the development of PSS is arguably the cultural shift required to move away from 'owning a product' to 'having a need or a want met in a sustainable way' (p15). In addition, business faces a number of barriers, including how best to design, develop and deliver PSS, as well as implementing the changes required in corporate culture to support a more innovative, service-orientated business.

Wales (2002) outlined a number of problems that commercial carpet tile manufacturer Interface had to address in the course of transforming itself into a provider of services rather than of products. Many of the company's customers were not aware of the wider resource efficiency debate, so the company had to communicate this to its customers in order that they understand the company's rationale for its shift to providing services rather than products, which has not been easy. The company also found that there was a need for a buy-in from the salespeople, in particular, as selling leasing arrangements as opposed to only a product requires a greater understanding of the advantages of the new arrangements and the needs of the customer. Hence, the salespeople have to understand the rationale behind the provision of the service, and be prepared and able to explain this to the customers. The salespeople also had to overcome the internal budgetary divisions of their customers, as they found that often the cost of purchasing, maintaining and disposing of carpets was covered under different budget lines. In order to convince customers of the economic benefits of leasing over buying floor covering, it was necessary to bring these costs together, as otherwise leasing would come across as more expensive than it actually is. In addition, as leasing is more complicated than selling, it also requires the salespeople to understand more about the contractual and legal side of things, which can vary from country to country. In this context, the leasing culture, (eg its strength and the type of products that are leased) of the country in question is also important. Finally, he noted that the economic viability of certain recycling material is also an issue.

Macklon (2000) identifies a number of obstacles on both the demand and supply side to the development and take-up of energy services for the domestic sector in the UK. A number of these relate to the lack of an obvious business case for energy providers to sell energy services, while others relate to the regulatory framework or the attitudes of consumers. He suggests that many energy providers believe that there are easier ways of gaining market share than trying to sell energy services. Tied to this is the fundamental tension between energy efficiency and the basic business equation that selling more units means more revenue. The lack of clear benefits leads to an ambiguous message, which makes marketing difficult, hence few resources are being put into creating a demand for energy services to date. In addition, the liberalisation of energy markets is driving prices down, which makes it more difficult to sell the importance of energy efficiency to customers. Even without declining prices, many customers were choosing to avoid the short-term, expensive disruption of installing energy efficiency measures in their home, which would only bring economic gain in the longer-term.

Oldham *et al* (2003) looked at examples of innovative services that contributed to improving resource productivity in a number of sectors, notably chemicals, energy and agriculture, and identified a number of barriers, which are a useful summary of the issues raised, above. These include:

- Cultural barriers – For example, the need for a change in approach on the part of the supplier and customer, the need for different business models, and nervousness surrounding the new, closer relationships required.
- Budgetary and management structures – These can effectively hide the full costs of product use, or at least make these difficult to identify.
- Implications for existing certainties – For example, concerns about the impact of the service approach on quality assurance and liability.
- Attachment to ownership – Domestic consumers, in particular, want more from a product than the service it offers, as, for example, they gain status through ownership and enjoying the experience of buying and owning products.
- Investment – Analysts and investors prefer product-based investment, as they lack understanding and awareness of service approaches.
- Cost – The low cost of energy, resources and waste management reduces the incentives to adopt a more service-orientated approach.

Heiskanen *et al* (2001) conclude that while the development of services does not necessarily lead to the dematerialisation of the economy, they, along with the development of Information and Communication Technologies, are a necessary, but not sufficient condition to decouple natural resource use from economic growth. The examples of this section highlight a number of barriers to the development of services for sustainability, and note, in particular, the need for a change in the approach on the part of both consumer and the service provider. The next section discusses mobility in the context of the broader services for sustainability debate.

3.3 Services in the Context of Mobility

This chapter, so far, has discussed the theory behind the development of services in the context of a future sustainable economy and reviewed a number of examples of the type of service being introduced in this context, along with the problems that they face. It was impossible to undertake such a review without an occasional reference to mobility, but care was taken not to discuss these in detail until now, rather to focus on services in other sectors. The aim of this section is to discuss mobility in the context of Sections 3.1 and 3.2 in order to attempt to highlight the parallels and to illustrate the potential problems for the development of mobility services.

Section 3.1 highlighted the potential contribution of services to the dematerialisation of the economy. Broadly, transport uses materials, or resources, in the construction and maintenance of infrastructure and the manufacture, maintenance and operation of vehicles. Hence, the dematerialisation of transport, or mobility, would only happen by dematerialising some or all of these activities. In relation to the discussion of the previous section, car rental, sharing and pooling clearly all have the potential to contribute to the efficiency of use of a vehicle, as such vehicles are likely to be used more intensively and for longer periods than privately owned vehicles. If this results in less demand for vehicles, then fewer vehicles might be required to be manufactured, which would also be positive in the context of the dematerialisation of transport.

Table 3.3: Potential Environmental Benefits and Disadvantages of Services in Transport

Environmental Impact*	Example in Relation to Transport
Potential Benefits	
A reduction in the number of purchased products	If car sharing were to result in less demand for vehicle ownership
More intensive and efficient use of products	If a car in a car sharing scheme is used more frequently than a comparable private car. Also car users can select a vehicle appropriate for each particular period of use, rather than having to own a vehicle large enough to accommodate all the range of uses to which it might be put.
An ability to use more expensive goods that have a higher environmental performance	The use of alternatively-fuelled vehicles, eg hybrids, through car sharing schemes
More intensive and efficient use of resources	If the average occupancy of a pooled car is greater than a comparable private car then fuel would be used more efficiently
Improved maintenance, as the service provider has an interest in increasing the lifespan of the product	This is potentially relevant in the case of a car share provider, although whether there would be more incentive compared to a private owner is not clear
The earlier introduction of cleaner technologies	If car share schemes bulk buy cleaner vehicles with new technologies
An incentive to produce more durable products that can be maintained, refurbished, re-used and recycled	If manufacturers had the potential to make a financial gain from mobility services
More possibilities for environmental chain management (including recycling and re-use)	If manufacturers were actively involved in more stages of a car's lifecycle, which could happen if they became, or were actively involved with, a car sharing provider
Potential Disadvantages	
Exposure to a wider range of products might result in more eventual purchases	If access to a range of cars in a car sharing scheme encourages a purchase of a car
Products wear out quicker	If a shared car is indeed used more frequently than a comparable private car
An ability to use more expensive goods that do not have a better environmental performance	The use of luxury or high performance vehicles through a car sharing scheme
Decrease in product responsibility on the part of the user might lead to irresponsible use	When a driver is using a rental or shared car compared to a private vehicle
Easier product replacement	If a driver is a member of car club, it is easier to change model (ie the next booking), which could result in more environmentally-damaging use; a privately-owned car is only changed when it is sold

** Based on Behrendt* et al*, 2003, and applied to transport by the authors*

Section 3.1 also noted the importance of services for dematerialisation and Section 3.2.1 identified mobility services as the most common examples of various categories of services, including rental and car sharing services, public transport and taxi services. However, it is

clear that not all of these mobility services, in common with the general discussion of services in Section 3.1, are necessarily environmentally-beneficial. On the simple level, public transport and taxis use fuel and pollute, as do private cars, and products that are used for repair and maintenance have the potential to damage the environment. However, public transport and car sharing have the potential to be more environmentally-beneficial than private transport, if comparable technology is used and they are used efficiently (eg high occupancy rates and reduced number of short distance journeys). There is also potential for fewer vehicles if they can be more intensively and efficiently used, thereby reducing demand for space and materials. More broadly, many of the potential environmental benefits and disadvantages of services, as presented in Table 3.1, are also potentially relevant to transport (see Table 3.3).

While some mobility services have the potential to be environmentally-beneficial, it is too much of a simplification to say that the development of mobility services will be beneficial for the environment. In order to explore further the mobility services that could potentially be beneficial to the environment, it is useful to discuss mobility services in the context of PSS, as outlined in Section 3.1. First, it is interesting to revisit examples of mobility services that were given in the previous sections in relation to the various PSS classifications. Table 3.4 shows the mobility-related examples given by Tischner (2003) along with other possible examples.

Table 3.4: Examples of Mobility-related PSS

PSS category	Example (from Tischner, 2003)	Comments/Other possible examples
Pure product	Buying a car	Buying other vehicles, eg vans and bicycles
Product-orientated	Leasing car with a maintenance contract	Warranties, insurance, repair and maintenance associated with vehicles; the production of vehicles on demand
Use-orientated	Using a car sharing system	Any car or bicycle sharing or pooling; the rental of a range of vehicles tailored to specific needs
Result-orientated	Using a mobile card for several transport modes	Any public transport or taxi service; any system that enables mobility optimised to service characteristics, eg integrated provision of information, ticketing, etc.
Pure service	Using a taxi	Taxis are not really an example of a pure service; a better one might simply be the provision of information relating to transport services

The discussion of Section 3.1 identified use- and result-orientated PSS as having the potential to be more environmentally-beneficial than product-based services. The examples given in Table 3.4 would seem to support this in relation to mobility services. In other words, the use- and result-orientated mobility services have more potential to be environmentally-beneficial than the vehicle-orientated services. Use- and result-orientated services focus more on intangible components, such as providing the mobility that the customer desires, rather than the more tangible product, ie a vehicle. As with other services, different categories of mobility service require a different relationship between the

user and the supplier. The relationship between the manufacturer and vehicle owner is rarely direct, usually being via a dealer in relation to its purchase and through a garage in relation to its maintenance. However, with respect to use- and result-orientated services, the relationship is much closer. For example, with respect to public transport, there is a need for the generation of trust in relation to, at least, the regularity and, ideally, the quality of the service between the service provider and user. In relation to car clubs, there also needs to be more trust between service provider and the user, eg the user must be confident that a car will be available when needed and that this vehicle will be well maintained and clean.

The discussion of Section 3.2 raises some interesting issues with respect to mobility services and transport, more generally. Information and Communication Technologies (ICT) were identified as a potential result-orientated PSS, as they enable the consumer to buy products over the internet, for example, without the need for travel. In this respect, ICT is clearly a result-orientated service in that it enables the purchase of a product without the need for time and money to be spent on travelling to the shop. With respect to mobility services, the example of ICT underlines an important point: that mobility is rarely an end in itself, rather it is undertaken for another end or, in the context of the above discussion, another result. In this context, it would be difficult to argue that ICT is a mobility-service, rather it is a service that potentially negates the need for mobility in the first place. However, as noted in the previous section, the net environmental impact of ICT was dependent on the net impact of a journey saved and the additional delivery journey.

The rebound effect, which was identified in Section 3.2.2 as an issue for services, is also relevant for ICT, as well as for mobility services, more generally. In other words, the net environmental impact of an ICT service or a mobility service, such as car sharing, depends on what the consumer does with the time and/or money saved by using the service. For example, in relation to ICT, time will be saved by not having to purchase the product, but there is the potential that this time is spent on more environmentally-damaging activities, eg instead of taking the bus into town, the person instead goes for a drive in the country. Similarly, if an individual is a member of a car share scheme, it will save them money compared to owning a car, but again the money saved could be spent on more environmentally-damaging activity, eg flying to another city for a weekend trip. Other examples of rebound effects are effectively the potential disadvantages of services, as presented in Table 3.3. These include, for example, the potential use of more polluting vehicles as a result of the membership of a car sharing scheme and the less responsible use of a rental or shared car.

Although not actually directly related to mobility services, Section 3.2.2 also raised the need to assess the impact of any additional transport in the determination of whether other services were environmentally-beneficial or not. For example, for certain services, eg the home delivery of some rental and leased products, the environmental benefit/impact of the service depends on the balance of material/resources saved through rental and the extra transport incurred. Such considerations could also apply to mobility services themselves if a ‘door-to-door’ service is offered.

Finally, the barriers raised in Section 3.3.2 in relation to the development of services, more generally, are also relevant to mobility services. In particular, the issue of the prevailing culture, and especially the significance of ownership, is of relevance in relation to car ownership. A lack of environmental awareness in relation to car use and the possible

benefits of car sharing might not be as relevant, as environmental awareness is considered to be one of the reasons why people choose to share rather than buy. In relation to persuading companies of the benefits of result-orientated services, the separation of budgets was raised. Although not directly comparable, the financial aspects of car ownership, as opposed to car sharing, are different, as the former consists of a significant upfront expense, which makes it difficult for potential travellers to compare actual costs.

3.4 Refining the Scope of the Analysis

As a result of the above discussion, it was decided that the scope of the subsequent literature review on mobility services, which is presented in Chapter 4, should be on use- and result-orientated services, as these have the greater potential to deliver environmental benefits. However, this would still have left the scope of the project unmanageably broad, as it would cover all public transport and all vehicle rental services. Instead, it was decided to focus on innovative use- and result-orientated services, ie those that go beyond what has become the norm in relation to the provision of transport or mobility services. This would exclude, for example, common forms of public transport services and traditional rental services, but include more innovative forms, such as car and bicycle sharing and pooling, and innovative developments in public transport, such as demand responsive services and integrated ticketing. In addition, it was decided to exclude ICT from the scope of the review. Even though ICT services have the potential to be environmentally-beneficial, they would do this by effectively eliminating a journey, and therefore could not really be included within a definition of mobility service.

This selection is consistent with the discussion of Section 2.3, in that it is effectively a subset of the services mentioned by the authors reviewed there. In addition, restricting the scope of the project to more innovative mobility services appears to fit with the focus of the policy debate on mobility services, which focuses on services such as car sharing rather than public transport.

Furthermore, the discussion of this chapter highlighted the need for different responses from the various stakeholders involved with the delivery of services if these are going to actively contribute to a sustainable future. There needs to be a cultural shift on the part of both the service provider, which could be the manufacturer, and the consumer or user to accept the new relationship that the provision of a service rather than a product implies. In addition, the role of policy-makers in setting the appropriate policy framework was noted. The role of these stakeholders in the delivery of mobility services will inevitably be touched on in Chapter 4, but will be discussed in more detail in Chapter 5.

4 Review of International Experience with Mobility Services

The review of international experience of mobility services focussed on those countries that are recognised as having a more innovative approach to the development of transport/environment policies or were those known to contain good examples of a type of mobility service. Consequently, the original focus of the review was Switzerland, Germany and the United States, as well as Scandinavia and the Netherlands. We also decided, however, to look at other major economies belonging to the G7 group of industrialised countries, ie France, the UK, Italy, Japan and Canada, as well as any other important leads identified through these reviews. Following on from the discussion of Section 3.4, the review focussed on the following types of mobility services, which are discussed in turn below:

- Car sharing;
- Car pooling;
- Bicycle pooling;
- Innovative public transport; and
- Integration of public and 'private' transport modes.

However, before discussing these examples of mobility services, it is first important to discuss the terminology used. In the previous sections, when we have referred to car sharing or car pooling, we have used the terms as they are generally used in English. However, strictly speaking the service that is referred to as car sharing in English is actually car pooling, ie a collection of cars owned centrally that are used by a number of different people. Similarly, the service that is referred to as car pooling, when one person effectively gives another a lift, is really car sharing. For the sake of avoiding confusion, this error will be propagated in the following section, where car sharing will refer to a pool of cars for shared use, while car pooling will refer to the sharing of a car for a particular journey between its owner and a third party.

4.1 Car Sharing

As has already been discussed, car sharing is widely given as an example of a mobility service. There is a multitude of car sharing schemes on offer, however the majority of schemes tend to fall within the following types of categories; public-private partnerships, co-operative, not-for-profit and commercial. Although not all schemes fit neatly into these categories it is nonetheless useful to look at them in terms of these distinctions in order to throw some light on the success/failure of such schemes and whether these categories play an important role in this. It is also useful from a motivational point of view, for instance to identify the objectives that the service providers had in mind when setting up the schemes. It is also important to note, though, that there is some cross-over of schemes. For example some not-for-profit schemes were originally set up with financial help from governments and some schemes that were originally not-for-profit were later purchased by commercial enterprises. A further, useful distinction to make relates to the membership of a scheme. For instance some have no membership restrictions, in that anyone is able to join them; conversely other schemes have certain requirements to be fulfilled before membership is

allowed. This section will address the different types of schemes by looking at international examples of car sharing schemes, although of course what follows is not an exhaustive list.

4.1.1 Public-Private Partnerships

In relation to car sharing, schemes that fall under public-private partnerships necessarily involve input from government or government agencies and private industry. In the majority of cases the government provides financial backing, whilst the private component of the partnership takes care of the practical side of running the scheme. Switzerland's car sharing provider Mobility, the development of which was supported by the Swiss government, is recognised as the world leader and is the largest provider of car sharing services in the world. Mobility cooperates with different partners, including the Swiss train operators (SBB, CFF, FS), the Zürich public transport authority (VBZ) and Hertz car rental firm, as integration with other modes of transport is seen as a strength of the system. In 2002, Mobility's membership passed the 50,000 mark for the first time and it currently provides about 1,750 vehicles in 400 locations. Its service is characterised by strong customer growth, country-wide coverage, a standardised and customer-oriented product range, simplest access to the vehicle fleet by means of the most modern communications technology, including via the internet (IAPT, 2002).

However the original format of Switzerland's car sharing scheme was markedly different to the current model. Car sharing in Switzerland began in 1987 with the founding of two operators, the Car Sharing cooperative ATG (Auto Teilen Schweiz for central Switzerland) and Share Com (in Zürich). For ten years, these two organisations operated separately, until in 1997 they merged to create the Mobility scheme, under which car sharing flourished.

In Italy, funding from the national Ministry of the Environment was also used to initiate the development of car-sharing in the country. The consortium *Iniziativa Car-Sharing* (ICS) has its origins in a decree of the Ministry of the Environment from 1998, which allocated more than €9 million to the project. In 2001, ten cities were involved, but this has subsequently risen to around 20 with active schemes in Turin, Milan, Venice, Bologna and Rimini. ICS helps cities to implement their car sharing schemes and coordinates the development of common operational and technological standards and procedures (MOSES, 2002; WWF Italia, 2003).

More recently, a number of car sharing schemes have benefited from EU funding. Financial support has been provided by the EU and then the various schemes are run by a variety of partners in the individual countries. The two most notable examples are TOSCA and MOSES. TOSCA (**T**echnological and **O**perational **S**upport for **C**ar **S**haring) was an 18-month initiative that enabled a number of European cities to implement car-sharing schemes and related services. These included integrated smart cards for public transport, car sharing and taxis or car sharing booking and information systems via internet, call centres and in the future Wireless Application Protocol (WAP). MOSES (**Mo**bility **Se**rvices for **U**rban **S**ustainability) began in May 2001 with the aim of developing innovative mobility services based on car sharing. It did this by improving the existing small-scale car sharing operations through better service, integrated innovative technologies, intermodal co-operation with other mobility services (e.g. public transport, taxi, cycling, delivery services etc.) and the integration of these innovative services into strategies of urban revitalisation and new developments to increase urban efficiency.

4.1.2 Co-ordination

Whilst the schemes above have seen government or EU backing through financial contributions, this is not the only means by which governments can help to facilitate car sharing. In the Netherlands, in 1995 the Dutch Ministry of Transport funded the creation of the *Stichting voor Gedeeld Autogebruik* 'Foundation for Shared Car Use' (Meijkamp, 2000). The Foundation is effectively the umbrella organisation for all car sharing organisations in the Netherlands, which are more widely known as Autodate. There are now around 20 companies offering car sharing services in various parts of the country, although the type of scheme offered varies. The most significant is Green Wheels, which is based in Rotterdam but has outlets throughout the country (Behrendt *et al*, 2003).

The network described above is not peculiar to the Netherlands. Indeed there are numerous examples of car share networks that have been set up to act as umbrella organisations to provide advice to companies setting up car share schemes or to members of the public wanting to join a scheme. CarPlus UK is the national co-ordinating body for car sharing clubs in the UK and is run by a not-for-profit organisation. Whilst the majority of these networks are run by not-for-profit organisations there are also government-led and commercial networks. For instance in Germany the Bundesverband Carsharing e.V. (BCS, 2003) was formed as a federal scheme to represent the interest of car sharing providers. It originated as a response to a period of stagnation of car sharing in the mid 1990s. After the formation of the network, car sharing has again flourished in Germany (Meijkamp, 2000).

In comparison the European Car Sharing organisation (ECS) is the European umbrella group for car sharers. This organisation was formed in 1991 by five car sharing companies and has approximately 40 members which operate shared cars for about 56,000 members in over 550 towns in Denmark, Germany, Italy, Norway and Switzerland. It aims to act as a focal point for the standardisation of car sharing schemes within Europe, including environmental and service standards. It also enables car sharers to access shared cars in all associated towns in Europe and encourages the development of new car sharing companies in Europe. Car Share schemes wishing to join the ECS are required to pay an annual membership fee with the amount depending on the size of the scheme in question. For instance, a scheme with 20 vehicles is required to pay 478 Euros a year compared to a scheme with 150 vehicles which would be required to pay 2850 Euros a year (European Car Sharing, 2003). The existence of such networks does seem to have helped facilitate car sharing, in particular, through the dissemination of best practice and general advice that benefits both operators and users of such schemes.

4.1.3 Not-for-profit Clubs

Other car share schemes are run by non-profit organisations. For example, in the US, City CarShare, a not-for-profit organisation, has 2000 members and operates 60 vehicles in San Francisco, making it the largest of any single city-based scheme in the US. It has close cooperation with the area's public transport operators, with car parks for its vehicles at public transport stations and joint marketing and ticketing arrangements (White, 2002; Car Sharing Network, 2003). City CarShare was founded in 2001 with a strong environmental impetus and like a number of other not-for-profit organisations it was originally set up with financial support from local government.

A not-for-profit scheme is currently being developed for Barcelona, which should enter into operation in the autumn of 2004. The local *Associacio per a la Promocio del Transport Public* (PTP; Association for the Promotion of Public Transport) has looked into the feasibility of the scheme. An initial fleet of 100 vehicles is planned, which will be distributed around the city's car parks, and it is hoped that after three years, the scheme will have 30,000 members. It is being set up by the not-for-profit organisation *Fundacio Mobilitat Sostenible I Segura* (Safe and Sustainable Mobility Foundation), which was created for this purpose by the PTP, Barcelona City Council and the *Generalitat* (Provincial Government) of Catalonia (Behrendt et el, 2003).

4.1.4 Commercial Schemes

As the popularity of car sharing grows so to does the emergence of commercial car sharing schemes. A large number of commercial schemes exist in Germany. The most well-known and widely cited car sharing organisation in Germany is *Stattauto Berlin*, which was formed in 1998 and was the first scheme to be set up in Germany. It is also considered to be the most profitable car sharing organisation in existence. In 2002 it had nearly 270 vehicles and 87 stations in the following five cities; Berlin, Potsdam, Hamburg, Rostock and Schwerin (Stattauto, 2003). Elsewhere in Germany, there are now other large car sharing service providers that appear to be comparable in size if not larger than *Stattauto*. *Cambio*, which operates in seven cities, including Aachen, Bremen and Köln, claims to have 325 vehicles and 10,000 members, while *Stadtmobil*, which has services in Dortmund, Duisburg and throughout the Ruhr region and elsewhere in Germany, has more vehicles and a comparable membership (Cambio, 2004; Stadtmobil, 2003). In addition there are numerous small organisations often operating in a single locality with a small fleet and less than one hundred members (BCS, 2003). *Cambio* has also had an important role in the development of car sharing in Belgium. Belgium not-for-profit organisation *Taxistop* formed a new organisation *Optimobil* in order to involve the *Cambio* in the development of car sharing in Belgium. With the support of national, regional and local government, companies and the public and in close cooperation with local public transport operators, the first scheme in the country was inaugurated in 2002 in the town of Namur in Wallonie; subsequently schemes have been set up in other cities (MOSES, 2002; Cambio, 2004).

The presence of so many commercial schemes in Germany can be attributed in part to legislation peculiar to Germany. Once membership levels increase above a certain level, organisations are obliged to change their legal status, usually from not-for-profit organisations to limited companies. Accordingly, such a change increases economic risk and therefore requires a more professional, business-like approach to running the organisation (Stattauto, 2003).

One of the largest car sharing organisations in the US is ZipCar; this is a commercial enterprise and its style of operation is based on the Berlin scheme, Stattauto, mentioned above. Its first and largest scheme was launched in Boston in 2000 and now has nearly 1900 members and operates over 70 vehicles. ZipCar also has schemes with a few hundred members in Washington DC and New York and smaller schemes elsewhere. ZipCar has focused on the use of technology in the development of its system, which has subsequently been adopted by other car clubs in the US (ZipCar, 2003; Car Sharing Network, 2003). The oldest scheme in the US is Flexcar. Members reserve the vehicles for hourly use and Flexcar cover the cost of the car, petrol, parking, insurance, and maintenance. Members pay only for the time they use the car. Flexcar serves more than 4,000 members in a

number of metropolitan regions, including Washington D.C., Seattle, California and Portland, Oregon.

Other examples of commercial schemes exist in Austria. The first Austrian scheme, *Autoteilen Österreich* (ATÖ) was originally founded as a non-profit organisation in 1993. However it was later purchased by the car-rental company Easy Drive and renamed *DenzelDrive* (DenzelDrive, 2003). In 2003, it was still the only car sharing organisation in Austria and has 750 cars at 180 locations. Commercial car sharing also exists on the Nordic market. In Denmark Hertz car rental company has introduced a car sharing scheme, which is purely a commercial transport service provision based on ordinary cars, while in Sweden *SunFleet Carsharing* offers a fleet of environmentally sound cars to companies and organisations. (Sunfleet, 2003)

4.1.5 Restricted Membership Schemes

The majority of schemes mentioned above are open to anyone wanting to join the scheme (providing of course they have a clean driving license and are usually required to be over 21 years of age). However, there are increasing examples of schemes that have restricted access. These fall within two main categories; work based-schemes and residential schemes. For instance, in May 1999, Toyota began an experiment with a smart car sharing system known as *Crayon,* which used smart cards and an automatic vehicle location and information system to manage the fleet of available cars. This service was restricted to employees at one of its sites, allowing them the opportunity to reserve the vehicles and drive between their homes and work (Smart Moves, 2003).

Residential schemes on the other hand are offered to residents of certain buildings or residential areas. For instance in Lubeck, Germany, Volvo was involved in the running of a car share scheme for a housing development. They provided environmentally friendly vehicles for residents living on the development. Similarly, in Deptford, UK, a new development of 450 flats had very limited car parking available and so the developer, in conjunction with Avis, a car rental company, launched a free car club for residents in 2002. Nineteen vehicles were provided on site, and the developer paid £99 to cover the annual membership fee for one member of each household to join the club in the first year (Enoch, 2002).

4.1.6 Environmental Implications

Behrendt et al (2003) review a number of studies that have estimated the environmental impact of car sharing, including Baum and Pesch (1994), Meijkamp (2000), Harms and Truffer (1998) and Muheim (1998). The conclusion seems to be that car sharing can reduce the negative environmental impacts of private car use and at the same time provide a similar and more equitable level of mobility. The environmental benefits arise from three distinct impacts. First, the fact that cars are shared and not owned results in the need for fewer cars than otherwise would have been the case. While for some car sharing provides access to a car, which had previously not been possible, for others joining a car sharing scheme leads to them giving up their own car, or avoiding buying a new one. Behrendt et al (2003) quoted figures from the Netherlands, Switzerland and Germany that suggested that car sharing resulted in around 30 to 44 per cent fewer cars. Interestingly, the figure for the

Netherlands was higher for neighbourhood schemes than those schemes run by car rental companies. On the basis of the existing number of participants in car sharing schemes in these countries, they estimated that car sharing schemes had resulted in around 30,000 fewer cars than would otherwise been the case. In the US, San Francisco's City CarShare claim that 25 per cent of their members have given up their car since joining the scheme; while Boston's ZipCar claims an equivalent figure of 15 per cent for its members. In addition, ZipCar states that 25 per cent of its membership claim that the scheme enabled them to avoid purchasing a car. This suggests that car sharing can, at least to some people, offer a viable alternative to private car ownership and therefore could have the potential to reduce car ownership in the longer-term (City CarShare 2003, ZipCar 2003).

Second, on average a shared car spends more of its time in use than a private car, as it us used by more people and therefore spends less time idle in car parks and garages. Muheim (1998) and Meijkamp (2000) both estimate that the reduction in the amount of space devoted to parking as a result of car sharing is around 44 per cent. Studies also estimate that the average occupancy of a shared car is around 25 per cent higher (ie around 2) than that of a private car, due to the fact that the former are generally not used for commuting journeys, where the occupancy is usually low (Baum and Pesch, 1994; Muheim, 1998). In addition, as a result of its more intense use, car sharing vehicles are replaced about every alternate year, allowing cars with the latest technology to replace older, less eco-efficient technology more often. However, as was discussed in Section 3.3, the fact that shared cars wear out more quickly, as a result of their more intensive use, is potentially an environmental downside for car sharing.

Third, figures suggest that, on average, car sharers spend less time travelling by car than do those who have access to a private car. The fact that users are not only paying a monthly or annual membership fee, but also pay for the kilometres driven every time they use the car, makes them more aware of the true average costs of driving. One of the reasons why users drive shared cars less regularly than they would a private car is that, in contrast to a privately owned car, the car-sharing car is not immediately or always accessible. While it is true that car sharers who did not previously own a car travel more by car than before, this is usually negated by the fact that those who previously owned a car travel significantly less by car than before. For a number of schemes in Germany, the Netherlands and Switzerland, the average reduction in vehicle mileage by car sharers was 28 per cent in the Netherlands, 36 per cent in Switzerland and 42 per cent in Germany (see Table 6.12 in Behrendt *et al*, 2003). In his study, Meijkamp (2000) found that on average the change in car mileage resulting from joining a car club was 33 per cent on average, with a reduction of 65 per cent from previous car owners, even though around 71 per cent of those joining a club did not previously own a car. However, it is worth noting that if people use a shared car in addition to their private cars the impacts on the environment are not necessary positive. For these 'additional users' car sharing can, for example, lead to a 5 per cent increase of their energy requirement (Behrendt et al, 2003). Interestingly, in Meijkamp's review of four schemes, the average number of weekly trips by all modes increased by 10 per cent on joining a car share scheme. While the average number of car trips per week declined by 43 per cent, the use of other modes increased, as the number of cycling trips went up by 14 per cent and train and bus use up by 36 and 28 per cent, respectively. Conversely, experience suggests that the existence of a reliable, accessible public transport system is of significant importance for the success of car sharing schemes. Muheim (1998) estimates that the environmental impact of car sharing can be in the order of a 30 per cent reduction in energy consumption and carbon dioxide emissions and a 25 per cent reduction in material input.

4.2 Car Pooling

4.2.1 Typology of Car Pooling

Car pooling has probably been in existence in an informal way ever since the car become a popular mode of transport. For example, hitchhiking is effectively informal car pooling, as those without a car seek to share a car with those driving in a similar direction. Similarly, colleagues working at the same organisation, or travelling to another organisation for a meeting, often lift share on an informal basis, as do parents sharing the school run. However, more recently a more formalised approach to car pooling has been established with services bringing potential car poolers together at geographical scales ranging from the local level to international trips. Although some schemes were in existence prior to the development of the internet, the advent of the world-wide web has opened up opportunities for the development of such services. Car pooling schemes tend to fall within two main categories. First, schemes that are available to any members of the general public, allowing them to find matches to suit their individual requirements; these can be local, national or even international schemes. Second, are schemes that have restricted membership. These are usually centred around workplaces, and allow employees to find colleagues that they can share a journey to work with. As noted, a number of schemes allow individuals to find suitable matches with which to share a journey.

4.2.2 Car Pools for Private Individuals

An example of a ride sharing service for individuals in Germany is the *Citynetz Mitfahrzentrale*, which has offices in 19 cities. It brings together drivers and passengers with the same destination on middle and long distance journeys. Customers can book trips (if available) via internet or telephone and passengers pay a small arrangement charge to the organisation and a fixed share of the fuel costs to the driver (Citynetz Mitfahrzentrale, 2003). In Belgium, nation-wide car pooling has been organised by not-for-profit organisation *Taxistop* since 1978. The service began in Flanders, the Dutch speaking region in the north of the country, but has since spread to the other two regions. French-speaking Wallonie and the capital, Brussels. The principal carpooling system operates by way of a database, which can be accessed online, to bring together people travelling to and from work along similar routes. Variations of the scheme are operated for trips to and from schools, major events and airports (Taxistop 2003).

In Scandinavia, databases accessible via the internet have been created. These are often financed by public funds and enable people driving the same route to share the same car. The databases automatically locate other users with the same transportation needs and notification is sent via email in the event of a potential match. An example of this is the Danish *Pendlernet*, which has 7,884 registered users and has had more than 20,000 members. Another example is the Swedish municipality Vellinge, where a database was created to coordinate lifts and increase vehicle occupancies for journeys to and from larger cities, such as Lund and Malmö. Similarly, in Finland, a number of web sites have been set up by organisations, such as radio stations, to bring together people who need a lift and car drivers who want some company on their trips (Pendlernet, 2003).

A particularly dynamic example of a carpooling system is the German scheme *FahrPlus*. This brings together drivers and passengers on a daily basis. The passengers are informed

that they will be picked up 10 minutes before the driver arrives. A range of measures also ensure that the passengers get home in the evening, even if there is no driver available. A new system *Tele-Shuttle*, which will be installed in the near future, will develop the service further by allowing shorter-term demands to be addressed, as drivers can be informed of where to pick up passengers once they are already on the road (FahrPlus, 2003). In Spain, there are a number of carpooling or ridesharing organisations based in the principal cities. In Madrid, the *Centro de Viaje Compartido* (CVC; Ride Share Travel Centre) brings together drivers and others travelling to the same location to share rides. The CVC also offers other services that aim to encourage trips to be undertaken by modes other than the private car (CVC, 2003). On a much wider scale are internet sites such as *compartir.org* which claim to hold details of 850,000 car journeys and aims to match potential sharers across 70 countries on all five continents (compartir, 2003). In addition to this, there are numerous sites that offer car pooling services for backpackers, eg *bugride* (Bugride, 2003) and Freewheelers a UK based scheme which provides an international car pooling service (Freewheelers, 2003).

4.2.3 Commuter Car Pooling

In addition to schemes set up for individuals one of the most common forms of car pooling involves journeys to the workplace. Although car pooling to work often occurs on an informal basis, increasingly companies are setting up formal schemes to encourage lift sharing. In larger companies for instance it may be the case that people are unaware of other colleagues living in close proximity to them who they could feasibly share with. The implementation of such programmes can range from paper based schemes which match sharers by hand, or the use of notice boards, to more detailed database schemes which make use of the company intranet or internet. Companies often have incentives for setting up car pooling schemes. The most prevalent reason is lack of car parking spaces and problems with congestion. For instance in the UK, many local authorities have limited car parking and so are keen to seek ways to reduce single-occupancy car journeys to their sites. Car pooling is perhaps one of the most politically acceptable measures as it does not unduly restrict employees, unlike other measures, or rather the perception of other measures, that are increasingly being pushed to reduce congestion and car use, such as *inter alia* promotion of public transport use, walking and cycling.

In Germany, car pooling is typically organised within a company. DaimlerChrysler AG set up a scheme after it moved its Mercedes Technology Centre (MTC) from the north to the south of the city of Stuttgart in the late 1990s. The move led to increased commuting distances for many of the company's employees and therefore the company, together with the state of Baden-Würtemberg's environment and transport ministry, instigated a project to use the latest telematics technology to combine single commuting journeys in the form of a rideshare (M21, 2003). In the city of Bremen, a city-wide car pooling service for commuters to all companies in the city (so called *Fahrgemeinschaftsservice*) is provided by the *Brüo für VerkehrsÖkologie* (BVÖ) and the *StadtAuto Bremen Car Sharing GmbH*. This developed from an EU-funded project *MOVE* run by the city council with the participation of Kraft Jacobs Suchard and Brauerei Beck & Co. Besides car pooling services, the scheme also makes available cheap seasonal public transport tickets to the companies' employees, as well as differential membership rates for the local car sharing scheme, which also utilises the car parks of the companies involved (MOVE, 2003). As an added assurance many car pooling schemes offer a guaranteed lift home for employees taking part if for some reason their lift is unable to take them home in the evening. Evidence suggests that this actually

occurs very rarely, with the most common example being through sickness, and as such costs are kept to a minimum for companies.[10]

In France, a number of associations have been established to promote the practice of car pooling between companies, providing expertise to companies wishing to introduce a car pooling service or to encourage their employees to car pool. For example, car pooling services are available through www.covoiturons.net for the Paris region (Ile-de-France) and the Alpes-Maritimes département (Nice, Cannes etc.) and via www.covoiturage.com for the country as a whole. The latter currently receives 1,000 requests per day and has a 4 per cent matching rate (Covoiturons, 2003). Other associations exist in France targeting particular groups. For example, for the Paris region, the Comité de Promotion du Covoiturage en Ile-de-France (Committee for the promotion of Car Pooling in the Ile de France) was established by a number of regional partners to promote car pooling among the public at large, as well as local authorities, private companies and public sector bodies.

4.2.4 Support for Car Pooling Schemes

It is apparent that there are countless different types of car pooling schemes in existence each operated by many different organisations. Whilst companies providing these services tend to specialise in one type of scheme, in the UK the company *Lift*share are specialists in a wide number of initiatives. *Lift*share are the UK's leading provider of car pooling services and oversee over 250 schemes with a client base of approximately 36,000 members which is increasing all the time. *Lift*share provide a general website for the general public, which allows anyone to log on and register for free. They also provide car pooling services for one-off events, for instance music festivals such as Glastonbury or the Reading Festival. More recently a specific webpage was set up for people attending the Stop the War protest in London (*Lift*share, 2003).

However, *Lift*share also provides software for companies wanting to set up car pooling schemes. They provide clients with a branded web-site, incorporating travel information and a car-pool scheme, which can be hosted on the internet or on an internal intranet. Clients range from private enterprises, for instance Manchester Airport, Norwich Union and IKEA. Whilst the majority of these are sites set up for the benefit of employees, IKEA has a link to their branded car-pool scheme on their company web-site. This enables customers to register free of charge and find other people with whom to share both their journey and the costs of travel. A large number of local authorities in the UK also use *Lift*share to provide their staff with a car pool service. More recently, regional areas have set up group car pool schemes to provide services for people living in a set geographical area. For instance SELTRANS (South East London Transport Strategy) a partnership of seven London Boroughs in the South East area, transport providers and businesses; have a web-based car pooling scheme called www.givealift.com. Anyone wanting to find a partner to share a journey with in the region can log on to the website and find potential matches (Givealift, 2003). There are comparable schemes for the South West region of London (SWALTRAC) and the Thames Gateway area (*Lift*share, 2003).

[10] A study undertaken by ACT in the UK found that the guaranteed lift home was rarely if ever used. One company surveyed used it only 3 times in 4 years and the main cause was either sickness or children being sent home from school. ACT Research (2004) Car Sharing – Cost of Providing a Guaranteed Ride Home

4.2.5 Assessment of Car Pooling

Whilst car pooling has and will most likely continue to occur on an informal basis, the growth in companies offering matching facilities for people wanting to share a journey has helped to open up car pooling to a much wider audience. Car pooling is viewed as an acceptable alternative to single occupancy car journeys as it still allows the user to effectively use their car, albeit in a slightly different manner. Other benefits include the social aspect of sharing a car journey with somebody else and financial savings from the sharing of fuel costs. Moreover, one of the most common forms of car pooling is to the workplace, and as these types of trips are usually undertaken at peak traffic times, accordingly, car pooling can help to reduce peak period vehicle trips.

However, on the downside, people can be put off by car pooling for a number of reasons. One of the main barriers relates to security risks. As mentioned previously, whilst people often share a journey with somebody they know, many (particularly women) are reluctant to get in a car with a person they have never met before. Whilst this may not present too much of a problem for those taking part in workplace schemes, as some common ground is evident, for one-off journeys this can be an issue. However, most car pooling sites offer safety advice to people embarking on sharing for the first time to overcome these problems. These guidelines include practical advice such as, meet in a public place, and avoid exchanging home addresses with your travelling companion before you meet them. Inform a friend or family member who you will be travelling with, when and to where and make sure you show each other personal identification so you know you are travelling with the right person.

Another barrier to car pooling however, is the inconvenience of being reliant upon other people that you are sharing with to undertake your journey. For instance, if sharing journeys to and from work on a regular basis, you are dependent upon the person you are sharing with leaving work at the same time each day. If an emergency crops up this may prove difficult and could result in having to wait around or worse still make alternative arrangements to get home. However with forward planning most of these problems can be avoided. Indeed, as mentioned earlier, many workplaces promoting car pooling put in place a guaranteed ride home for those sharers stranded in the event of unforeseen circumstances.

Some of these barriers can be overcome with the aid of incentives. For instance, high occupancy vehicle lanes, dedicated car sharing spaces and cash back for parking can help encourage car pooling and have been attributed with reducing commuter trips by between 10-30 per cent (Winters and Rudge, 1995). Other studies suggest reductions at workplaces of 5-15 per cent rising to 20 per cent where incentives such as those outlined above are put in place (Ewing, 1995). Indeed, despite the appearance of apparent barriers to car pooling, it is evident that car pooling sites are frequented by a number of visitors and work based schemes are consistently growing in stature. As noted earlier, *Lift*share in the UK claim that approximately 47,000 members are registered on their site, and the international site 'compartir.org' claims to have details of 850,000 car journeys. Whilst registering details on a website does not actually equate to using the service *Lift*share believe that 34 per cent of all journeys registered result in successful matches. From this they calculate that 1,7690,302 miles are currently being saved per year through people using their site and going on to share journeys with other people, and that CO_2 emissions are reduced by 5,000 tonnes (*Lift*share, 2003).

4.3 Bicycle Pooling

According to DeMaio (2001), some form of bicycle pooling, or Public Use Bicycle (PUB) scheme, exists in around 50 cities world-wide. He identifies four generations of PUB schemes ranging from the earliest first generation scheme that began in Amsterdam in 1968 to fourth generation schemes that are being set up in the US. The principal difference between the first and fourth generation PUB schemes is the level of technology used both to track the bicycles and to ensure that they are not stolen. Widespread theft of Amsterdam's original White Bikes caused that first scheme to fail, as did a similar scheme in Milan 10 years later. Whereas the bicycles of the first generation schemes are free-to-use and have no fixed storage location, fourth generation schemes employ smartcard technology that allow the bicycles to be tracked and their use, and abuse charged. DeMaio estimates that, as of summer 2001, there were still around 25 first generation PUB programmes in the US, including in Portland, Bolder and Minneapolis/St Pauls, which have been reasonably successful, although theft is a problem.

After the Amsterdam White Bikes scheme, the most famous bicycle pooling scheme in Europe is the *Bycyklen* or 'City Bike' in the Danish capital, Copenhagen. The scheme began in 1995 with 1000 bicycles of which 800 were sponsored. The bicycles are kept at 110 secure racks scattered around the city and can be used once a coin, which is effectively a deposit, is put in the appropriate slot. The coin is returned once the bicycle is returned to any rack in the city. The scheme is run by an independent foundation *Fonden Bycyklen i København* (City Bike Foundation of Copenhagen), which is supported by the city government, national ministries and the local tourist office, as well as additional sponsors. DeMaio (2001) refers to such schemes as second generation PUBs, as, unlike the original Amsterdam scheme, the bicycles have fixed storage locations, although they do not utilise advanced technology, as the latter generation schemes do. However, while theft is still a problem for the City Bike scheme, the theft of private bicycles in Copenhagen has declined by 15 per cent in 1994-5 and 12 per cent in 1995-6 since the introduction of the free bicycles (Bycklen, 2003).

A City Bikes scheme, similar to the one in Copenhagen, has been set up in the Finnish capital Helsinki and the Austrian capital Vienna. The Helsinki scheme was set up in 2000 and as with the Danish scheme, sponsorship was key in setting up the programme, while the city authorities are responsible for maintaining the bicycle racks and the bicycles themselves. It operates along similar lines with a coin releasing the bicycles from their storage racks (DeMaio, 2001). The Viennese scheme began in May 2003 and is operated by an advertising company GEWISTA, which plans to provide about 1000 bicycles in 2004. Its aim is to encourage people to use bicycles instead of the car on journeys of less than 5km, which is estimated currently to account for around 50 per cent of car journeys in the city. The city authorities have already stated that the provision of the City Bikes is responsible for a rapid increase in bicycle use in the city (Vienna city council, 2003; City Bike Wien, 2003).

The Danish city of Odense has also sought to encourage cycle use instead of car use through encouraging the lending of bicycles. The local municipal council contacted companies in the town to encourage them to buy bicycles to lend out to their employees. If the bicycles managed to travel more than 500km as measured by their onboard computer in their first six months of use, the municipality promises to pay for half the cost of the bicycle. The scheme

only started in 2002 and currently involves 28 companies 'lending out' 67 bicycles. Foldable bikes are also lent to people commuting to Odense in order for them to leave their cars at the border of the city. These bikes were also equipped with a computer to enable the scheme to be evaluated (Cycle City, 2003).

Third generation PUBs, or SmartBikes, were the first to use advanced technology in an attempt to address the problem of bicycle theft. Smart Bikes are released from their racks with a smart card, which contains the users personal details, thus if the bike is not returned, the person who took the bike from its rack could be charged. In summer 2001, five smart bike schemes existed. Four of these are operated by advertising company Adshel and are situated in Rennes in France and in three locations in Singapore; while the fifth scheme is DEPO, the revived White Bike scheme in Amsterdam. The Adshel programmes have been in operation since 1998 and have been relatively successful, with more schemes planned in the future. DEPO began in 1996 and functions slightly differently as one needs a special telephone card to access the bikes. At the origin rack, the user must enter the destination of the journey and must reach the destination rack in a limited amount of time or risk being charged. Many have complained about these requirements, and the programme has been having difficulties, so is being redesigned. Fourth generation schemes are also under development in the US for the cities of Annapolis (Maryland) and Alexandria and Arlington in Virginia, and Washington DC, for which the smart cards will be integrated with other public transport ticketing (DeMaio, 2001).

In the UK a number of schemes aimed at promoting cycling have benefited from Department for Transport funding. In 2002 £2.2 million was offered for schemes which promote cycling and a further £2 million was made available in June 2003. One of the more innovative schemes that received funding is the 'OY Bike' scheme (On yer bike). The DfT funding, along with sponsorship from the Opportunities Centre at Hammersmith, helped to set up a pilot scheme in the Hammersmith and Fulham area providing a pool of bicycles for hire. 130 green and yellow bikes have been placed at various locations across the Borough, in particular at strategic points such as tube stations, public buildings and car parks. Users of the scheme register online giving credit card and mobile phone details before they can access the bicycles (Edie, 2003).

Finally, it is worth noting the potential contribution of electric bicycles and scooters to future transport in urban areas. An EU-funded project called E-tour, which ended in 2002 after having run for two years, investigated the potential for such vehicles through a series of trials in a number of European cities, including Rotterdam (the lead city), Rome, Barcelona, Brussels, Basel, Stockholm, Erlangen and the resorts of Capri and Mykonos. The project concluded that both electric bicycles (e-bikes) and scooters (e-scooters) were a potentially useful means of transport that could have environmental benefits. It concluded that rather than being seen as an alternative to the bicycle, the e-bike should be seen as a new mode of transport that can compete with the car on short trips. While there are enough e-bikes on the market, there needs to be further development of e-scooters and legislation needs to be addressed, particularly in relation to the maximum speeds, in order that the modes can develop to their full potential (City of Rotterdam, 2003).

4.4 Innovative Public Transport

As noted above, all public transport could be classified as a mobility service in the broadest sense. However, this review is focussing on innovative mobility services, so we will only mention innovative public transport services that are not mentioned elsewhere in this section, the most evident example of which is demand-responsive public transport.

Flexible public transport concepts, such as mobility on demand for those with mobility impairment or even taxis, are not new. Indeed this sort of transport has existed for some time to serve the needs of people with disabilities, who are unable to use traditional forms of public transport as a means to get about. However, the advent of new technologies, such as the internet and real-time information systems, have broadened the potential application of flexible public transport services by enabling the provision of more efficient and responsive services. From the perspective of the public transport operator, demand-responsive transport offers the potential of increasing occupancy during off peak hours or in more thinly populated parts of towns or rural areas, by trying to make their services meet demand though being more flexible in meeting requirements.

In Germany and Austria, an example of a more flexible, demand-responsive public transport services is the *Anruf-Sammel-Taxi* (AST; flexible taxi on demand), which first appeared at the end of the 1970s and early 80s. In typical schemes, passengers are picked up at designated departure points – normally regular bus stops – and are driven to the destination of their personal choice. An AST must be booked at least 30 minutes before the desired departure time. Fares are usually structured in a separate AST fare zone system and are usually higher than regular bus fares, which is justified by the convenience of the door-to-door service. The route taken by an AST is not the shortest possible, but begins at the first pre-booked stop. The next passengers are 'collected'; hence the German name 'Sammeltaxi' (collecting taxi), but travel time and distance is kept to a minimum (Walder, 2000).

A system similar to the AST that is found in Germany is the so-called 'route taxi', which is used on routes with few passengers and narrow roads. Taxi firms are contracted to operate routes to a fixed timetable and at public transport fares. Generally larger cars, for example those with 8 seats and sliding doors are used. At times of low demand, 'route taxis on demand' are used, which passengers must book by telephoning the bus company between 30 and 60 minutes in advance. The taxi replaces the bus on the normal bus route, but for reasons of capacity picks up only pre-booked passengers. Normal bus fares are charged (Walder, 2000).

Another scheme similar to the AST is the 'dial-a-bus' system. The only difference to the normal AST is that buses are used rather than taxis and that a busier corridor is served. Slight deviations to set down passengers or pick up pre-booked passengers are possible. Usually normal bus fares are charged. These services are in most cases provided all day in areas of low demand. Another example of an innovative mobility service in rural and low-density areas is the so-called 'People's Bus'. Again based in Germany it originated 15 years ago and consists of people organising additional public transport services in times and areas where normal public transport cannot be operated economically (Walder, 2000).

In Austria, a pilot project for a system of 'regional buses on demand' is currently under development in the region of Freistadt. The system is called *FLEXBUS* and it uses new technologies to increase the level of public transport service in rural areas and to reduce existing inefficiencies, eg the number of journeys undertaken by empty buses. Facilities at bus stops allow potential passengers to notify oncoming buses of their presence and this is immediately indicated to the bus driver, via a central computer that coordinates the journeys (MOVE, 2003).

It is not only by putting on more flexible services for transporting people that public transport operators have tried to develop more innovative services. In the German city of Bonn, public transport operators are trying to tackle the problem of transporting luggage on public transport and so have developed a scheme called *EasyShop – Der Bring Service der Stadtwerke Bonn* (Delivery service of the Bonn transport operator). Since October 2000, shoppers have been able to use EasyShop service to have all their purchases from participating shops delivered to their home, while they return separately on public transport (Easyshop, 2003).

Optitod is an IT tool designed to assist the management of a range of public transport services on demand with an aim of providing solutions for servicing the greater suburbs, servicing rural areas and providing transport for the mobility challenged. It works by matching demand with the most appropriate contractor. For example, members make reservations and the 'optitod' software package will choose the most suitable vehicle to perform the service they require. (Cabri22, 2003)

The DRIN bus is a flexible demand responsive transport service. It's route and timetable is flexible in order to enable it to better meet users needs. Users can choose where to begin and end a service by simply calling in to the call centre, which will decide on the optimal route taking into account all the potential users. Reservations must generally be made up to 30 minutes in advance, although users can book at shorter notice if an existing planned route does not have to be modified. The service operates methane-fuelled minibuses in a populated but hilly part of Genoa, which has not hitherto been served well by public transport for reasons of accessibility.

Whilst traditionally bike taxis or bike rickshaws conjure up visions of India and China, this innovative form of public transport is growing in popularity in a number of other countries too. One example is the 'velotaxi'. The velotaxi concept was developed by an ex-employee of Mercedes and they were first put into action in 1997 in the German capital Berlin. Velotaxis, which only operate between April and October, are human- or electric powered, environmentally-friendly, flexible taxis, which consist of a driver using pedal power to transport one or two passengers, seated on covered sets behind, around the city. While tourists are a significant source of revenue, a study in Berlin suggested that 50 per cent of users took a velotaxi instead of a normal taxi. Again, advertising plays a key role as the taxis carry advertising, which effectively covers at least some of its operational costs. In 2002, velotaxi went international and companies have been set up in a number of countries and velotaxis can be seen on the streets of many major cities, including Amsterdam, Brussels, London and Tokyo. Other cities in Germany, such as Düsseldorf, Münich and Cologne, have also shown interest in introducing their velotaxis (Berchicci, 2003).

4.5 Integration of Public Transport and 'Private' Transport Modes

Services can also be developed to better integrate different modes of transport, with the aim of providing a more seamless service and therefore a more viable alternative to the private car. Car sharing, in many ways is a complimentary service to public transport as it often could not be used optimally without the existence of a good quality public transport system. Also, the payment structure for car sharing is similar to public transport, as essentially it involves the user paying for what they use, accordingly the user focuses on adopting mobility patterns using services that offer the best value for money. In urban areas, this is public transport (Jussiant, 2002). Hence, organisations offering innovative mobility services often work with a range of other organisations, particularly providers of traditional public transport.

4.5.1 Car Sharing and Public Transport

Swiss car sharing organisation Mobility cooperates with a number of different partners, including local and national public transport operators and car rental companies. In 1997, Mobility joined the *zürimobil* scheme, which was a joint ticketing scheme in Zürich run by the Zürich public transport authority (VBZ) and the Europcar car rental company service. The scheme, which has now been relaunched as *ZVV-Kombiabo*, allows holders of annual public transport tickets to pay an additional fee of CHF25 for an electronic 'chip-ticket' which acts as a combined public transport ticket and access card for Mobility's shared cars (Baumann, 2002). It has been estimated that Mobility customers have brought in around CHF 1 million since 1997 for the VBZ and that annual public transport utilisation among Mobility members has increased by 14 per cent as a result of the scheme (UITP/MOSES, 2002). At the national level, in 1998 Mobility launched the *Mobility Rail Card 444* with Swiss Railways (SBB), which for CHF444 gives half-price access to public transport country-wide for two years, as well as a two-year membership of Mobility. The ticket also acts as the access key to Mobility cars. In the first two years of its operation, on average about 1,000 Cards were sold every month (Vonarburg, 2000).

In June 1998, the German city of Bremen launched a scheme where a monthly or annual travel card is effectively the key for the local car sharing scheme. The original card, the Bremer Karte, was developed in cooperation with Cambio (who operated the local car sharing club), a local OPEL dealer and Bremer Strassenbahn AG, the local public transport operators' association. However, subsequently, the Bremer Karte has been developed into Bremer Karte PLUS, which also includes an 'e-purse', which can be used in over 300 shops in the city. The integrated card can be used additionally as a loyalty card. As was the case in Zürich, the introduction of the card has resulted in an increase in the numbers of car sharing customers using public transport, as 78 per cent of the members of the Bremen car sharing organisation now have an annual BSAG travel card (UITP/MOSES, 2002).

Similar integration of public transport and car share membership/access can be found in Austria, where the car sharing operator DenzelDrive works with companies at both the national, eg *Österreichische Bundesbahnen* (Austrian railways), or local level, eg *Wiener Linien GmbH & Co KG*, the public transport operator in Vienna. Anyone who has a season ticket of one of DenzelDrive's partners only has to pay a reduced yearly fee to be a member of DenzelDrive. By cooperating with public transport companies, DenzelDrive also manages to locate its car parks at public transport nodes, such as railway or underground

stations. DenzelDrive also works with international partners to ensure that its members have access to reduced car rental prices outside Austria (DenzelDrive, 2003).

In the Netherlands a national e-ticketing system is currently under development. A new company Trans Link Systems was set up by the five largest public transport operators in the country – Nederlandse Spoorwegen (Dutch railways), Connexxion (buses), GVB, RET and HTM (the public transport operators in the cities of Amsterdam, Rotterdam and The Hague, respectively) – who together represent 90 per cent of the country's public transport market, allowing them to develop and implement the system on a large scale. A consortium has been chosen to implement the system, which will be tested in early 2004 on a part of the national railway network, 125 of Connexxion's buses and on the Amsterdam and Rotterdam metros (Translink, 2003).

4.5.2 Integrating Cycling and Walking

The focus of modal integration is not just the integration of public transport and car sharing, as some cities are working to integrate cycling and walking more into the local public transport system. Improved interchange facilities for pedestrians and cyclists are now quite widespread, but in some cases a more active approach has been pursued. For example, in the Austrian city of Salzburg, the local public transport association also offers services to cyclists and pedestrians. For cyclists, it provides automatic bicycle renting stations and secure bicycle storage facilities near to public transport stations and train stations. For pedestrians, it provides automatic baggage lockers at central public transport stations and market squares. All services additional to public transport, such as renting bicycles, are operated with a chip card called the *Salzburg Card*, which is similar to a credit- or bank-card. Another project integrating bicycles with public transport is the *Chip'n'Bike* project in the city of Graz, which provides bicycle rental services for public transport users to continue their journey. New technology is currently being developed, which will allow the system to operate with multi-application chip cards and mobile phones (MOVE, 2003).

An integrated smart card for public transport and bicycles is also being developed for the US capital of Washington DC and the surrounding area. The Washington Metropolitan Area Transit Authority (WMATA) was the first in the US to introduce a smart card on its underground system. It intends to extend this system to the region's trains and buses, as well as to those of the neighbouring Maryland Transit Authority. The smart cards that will be used to access and pay for the use of the smart bikes that are being introduced in the neighbouring cities of Annapolis (Maryland) and Alexandria and Arlington in Virginia (see above) are being made compatible with those in use on Washington DC's metro system (DeMaio, 2001).

In 1995, the German state of Nordrhein-Westfalen initiated a programme to set up a series of one hundred *Fahrradstationen* or bicycle stations to make changing between bicycles and public transport as easy as possible. The aim of these was to encourage the use of bicycles, so the stations provide safe and secure bicycle parking facilities, which are protected against the weather, theft and vandalism. In addition, the stations provide a range of other services such as bicycle repair and rental. An agency *Entwicklungsagentur für Fahrradstationen* (Development Agency for Bicycle Stations) was set up to support the operators of the stations and to develop a central bicycle station operator network. It also designs services and concepts to operate the stations. Of the 50 bicycle stations currently in operation in

Nordrhein-Westfalen, 35 were set up by this agency. In the whole of Germany, there are currently about 67 bicycle stations (Radstation, 2003).

The German experience with bicycle stations led to the creation of the first *Velostation* in Switzerland, which opened in Burgdorf in 1997. A national organisation, the *Koordinationsstelle Velostationen Schweiz* (Coordinating Office for Bicycle Stations in Switzerland), is responsible for the development of *Velostations.* There are currently around 20 such stations in Switzerland providing similar facilities and services to the German *Fahrradstationen* and now service around 10,000 customers a year (Velostation, 2003). Also in Germany, the national railway company Deutsche Bahn (DB) AG has included bicycles in its integrated mobility concept, which it hopes will enable it to eventually provide mobility for entire journeys from door-to-door. This part of the scheme is called 'Call a Bike' and the company already has 2,000 such bikes in Berlin and 1,000 in Munich, where its original pilot project took place (DB, 2003a).

4.5.3 Integrated Travel Information

The other important aspect of intermodal integration is integrated information. A number of projects in Germany aim to provide an integrated information service that provides real-time information on a range of transport modes. For example, *Stadtinfo Köln* (city information of Cologne) provides information on different transport modes with collective and individual user-interfaces for the conurbation of Cologne. This includes information on parking, private vehicle traffic, public transport, travel time comparison between car and public transport, local car-pooling and geographic positioning. The public transport information services have been developed for the everyday routine of the Cologne public transport operator KVB (City of Koln, 2003). A similar system is the *WAYflow* system, which has been developed for the region around Frankfurt Rhein-Main. This covers traffic management, including areas beyond the borders of the region, optimises traffic flow and provides information to all transport users, and a mobility service, which is organized on a private-enterprise basis and is geared towards the customers and their individual mobility needs (Federal Ministry of Education and Research, 2002).

An integrated ticketing and information system is being developed for the German city of Dresden and the surrounding Region of the upper Elbe. The project, called *Intermobil*, began in 1999 and is due to finish its development by the middle of 2004. The project's information system (Doris) will provide timetable and real-time information via the internet, public information terminals and phone. *Intermobil* also offers new information opportunities for the entire region via SMS and WAP for informing users about stops and connections in public transport. The system already handles more than 400 inquiries per day. The information system is complemented by the traffic management system VAMOS, which is currently under construction and which will coordinate measures to influence the traffic. In addition, there will be an electronic ticketing system called the *intermobilPASS*, which was expected to be introduced sometime in 2003. Car sharing and park and ride will also be integrated into the system. Similar actions and co-operations are underway in other German cities, eg Stuttgart (called *Mobilist*) and Munich (*Mobinet*) (Federal Ministry of Education and Research, 2002).

Also in Germany, the national railway company Deutsche Bahn (DB) AG has explicitly declared its intention to provide the entire chain of mobility from 'house to house'. To do

this DB wants to integrate different transportation modes and with this aim has invented a mobility concept, which includes carsharing, leasing, a chauffeur service and a 'Call a Bike' previously mentioned. Pilot operations for the combination of trains and car sharing have been running in Berlin and Frankfurt am Main for railroad employees and customers with rail passes. By the end of 2002, the intention is for a franchise system encompassing local car-sharing organizations to extend standard DB services to most German conurbations. The Deutsche Bahn created a subsidiary, DB Rent, which is to complement classical rental business by operating nationwide car sharing as well (DB, 2003b).

In order to facilitate the creation of an inter-modal transport network between local and long-distance public transport and other modes of transport such as bicycles, car sharing, taxis and rental-cars, many German cities are setting up mobility centres. These, such as *Mobile* in the city of Freiburg, sell tickets for local and long-distance public transport and give advise about route planning and time-tables. *Mobile* is located at Freiburg's main railway station and also includes a bicycle station. It is also possible to become a member of the car-sharing scheme at the centre. Similar projects can be found in many German cities, eg Wuppertal, Münster, Heidelberg, Karlsruhe, Magdeburg, Ulm and Bremen. Mobility centres can also only exist virtually on the internet, eg *Verkehrsmanagementzentrale* (VMZ) for the city of Berlin. The web page provides detailed and real-time information about all traffic modes in Berlin. The VMZ mobility centre is a Public-Private-Partnership developed on behalf of the region of Berlin, by a consortium involving DaimlerChrysler Services AG, which is the lead partner, and Siemens AG. Mobility centres are also found in other countries, eg the MobilCenter project in Switzerland and in Austria (von Below, 2002). The latter was the first European country to introduce an officially recognised professional qualification for mobility advisers (Hörmandinger, 1997). In Finland, the Ministry of Transport is planning to set up 23 Travel Centres based on the principle of providing information about different transport modes.

4.6 Summary and Conclusions

The above discussion has shown a number of car sharing services exist in industrialised countries – some of which have evolved from small beginnings, while others have been actively set up in a quite advanced form, often with some help from government. The schemes vary in their make-up – some are not-for-profit, while others are run on a commercial basis; some are open to all, while others are exclusive in their membership. However, the extent of the development of car sharing services varies between countries, with the more developed schemes being present in Germany, Switzerland, the Netherlands and in some US cities. The different stages of development can be put down to a number of factors, such as the role of the government, the general culture towards renting and sharing, environmental awareness, etc. Studies suggest that car sharing services can have a benefit both on the operation of the transport system and the environment, as they can result in a reduction in the amount of travel undertaken by car and the need for fewer cars, although similar levels of mobility are retained, as the use of other modes increases. This, in turn, reduces emissions, resource use and the need for land to be devoted to parking. These studies suggest that any increase in car use resulting from giving car access to those previously without such access, brings social benefits and is more than compensated by the reduced use of those who give up their car on joining.

Car pooling has existed, at least informally, for probably as long as the car has been a popular mode of transport. However, a more formal approach to car pooling is now being

facilitated by the development of the internet. Car pooling services can be local, national or even international and, as with car sharing services, some are open to all, while others have restricted membership, eg they are linked to a place of employment. Studies have suggested that workplace-related schemes have the potential to reduce commuting trips by up to 20 per cent, which could significantly reduce peak-time congestion if replicated on a wider scale. Earlier bicycle pooling schemes were not successful, as the bicycles were not kept in secure conditions and were therefore stolen. However, the development of new technologies, such as smart cards, is enabling an increasing number of cities to introduce more sophisticated schemes which could benefit traffic in urban areas. As with car pooling, flexible, demand responsive transport has also been in existence for some time, eg for disabled or elderly people. However, again, new technology is enabling the broader application of such transport for use by more of the population. In addition, some of the major cities in Europe are seeing the introduction of adapted bicycles as a form of public transport, something which is a much more common sight in the developing world. New technologies – the internet, smart cards, etc – are also enabling more integrated and sophisticated information and ticketing services. These are increasingly being used to combine car sharing and public transport services, thus potentially stimulating interest in both.

Even though there are many examples of such 'innovative' services, as yet, these tend to be small-scale and relatively new, so their impact and potential may not have been fully realised. The review has identified a number of studies that suggest that mobility services, such as car sharing, can be environmentally-beneficial and have great potential but, such schemes are still not that common. The reason for this is that there are a number of issues, such as consumer acceptance, the organisation of services and legislation that inhibit the development of such services. As against this, a broad range of new information and communication technologies present major new opportunities across the board. The broader role of the stakeholders in the development of mobility services will be discussed in more detail in the next chapter.

5 The Role of Stakeholders

As highlighted in Section 3.4, the role of stakeholders is key to the development of services, and Chapter 4 gave several examples of the role of stakeholders in mobility services. This chapter will explore in more detail, the role of three key stakeholders in the development of mobility services:

- Local, regional and national government;
- Vehicle manufacturers; and
- Consumers or users.

These will be discussed in turn in the following sections.

5.1 The Role of Local, Regional and National Government

Government intervention in mobility services is motivated by a number of factors. As mentioned in earlier sections the increasing use of cars results in a variety of problems such as congestion and pollution. Congestion can result in economic losses for businesses from *inter alia* employees being stuck in traffic and deliveries taking longer than anticipated. Pollution from increasing numbers of cars can also cause damage to both the environment and the health of the population, which in turn can have economic and social costs. Accordingly governments are motivated by economic, environmental and social factors. The precise extent to which government action is responsible in promoting mobility services is unclear, however it is clear that their intervention has helped garner support for mobility services in many cases.

The role of the federal government is widely seen as having played a very important part in the success of car sharing in Switzerland (OECD, 1999; Hörmandinger, 1997). In order to address the environmental impacts of energy consumption, the Swiss government wanted to stabilise energy consumption and CO_2 emissions and enlarge the share of renewable energy within the total share of the energy consumption. In order to contribute to this, in 1992 it launched *Energie 2000*, a programme that brought various stakeholders to work together to identify and develop market-oriented solutions involving the public and private sectors. The success of Mobility is partly due to the financial support that it has received from the *Energie 2000* programme, which encouraged and enabled Mobility's service to become more professional and tailored to meet the demands of the market.

Car pooling in the Netherlands was promoted by the 1988 policy programme of the national Ministry of Transport, with the explicit aim of increasing the occupancy rates for commuting trips from 1.2 to 1.6. However, it was not until the Government's Policy Plan on the Environment and the Economy that a policy document explicitly advocated car sharing. This increased emphasis on car sharing was driven by a number of factors, including the emergence of various kinds of commercial car sharing services and a government feasibility study from 1993 that suggested that there was a potential market for such services in many Dutch cities. The government helped stimulate the debate through workshops and meetings that brought together entrepreneurs to exchange their ideas and experiences of setting up and developing car sharing organisations. In 1995, this role was formalised by the creation of the *Stichting voor Gedeeld Autogebruik* (Foundation for Shared Car Use) funded by the Ministry of Transport. The Foundation's aim is to

communicate car sharing to the public and media; to give advice to entrepreneurs starting car sharing organisations; and to support the authorities in their policies towards car sharing (Meijkamp, 2000).

The Netherlands government has also taken a number of steps to encourage car pooling, including separate lanes on roads for cars carrying more than one passenger and dedicated parking spaces, which are enforced by the Municipalities. They also employ a number of fiscal incentives. For instance under normal circumstances employees have to pay 25 per cent of the value of their company car if they travel more than a certain threshold distance. However, employees that use Autodate cars (ie shared cars) are exempt from this payment. Autodate customers also get discounts on public transport, and frequent users of public transport are permitted to join Autodate at a reduced price. The Netherlands government also mandate that where an appropriate area is redeveloped for housing (between 10,000 and 30,000 people) there must be a car sharing scheme as soon as the first 500 homes are ready for use. However at the time of writing no scheme of the necessary scale has yet been completed (Meijkamp, 2000; Behrendt et al, 2003).

In 1999, the Austrian federal government started a five-year 'impulse' programme called *MOVE* to support innovative ides for sustainable transportation. The early part of this programme involved a contest to identify five projects on 'innovative mobility services', which would be funded by the programme. In the end, in addition to the five winning projects, it was decided that four others would also receive financial support. Many of the projects that have been financially supported by *MOVE*, such as the *Mobilitätsverbund-Card*, *FLEXBUS*, *the Salzburg Card* and *Chip'n'Bike*, have been described in the previous sections (MOVE, 2003).

In Germany, there is also support at the national level for innovative mobility projects through the programme *Mobilität in Ballungsräumen* (mobility in conurbations) of the Federal Ministry of Education and Research (BMBF). The aim of this programme is to encourage and sponsor projects that involve innovative approaches which show that, even in conurbations, an efficient transport system and protection of the environment, health and safety need not be conflicting objectives. The BMBF has provided more than €77 million in support of these mobility initiatives – a sum that is matched in an almost equal amount by the lead project partners. *Mobilität in Ballungsräumen*, has resulted in a number of projects such as the *CashCar* Project in Berlin (Cashcar, 2003), Dresden's *Intermobil* (Intermobil, 2003), *Mobilist* (Stuttgart), (Mobilist, 2003), *Mobinet* (Munich), (Mobinet, 2003), the StadtinfoKöln and Frankfurt's *WAYflow* project (Wayflow, 2003). Also in Germany, some regions and cities support the development of innovative mobility projects. For example in Nordrhein-Westfalen, the *Combicar* is part of the pilot programme *Sicherheit und Service im ÖPNV*, sponsored by the *Ministerium für Wirtschaft und Mittelstand, Energie und Verkehr*, while the regional government also supports the *100 Fahrradstationen* initiative (Cambicar, 2003).

In the Nordic countries, while there are some examples of innovative mobility services, these are not as common as in some other European countries. To some extent, this is because the debate has not yet moved on to mobility services, as most initiatives relating to environment and transport are more mobility management than mobility services. A lack of a central authority in implementing mobility management and services and an inertia towards change in transport policy have been put forward as possible reasons for this

(Ramboell Nyvig A/S and COWI, 2003). There is a arguably a similar situation in the UK, where the national government has been advocating more innovative approaches to transport, but there is often a lack of political will at the local level and a low level of resources allocated to such iniatives. This is due, for example, to the perception that support for car clubs conflicts with public transport provision and a poor understanding of the potential benefits of the possible scale of take-up.

One positive development in the UK, of which more innovative approaches to mobility, including mobility services, might be a part, are travel plans. Travel plans are a package of practical measures designed to establish ways in which journeys generated by businesses and schools can be reduced or eliminated and more sustainable modes of transport are promoted. Travel plans often include mobility services such as car pooling schemes, walking buses (for schools), along with other measures such as secure cycle storage and provision of public transport information. In 2001 the UK Department for Transport funded 111 three-year Travel Plan Co-ordinator bursary posts across various UK local authorities to provide advice and support to schools and businesses developing travel plans (DfT, 2003). However the uptake of voluntary travel plans have to date been quite low and more commonly those travel plans that do exist are drawn up in relation to planning permission requirements for businesses and/or schools that relocate or extend their current premises.[11] Indeed, development controls are increasingly used in the UK not only to secure implementation of travel plans but also to fund innovative mobility services. For instance local authorities can secure financial contributions from section 106 agreements[12] to be put towards the financing of various schemes designed to promote sustainable travel. This can take the form of monies being used towards *inter alia* cycle storage, improving public transport or a car pool database.

However, a major problem with travel plans is the lack of mechanisms or rather the lack of will to enforce them. However, despite some problems, travel plans can be seen as an effective tool in helping to reduce car journeys. Indeed a recent survey by the DfT found that based on the findings of 20 UK organisations with travel plans on average the proportion of commuter journeys made by a car driver was reduced by at least 18 per cent (DfT, 2002).

In Edinburgh, Scotland, which has the most successful car sharing scheme in the UK, government policy and funding was also influential in the origins of the scheme. The City of Edinburgh Council's policy document 'Moving Forward' committed the council to examine alternative transport options for the City. Public funding also helped get the scheme off the ground with the City of Edinburgh Council providing £48,000, a £150,000 grant from Central Government for technology and other set up costs and a further £30,000 from the Scottish Executive to monitor the project (Enoch, 2002). Furthermore the Council's membership of the European Car Free Cities network also contributed to the participation in the car club (Hope, 2001).

Danish studies have concluded that the development of commuting plans for Danish companies of a certain size are beneficial in promoting mobility services. Again, these are

[11] Planning Policy Guidance Note 13 (PPG13) sets out a basis for requiring and securing travel plans, although recognises that there is no standard format or content of a travel plan.
[12] PPG13 clarifies that either a planning condition or a section 106 agreement can be appropriate to legally secure a travel plan.

encouraged to include, for example, the establishment of a car pooling scheme; company bicycles to be made available at the nearest station to allow commuters to complete their journey to work; the ability to take bicycles on trains; the establishment of a bicycle repair shop at the company; the improvement of the cycle/pedestrian paths between the company and railway stations; and the optimisation of bus transport. The Greater Copenhagen Authority (HUR, 2003) has a set up an office to help public and private institutions set up commuting plans for their employees. An information centre has also been set up in the Finnish capital Helsinki to coordinate and start projects and support organisations in planning the travel of their employees (Helmi, 2003).

In addition to these specific examples, there were many examples in the previous section where the role of the local authority was crucial. These are particularly so when dedicated infrastructure, eg parking spaces reserved for shared cars, or secure parking facilities for pooled bicycles, needs to be put in place and maintained. In addition, local authorities are often key players in partnerships that bring together different actors to develop car sharing schemes, eg as with the recent schemes in Barcelona or Belgium, or initiatives to integrate information and ticketing services for various modes, eg in Bremen.

5.2 Manufacturers' Perspectives on Mobility Services

At first glance, it would seem that mobility services and the motor industry should have a somewhat uneasy relationship, if it is taken that one of the main objectives of a mobility service is to reduce car use and the distance travelled. However, arguably the motor industry has played an important role in both the development and in shaping the future direction of mobility services.

Understandably, the motor industry's biggest role in mobility services is in schemes based around car use, primarily the facilitation of carsharing schemes. Although the motor industry has also been involved in public transport schemes, this is only to a lesser extent and these too are usually inextricably linked with car sharing schemes. This section will examine the different types of schemes in existence and inter alia assess the motor industry's motivation for involvement in such schemes.

Involvement in mobility services can be attributed to a mixture of factors both environmentally and economically motivated. Environmental motivations, although present, arguably play a much smaller role than economic factors. Indeed, environmental motivations can be seen to take two main forms, first in relation to corporate social responsibility and company image and second through the advancement of environmentally friendly car technology, although it is apparent that both of these could be said to have underlying economic factors too.

Corporate social responsibility has become a core issue for many large businesses. Approximately 80 per cent of FTSE-100 companies in the UK now provide information about their environmental performance, social impact, or both, and this is a trend that is increasingly mirrored globally (DTI, 2003). During the last few decades all the top car manufacturers have taken steps to green their image and publish reports to stakeholders and the public alike on measures they have taken to fulfil such requirements. Whilst mobility services may not always be motivated by environmental factors inevitably such schemes do *inter alia* encourage responsible car use, aim to make urban transportation more efficient

and seek to reduce pollution and traffic congestion, and thus aid moves towards a sustainable transport system. Accordingly, the participation of the motor industry in such schemes helps to improve the environmental image of the motor industry.

The problems associated with increasing levels of car use have been well documented by many authors (Section 2.1). Environmental damage caused by harmful emissions has stimulated a flurry of research by the motor industry into developing vehicles that are environmentally friendly. This has resulted in a variety of electric vehicles, hybrids and cars using alternative fuels. Literature would suggest that certain mobility service schemes present the ideal situation to test out new vehicles. Indeed this is evident with the large number of carsharing schemes that use 'environmentally friendly' vehicles.

Despite the motor industry moving towards a cleaner, greener image by embracing both mobility services and environmentally friendly car technologies, economic factors have undeniably played a fundamental role. For instance Volkswagen believes that 'this [the car sharing] market will grow at a rate of up to 50 per cent per annum to a potential market of 2.45 million vehicles across Europe within ten years' (Volkswagen, 1997). Moreover other manufacturers believe that because of the lower costs of car sharing this can enable people who currently do not use a car to do so, thus extending their customer base. A further motivation stems from the fact that, often, participation in mobility services is combined with the development of new technologies, for instance 'smart cards', real time traffic information and the integration of the possibilities given by mobile phones and of course the development of environmentally friendly cars as mentioned above. All of these offer potential business opportunities for the motor industry.

Honda has shown ongoing interest in the shared use of cars over the last few years. In October 1997, Honda launched the Intelligent Community Vehicle System (ICVS) at their Motegi site in Japan. The ICVS allows employees to select electric vehicles for short-term rental. Smart cards unlock and start the car and user fees are calculated automatically and accordingly deducted from the user's stored value cards. An additional feature includes the fitting of AVI technology to each of the vehicles; this allows the ICVS management center to monitor vehicle location in real time and also instructs the vehicles to dock at a charging terminal when batteries are low (WBCSD, 2001). More recently Honda purchased an 18.4 per cent equity stake in one of the largest US car sharing companies Flexcar in 2002. Honda supports Flexcar's mission to develop and implement smart, new mobility concepts that reduce pollution and traffic congestion (Flexcar, 2003). In July 2003, Flexcar announced plans to convert its entire Southern California fleet to Honda Civic Hybrids (Honda, 2003).

In the UK subsidiary of General Motors, Vauxhall Motors supports a national network of car sharing clubs, being the leading supplier of cars to the clubs, which increasingly (in response to demand) include alternatively fuelled cars. In 2001 Vauxhall hosted a conference in Luton of the 'Community Car Share Network' (CCSN) a non-profit organisation linking ten car sharing clubs across the country. To highlight their commitment to the scheme Vauxhall has supplied 20 free cars to the clubs for the first year and then at a highly preferential rate in the second year. The company is also covering servicing and general maintenance costs. Nick Reilly, Chairman and Managing Director of Vauxhall said, 'Vauxhall is pleased to be supplying the community car share clubs with a range of Astra and Corsa vehicles. Sustainable transport means thinking responsibly about car use, and we're proud to be taking a leading role in this initiative.'(GM, 2003)

One of the more innovative mobility schemes involves GEM, a wholly-owned subsidiary of DaimlerChrysler. The company became involved with developing what was hailed as one of the most comprehensive zero-emission vehicle mobility systems at Playa Vista, which is a mixed use community based in California. The project has received numerous national awards and recognition for its commitment to sustainable development. One of the objectives of the zero-emission vehicle mobility system was to develop a fleet of electric city cars that would be available on a per-trip basis for use by residents and business tenants. This car-share system is accessed through an internet reservation system or by calling a toll-free number. Larry Oswald, vice president of DaimlerChrysler's Hybrid and Electric Vehicle Product Team and chief executive officer of GEM, said the mobility project is aimed at future technology applications by using existing systems. 'GEM and DaimlerChrysler want to showcase current and future alternative fuel and advanced technology vehicles in a real-world application. We're excited about the possibilities at Playa Vista.' (Emotionmobility, 2002).

DaimlerChrysler also acted as a project co-ordinator for the *MOBILIST* project between 1998 and 2002 working with the *Umwelt- und Verkehrsministerium* (the environment and transport ministry*)* of the region of Baden-Würtemberg and other partners in the region of Stuttgart. The aim of the project was to encourage environmentally friendly transport by creating mobility services which facilitate more efficient use of existing infrastructure and IT use. One of the schemes within the project was the dynamic car pooling service *FahrPlus*, which was discussed in Section 4.2 (Mobilist (2003), FahrPlus (2003)).

In 1999 Volvo became involved with a car sharing scheme in Göteborg. This scheme was slightly different to some of those already mentioned in that it provides cars solely for business use. Volvo established a pool of cars in an area occupied by several companies. The vehicles were intended for use during the working day, their availability was intended to act as a stimulus for more employees to travel to work by public transport or other sustainable modes of transport, without the excuse of saying they need to drive their car as they may need it for work purposes (Volvo, 1999). Volvo also supports a car sharing project in Lubeck, Germany. This scheme is based around a housing development. The vehicles are run on natural gas with a new natural gas station within the housing development (Flintenbreite, 2003)

Volkswagen have been involved in a number of car sharing schemes in Germany. One of these involved the provision of vehicles for a residential car sharing scheme. This scheme consisted of tenants in a block of units sharing a vehicle or vehicles, which is kept right outside the main door of the apartment block. For larger groups of people or organisations a range of vehicles are kept, allowing car sharers to chose the vehicle that is ideal for each trip, for example a Polo for a single person journey, a Caravelle for a group or a Passat wagon for a shopping trip. To aid smooth running of the scheme Volkswagen run an automatic car booking system where users are charged a small fee. However, this is considerably modest and less than a taxi, car rental or normal car ownership. The first results of Volkswagen test programmes have proven that the concept has major advantages and benefits. The scheme has been highly rated by all involved in it, with more than 70 per cent of people becoming regular users of the shared vehicles, often enabling them to sell second cars. Estate agents and housing companies have found that blocks of units involved in the scheme are considerably more attractive to renters and purchasers. The research has also shown that the primary use of the vehicles is the type of journey which allow cars to

perform at their best, unique trips carrying more than one person for shopping and recreation, as opposed to commuting (Fastlane, 2003, Schrader, forthcoming).

In 2000 Citroen developed a zero emission car entitled the *Osmose* which aims to make urban transport more efficient by equipping the vehicle with a system offering lifts to potential users via GSM and WAP technology. The car is divided into two compartments, one for the owner of the car and another at the rear for those wanting a lift. When the *Osmose* sets off on its journey, its destination and route are displayed on the side of the car, using a GPS navigation system. If a pedestrian wants to hitch a lift, they press a button on the side of the car that initiates a conversation with the driver. Alternatively people requiring a lift can obtain information regarding the current position and route of the *Osmose*'s cars using their mobile phones. (Fastlane, 2003)

Liselec is an innovative alternative urban transportation system in La Rochelle involving Citroen and Peugeot, set up in September 1999. It comprises a fleet of electric cars parked at strategic locations around the city, such as the train station, the university and the shopping centre. Users access the cars with a smart card, which is paid for in advance. Users can either play a fixed hourly fee or a membership programme that bills for actual use. Vehicles are available 24 hours a day and include a fleet of 50 electric Peugeot 106s and Citroen Saxos. The scheme aims to make it easier to get around the city by extending the range of public transport, whilst at the same time protecting the city environment (Liselec, 2003). As of mid-September 2000, the 50 cars had been driven a total of approximately 100,000 km. The average trip covered 6 km and the mean time of use was 30 minutes, while the median trip time came to 10 minutes. That is, most trips were very short, with the mean value elevated by a 'tail' of significantly longer journeys. In all, the cars in the Liselec fleet were used to take some 15,000 trips. In response to the positive feedback from customers, the authorities in La Rochelle have decided to expand the scheme (Auto Intelligence News, 2003).

Another innovative scheme involves a partnership between the Parisian urban transport authority (RATP), car manufacturer Renault and French energy agency ADEME. Entitled *Caisse Commune*, this partnership develops the concept of 'car-division' in Paris. The service consists of a fleet of vehicles and users can reserve a vehicle either by telephone or internet for as little as an hour, or as long as a month. There is also the opportunity to rent a car immediately, with no prior notice required, making the scheme extremely flexible. Users are charged one of two rates, depending on the distance of journey to be made. The 'mobility' rate which is for longer journey entails a membership fee of €300. The 'liberty' rate costs €100 and is designed for shorter journeys. Both membership rates include VAT and fuel is free of charge. IInsurance, breakdown service and maintenance are all included in the price (Caisse-commune, 2003).

Although the majority of schemes are based around car sharing schemes there are some that work in conjunction with public transport operators. For instance in France, Renault has forged partnerships with key public transport operators to study and develop intermodal park and ride solutions. *SARRASIN*, a subscriber car service for rural areas is being piloted in the Abbeville area. Typical of most rural areas, mobility and accessibility are a major problem due to a sparsely populated area which is not served particularly well by public transport. *SARRASIN* aims to respond by combining transport on demand by

optimising the capacity of a car fleet within a comprehensive public transportation system (Renault, 2003).

Ford initiated the use of company buses at its plant in Genk, Belgium as it wanted to reduce the environmental impact of its 12,000 plus employees travelling to work each day. In particular, congestion in the local area was a major problem during shift changeover when approximately 3,000 employees changed shifts. Ford provided a direct and fast bus service which also allowed employees from neighbouring companies to board. Car pooling was also widely encouraged and if staff had to work overtime they were guaranteed a free ride home. Inclusion of a bus service along with other measures encouraging sustainable travel resulted in a huge reduction of staff driving to work on their own. For instance the company achieved the following split of travel modes used to get to work: 27.8 per cent drove alone, 32.8 per cent car pooled, 24.4 per cent used the company bus, 5.7 per cent caught public transport buses, 1 per cent rode a motorbike, and 2.9 per cent cycled (TravelSmart, 2003).

It is evident from the literature that there are lots of examples of the motor industry becoming involved in mobility services. The extent to which mobility services provide the motor industry with a profitable business venture is at this point still somewhat unclear. Clearly some of the more innovative schemes mentioned above have been undertaken as pilot projects, whether such schemes will be extended once the pilot expires is also unclear. However, some schemes do give car manufacturers opportunities to showcase alternatively powered vehicles and to test out other innovative technologies. Also, car share schemes create a relationship with a new class of motorists – one which might well own their own cars otherwise, but might not purchase a brand new one. Extension of and the development of further schemes is perhaps an indication that the motor industry does see mobility services as providing a viable business opportunity. It is clear that more research needs to be undertaken on the longevity of schemes and the benefits that they can offer to the various parties involved.

5.3 The Role of the Consumer

The government and the motor industry have an important role to play in relation to mobility services, with the former helping to promote them and the latter in providing them. However, ultimately the success of such schemes depends upon their being used, and this of course depends on the consumer. Whilst the last two sections have touched upon the motivations behind government and the motor industry's involvement, this section examines what motivates consumers of mobility services.

The motivation of consumers to use mobility services is a complex issue, as individual consumers will ultimately have a variety of motivations based on their own individual needs. To many the main requirement when deciding upon a mode of transport is to choose the fastest and most convenient one, the economic cost of this mode may also play a part, although research would suggest to a lesser degree.[13] It is clear that for the majority of people the fastest and most convenient mode of transport is the car. However, to some extent this rests on perceptions of what mode is the fastest and most convenient, as arguably

[13] For example, the increasing cost of motoring has not priced people out of their cars. However price-eventuality is a complex issue, as it is known to vary according to mode, user type and journey type. Also, it is known that motorists often overlook capital costs and many other expenses in estimating their marginal cost of driving.

on short distance journeys the bicycle could in many cases clearly be faster than a car. Similarly, on longer journeys, public transport (particularly where infrastructure allows for dedicated bus lanes, or of course railways) can also be found to be much quicker. Nonetheless it is important to note that convenience is not always based on the speed of a journey, rather the ease of getting in one's car as opposed to walking to a bus stop/train station and waiting for public transport, or the ability to carry heavy goods which can become far more difficult when travelling by bicycle, on foot or with public transport. Conversely, a long rail journey may allow time for relaxation, working etc.

Of course there will always be some members of society that do not drive and already use sustainable modes of transport. However, for the majority of western society the car is undoubtedly seen as the most convenient mode of transport to get from A to B. Nonetheless, it is apparent that an increasing number of consumers are beginning to use mobility services. Understanding why this pattern has emerged is perhaps fundamental to the future prospects of mobility services as a feasible alternative to single occupancy car trips. The rise in mobility services could be explained by the fact that speed and convenience are not the only factors consumers take into account. For instance, consumers can be motivated by the environmental impacts of their travel behaviour, or by the health benefits of using alternatives to the car and of course the cost of using and running a car. Behrendt *et al* (2003) compare studies from Germany and Switzerland that have explored the reasons people have for joining a car share scheme (Baum and Pesch (1994) and Muheim (1998), respectively). Baum and Pesch found that environmental aspects were the most common reason for joining a car sharing service, as it was cited by 70 per cent of respondents. Around two in five respondents also highlighted the complementarity of car sharing to public transport and the rising costs of car ownership. Muheim found the main reason to be that car sharing met users mobility requirements (63 per cent), whereas the cost of car ownership and environmental reasons were only mentioned by one in four and one in five people, respectively. Two Dutch studies also investigate the reasons for joining car sharing schemes, although neither take into account environmental considerations. Both Bosch *et al* (1998) and Meijkamp (2000) identified the increasing cost of car ownership and the inadequacy of public transport as key reasons for joining a car sharing scheme (both were cited by around half of the respondents in Meijkamp's study). Schrader (forthcoming) found that users thought that the principal advantages of car sharing when compared to owning a car were not having to buy the car in the first place, not having to maintain the car and the range of cars that car sharing schemes can offer.

However, understanding travel behaviour is an extremely complex issue, as although consumers may have awareness and concern for environmental and health issues this does not necessarily translate into changing behaviour pattern. For instance it could be argued that the majority of smokers know that smoking is bad for them, however still continue to smoke. Similarly many drivers understand the damaging effects that arise from car use but this does not stop them from using their cars. Accordingly it is important to understand when awareness and concern actually translates into a change of behaviour, which in this case results in the use of mobility services?

As mentioned earlier, most car owners/drivers use this mode of transport because they perceive it to be quick, convenient and relatively cheap to use. For a car owner to decide to car share they would need to make the decision that 'access' to a car provides similar or more benefits than actually owning their own vehicle. Schrader (forthcoming) attempts to shed some light on why they might come to this decision by examining the nature of the

property rights and duties resulting from ownership. An increased understanding of these rights and duties, particularly with respect to identifying the potential benefits of non-ownership, could enable the development of policies to influence consumer acceptance of a different product-service combination, eg a shift away from ownership to other forms of product-service combinations. Table 6.1 gives an overview of property rights and duties associated with car ownership compared to those inferred by car sharing (see Table 6.1). It can be seen that a different model of ownership, such as car sharing, restricts the property rights of the user over the product, thus making it less attractive than ownership in this respect. However, when the duties associated with ownership are also taken into account, it can be seen that there are also significant benefits to be gained from not owning a product, but being able to use it through alternative product-service arrangements. While this approach provides a useful perspective, it is not the complete solution to increasing the acceptance of such services, as the symbolic nature of ownership is clearly also important. On a positive note, Schrader argues that such symbolism could also be attached to services; for example for some target groups, the symbolic nature of membership of a car sharing organisation, or access to the broad range of cars that a large organisation might provide, could become just as important.

Of course it is important to note that participation in a car sharing scheme does not necessarily mean that users surrender all of their vehicles. Research has suggested that car sharing schemes have allowed some members to effectively use the shared car as a second car in addition to the one they already own (eg Bosch *et al*, 1998; Meijkamp, 2000). However, these studies also identify significantly more people who do actually give up their car. Similarly, San Francisco's City CarShare scheme claims that 25 per cent of their members have given up their car since joining the scheme, and a further 25 per cent claim that membership has enabled them not to have to purchase a car (Behrendt et al, 2003).

Schrader's model can also be extended to bike pooling. For instance users can weigh up the pros and cons associated with owning a bike compared to using communal bikes from the pooling scheme. This could take the form or balancing advantages of owning a bike all the time and being able to use it whenever and wherever, compared with the restricted zones for bikes from the pool. Similarly there are issues of owners being responsible for maintenance of their own bike, compared with always having a 'working' bike on hand. Similar analogies can be made with some of the more innovative forms of public transport and also with car pooling (these have been touched upon in Chapter 4).

Of course the power of advertising may also play an important role in people deciding to choose mobility services in that awareness of alternatives to single occupancy car journeys is fundamental in encouraging the rise of mobility services. Often people use their car, as it's the only thing they know. The majority of people who drive will not necessarily be aware of bus/train times, routes or the cost of a ticket. Similarly car sharing and bike pooling schemes are only a feasible alternative if people are actually aware that they exist. The power or advertising, or the awareness of alternatives is fundamental to the success of mobility services. This has been highlighted with recent examples of individualised marketing schemes or personalised travel plans.

Table 3.3: Property Rights and Duties as applied to Car Ownership and then compared with car sharing

Property rights	Example in relation to car ownership	Change if driver chooses car sharing rather than ownership
Right to use	An owner can use his car when, how and where s/he wants to.	+/- as the car sharer has an extended right to use a range of cars, although his/her right to use is restricted in terms of time.
Right to exclude others	An owner can exclude other persons from using the car.	- as the car sharer has no right to exclude other members of the car sharing organisation from using the car .
Right to physically transform	This refers not only to wear and tear, but the owner is also allowed to customise the car, internally and externally, as desired.	- as the car sharer has no right to customise the car in a lasting fashion.
Right to transmit or dispose	An owner can sell on or dispose of the car.	(-) as the car sharer cannot transmit (or dispose of) the car, but this is not too important for cars, as with other consumer goods
Right to benefit	An owner can gain from exercising any of the above rights. For cars, the monetary benefit of transmitting is often not significant, so is not really relevant here, although there are obvious intangible benefits to be gained from exercising some of the other rights.	(-) as linked to other rights, above.
Property duties		
Duty to use	An owner will only benefit from the car by using it, so in one sense, there is a duty to use, but this is not too relevant in this case, as few drivers see driving as a duty.	(o) as a car sharer also has a duty to use, but this is not really relevant for the reasons set out in the previous column.
Duty to store away	Coupled with the right to exclude others is the duty to store the vehicle in a manner that does not burden others, hence space (either public or private) needs to be allocated for parking.	- as the duty to store is the responsibility of the car sharing organisation, so the owner car sharer's duty to store is restricted.
Duty to maintain	Coupled with the right to physically transform is the duty to maintain it so that it does not pose a danger to other people.	- as the duty to maintain is the responsibility of the car sharing organisation, so the owner car sharer's duty to maintain is restricted.
Duty to transmit or dispose	As well as the right to transmit or dispose, there is also a duty to transmit (or dispose of) the car lawfully.	(-) as the duty to transmit (or dispose of) is the responsibility of the car sharing organisation, so the owner car sharer's duty to transmit (or dispose of) is restricted.
Duty to take over costs	The right to benefit from ownership is accompanied by the duty to take over the costs. This includes fixed costs, such as the purchase of the car, and variable monetary costs, such as fuel, insurance and maintenance, etc, as well as non-monetary transaction costs.	- for fixed costs, as these are paid by the car sharing organisation + for variable monetary costs, as, in addition to fuel costs, there are costs associated with the operation of the car sharing organisation. + for non-monetary transaction costs, as the shared cars have to be booked.

Note: '+' means an extension; '-' means a restriction; 'o' means no change; and () means that the classification is not important for this discussion.

Source: Summarised from Schrader (forthcoming)

In Perth, Australia, an individualised marketing trial was initially applied to 380 households[14]. Households that agreed to take part were given localised information on sustainable travel options and small rewards for trialing such modes. This included free public transport tickets and discounts at various local shops. Evaluation surveys showed a 10 per cent reduction in car driver trips and an increase of public transport trips by 21 per cent. Furthermore surveys conducted twelve months and two years later showed these changes to be sustained. However it is important to note that the individualized marketing scheme was just one of a number of complementary programs included in the Australian's Department of Transport's 10 Year Plan to replace car trips with alternatives. In addition to improving travel awareness the plan included inter alia the improvement of public transport and cycling infrastructure, to make alternatives more attractive (Brog and John, 2001). Nonetheless the degree to which raising awareness undoubtedly played in promoting alternatives should not be ignored. Indeed, this could have important connotations for the promotion of mobility services as a viable alternative.

5.4 Summary and Conclusions

From the discussion of this chapter, it is clear that industry, government policy and consumers all have an important part to play in relation to mobility services. It is also clear that in many ways the roles of these actors are interlinked and each represents an important ingredient necessary to provide a successful outcome. Furthermore, other exogenous factors also play an important role, such as efficient public transport, in determining the success of mobility schemes such as car sharing and bike pooling. A more detailed look at the extent and nature of the roles that they play in relation to the success of a scheme will be progressed in the next stage of this project. However it is important to note that to a large extent this paper has concentrated on illustrating examples of the more successful stories of mobility services. This has occurred because by their very nature, information on successful schemes is more widely available than those that have failed. However, to ignore schemes that have failed is perhaps misleading as looking at failed schemes can prevent similar mistakes being repeated in the future. Accordingly, a more detailed look at why some schemes failed when others succeeded, and the lessons that can be learned from this will also be examined in the next stage of the project. Chapter 6 will now outline these in more detail.

[14] The success of the pilot led to a repeat of the project over a wider area covering 17,500 household in South Perth during February and June 2000 of which 6,100 households were identified as potential new users of public transport, cycling and walking and were provided with information accordingly.

6 Summary of the Main Findings and Next Steps

As was outlined in Chapter 1, the aim of this report was to report on the first stage of this project – *Mobility Services: Setting the Policy Framework*. The aim of the report was not to be comprehensive, but rather to give an overview of the state of play with respect to the development and introduction of mobility services. This has a number of elements, including addressing what is meant by the term 'mobility service', how and where these are being developed and implemented and the role and motivation of the various stakeholders involved. The ultimate aim of the report, and the first year of work on the project, was to set the framework for the indepth research to be undertaken in the course of the second year of the project. This chapter starts with a summary of the findings of the first year and outlines the work that will be undertaken in the course of the second year.

6.1 Summary of the Main Findings of the Report

The principal conclusions that can be drawn from the report include:

- Mobility services are put forward as part of the solution to the problems of the transport sector and as having a role to play in a future sustainable transport system (Section 2.3).
- A range of services are claimed as examples of mobility services, but few definitions exist, and these are not necessarily consistent (Section 2.3). Certainly some of the claimed mobility services fall outside the scope which we have adopted in this report.
- The discussion of mobility services in the transport sector is mirrored in other sectors of the economy where services are seen as having a key role to play in a future sustainable economy (Sections 3.1 and 3.2). There are both similarities and key differences in the nature of each services between … and other sections
- The service literature underlines, however, that services per se are not necessarily beneficial for the environment, and a number of concepts have been developed to characterise this issue (Section 3.1).
- Many of these emphasise the need to shift the focus of a service away from a tangible product towards use- and result-orientated services, where the focus is on providing for the intangible needs of the consumers (Section 3.1).
    - Necessarily such a shift requires a change in role of, and relationship between, the service provider and the consumer. The need for government intervention to set the appropriate policy framework is also emphasised (Sections 3.1 and 3.2).
    - The broader service literature gives many examples from the transport sector in its discussion about services that are beneficial for the environment, ranging from taxis and public transport to car rental, pooling and sharing (Section 3.2).
    - This literature also contains many innovative examples where products are being delivered through a more service-orientated approach, and which have environmental benefits (Section 3.2.1).
    - However, the development of a more service-orientated approach faces a number of barriers that are cultural, financial and economic and may yield unexpected environmental impacts (Section 3.2.2).

- Many of these issues were shown to be equally relevant to the transport sector (Section 3.3).
- It was noted that while many services in the transport sector could be referred to as mobility services, not all necessarily positively impact on the transport system in the context of the need to move towards a more sustainable transport system. It was proposed, instead, that when we talk of mobility services in the context of a future sustainable transport system, we are talking about services that focus on the providing for the needs of the transport user rather than those related to products (Section 3.3).
- Hence, the review of mobility services focused on 'innovative' mobility services, ie those that focused on providing for the needs of the transport user, but which are not, at present, a common element of the transport system (Section 3.4).
- Examples of car sharing services were the most common form of mobility service identified, but examples were also found of car pooling, bicycle pooling, innovative public transport and initiatives to integrate better information and ticketing of various modes (Chapter 4).
- Car sharing schemes varied in the origins, size, commercial motivations and membership. They were found to be more developed in some countries, such as Germany and Switzerland, than in others, eg the UK (Section 4.1).
- Studies suggested that car sharing could have benefits for the transport system and for the environment, while allowing users to maintain comparable levels of mobility, through reduced car trips and the need for fewer cars, but increased use of other modes. Other services were also seen to have benefits (Chapter 4).
- Many of the 'innovative' services are enabled by technological developments, such as the internet and smart cards (Chapter 4).
- Some level of government has played a role in the development of many of the examples of innovative mobility services that were identified, due to their potential benefits for the transport system, in terms of reducing car dependence, and the environment (Section 5.1).
- Many vehicle manufacturers have also become actively involved in the provision of some mobility services, principally for their potential economic benefits, but also for their environmental benefits (Section 5.2).
- Consumers use such services for a number of reasons, including costs and their perceived reduced impact on the environment (Section 5.3).

These findings suggest that a number possible agendas for future research, three of which will be pursued in the course of the second year of the research. These are addressed in turn in the following sections.

6.2 Next Steps

This report has highlighted a number of issues, and to afford a greater understanding of them a more detailed analysis is required. Accordingly, three specific areas have been chosen to form the basis of three separate research projects. These are:

- **Sustainable Transport as a Service for Sustainability**. The aim of this work is to expand the analysis of Chapter 3 to explore the links between transport and services in the context of sustainable consumption in more detail.
- **Manufacturers' Role in a Future Mobility Service-based Transport System**. The aim of this project is to examine in more depth the role that the motor industry might play in the future provision of mobility services.
- **Selling Mobility Services to Consumers**. The aim of this project is to examine how various mobility service schemes engage their consumers, in particular through advertising schemes, with a view to establishing rationales for the type of strategies undertaken and also to provide a best practice guide to help direct future marketing of schemes.

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