Mobility Sector Report

Deliverable 5.1

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Executive Summary

The SPREE Mobility Research (Work Package 5) aims:
- to explore existing examples and best practices of servicizing systems within the mobility sector and to identify additional servicizing opportunities;
- to develop sector-specific methodological tools in the mobility sector to measure the impacts derived from the shift towards servicizing;
- to build a conceptual framework for assessing social aspects of servicizing systems in the mobility sector, in particular car- and bike-sharing;
- to identify the drivers and barriers for the diffusion of servicizing practices in the mobility sector;
- to provide a broad overview of why previous policies in the mobility sector had not led to absolute decoupling;
- to identify potential servicizing policy paradigms that can lead to an absolute decoupling in the mobility sector;
- and to collect the relevant data for the servicizing System’s Agent-Based Modelling (ABM).

In light of these pre-defined tasks, the aim of this deliverable is twofold: (1) It sets out the conceptual and methodological frameworks of servicizing in the mobility sector, and (2) It serves to identify the specific mobility system to be investigated in the project and presents the appropriate methodologies to employ for researching this system in the SPREE countries (UK, Sweden, Finland and Israel). Exploring the key elements and aspects of servicizing in mobility seeks to clarify what is happening in the mobility sector in relation with servicizing systems. The identification of the assessment indicators guides what action should be taken to increase the uptake of servicizing systems increases in the mobility sector. The SPREE Mobility research was conducted in parallel to the Water and Agri-food research (Work Packages 4 & 6) and established mutual learning processes and exchange of information.

Conceptual Framework of Servicizing in Mobility

Servicizing is defined in SPREE as “a transaction where value is provided through combination of products and services and where satisfaction of customer needs is achieved by selling function of the product rather than product per se and/or by increasing the service component of the offer. Thus, each offer represents a continuum of products and services, which can be further servicized” (task 2.3: “Establishing a common understanding of the notion of servicizing”). The strategies toward sustainable business models as described in Work Package (WP) 2 (“Conceptualization”) are clearly applicable to mobility. The servicizing continuum in mobility moves along from transport goods to mobility services and covers reduction of the need to travel with changing levels of ownership, space/time, actors, products and services. These elements are in turn affected by Information and Communication Technologies (ICT), eco-innovation and the European Union’s (EU) sustainable development vision.
As the upper part of the above figure shows, ownership issues are most evident in car-sharing, while at the other end of the spectrum public transport does not entail any ownership issues. The level of ownership is less of an issue in bike-sharing as owning a bicycle does not entail any status or as much flexibility as owning a car provides. Car-sharing needs the highest number of new actors including accreditation bodies and service providers (i.e. car club operators), while bike-sharing only needs a bike-sharing provider and servicizing in freight transport only needs logistics collaboration companies as new actors. Spatial aspects like walking distance to parking zones are most important with car-sharing and bike-sharing. Car-sharing, bike-sharing and goods mobility have significant time management aspects within the temporal aspects that include reliability, availability of cars and the proportion of walking and driving time. Servicizing in goods mobility and telepresence are highly dependent on the use of ICT and it is car-sharing that requires several business and policy innovations.

Such implications of exploring the key elements of servicizing practices in the mobility sector are then integrated into social and political aspects (social progress and justice and equity implications of servicizing for social progress) of servicizing practices. The discussion reveals that mobility capitals and political economic institutions influenced by public, political and business discourses, respectively, lead to crucial social impact assessment indicators as indicated in the above diagram. Overall, the review of the empirical evidence provides us with the conceptual framework of servicizing in mobility, which in turn identifies the political, cultural, resource and physical constraints that need to be addressed when assessing the social, economic and environmental impacts of servicizing in mobility.

**Methodological Framework of Servicizing in Mobility**

In constructing the methodological framework, the discussion provides a critical overview of the existing methodologies in measuring decoupling and social impacts of transport and mobility as well as the identifying the key challenges of using these indicators and methodologies for servicizing in mobility. In doing so, how physical and resource constraints (to inform decoupling indicators) and
social and political constraints (to inform social impact indicators) should be addressed has also been discussed.

The wide literature on the wider societal/economic benefits of transport involves holistic consideration of economic, environmental and social impacts of servicizing in mobility. Given that policy scenarios are a substantial part of the research, it is important to understand different pathways toward absolute decoupling through servicizing. We propose to assess separately economic and environmental impacts to identify the direction of changes amongst the combinations of the following pathways: (i) wellbeing from economic growth (ii) Economic growth from mobility, and (iii) mobility from environmental impacts. The social impacts of any servicizing system in mobility should be categorised into direct/indirect and subjective/objective measures.

Mobility System Definition

The system chosen for study within the mobility sector is the potential to move along the servicizing continuum between vehicle ownership, through the currently available methods of sharing to passenger transport in particular city contexts. It is entitled “From owning to sharing in car and bicycle use across European contexts”. Specifically, the empirical work will focus on moving away from private car ownership towards servicized vehicle use mainly concentrating on car sharing and bike-sharing. The following diagram depicts how the chosen system is considered, based on the project’s servicizing definition.

The continuum between car ownership and car sharing was chosen because it was seen as an area through which comparisons could be derived from both different contexts, including both large cities
versus smaller towns, but also due to the potential for interesting comparisons to be made across the selected country contexts in the project (UK, Israel, Sweden and Finland).

Methodology and tools

The **decoupling indicator** for the mobility sector in this project is identified as the emissions/energy use per unit of revenue (and household income) from car club sector growth (or vkm driven if bike-sharing is the focus depending on the country system definition). This will be compared to the conventional private ownership model. The social impact assessment should concern whether the impacts are socially just and the benefits are evenly distributed. The study will be conducted employing expert/business interviews, surveys and focus group discussions. The research design for mobility research in the SPREE project consists of the following steps.

- Identification of the country-specific social aspects/impacts and behavioural data collection
  - Conduct focus group discussions to understand country-specific policy and social dynamics
  - Change the SPREE mobility questionnaire according to the country-specific characteristic
  - Conduct survey (150-200 people)
- Economic and environmental data collection
  - Identify the key players (car clubs/bike-sharing providers)
  - Identify the types of vehicles that car clubs/bike-sharing providers use through desk research and business interviews
  - Identify the vehicle supply arrangements of the car clubs/bike-sharing providers in the city (i.e. whether trucking is used for transporting vehicles)
  - Identify the maintenance arrangements of the car clubs/bike-sharing providers in the city (i.e. whether cars/bicycles are transported to cleaning facilities)
  - Identify the legal requirements by the government through desk research and expert interviews (i.e. the minimum emission profiling of the sector given the accreditation system)
  - Identify the arrangements between government-car club sector/bike-sharing provider with respect to infrastructure and road use charges
  - Collect the life cycle analysis (LCA) data identified from the secondary sources (i.e. published papers)
  - Collect the business data identified above from the annual reports/press/business interviews.

**Progress beyond the state-of-the-art**

The innovative character of the SPREE Mobility research is the holistic perspective it provides on the systems of private car ownership and alternative modes of transport. As well as treating moving away from private car ownership in the form a continuum as guided by the generic definition of the project, the SPREE Mobility research also examines social and governance elements of the transition towards servicizing alongside changing business models and associated environmental benefits.
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1. Introduction

1.1 Mobility, society and economy

Global movement of people and goods has historically defined the social and economic trajectories of nations’ development. It has long been proposed that transport infrastructure development can be used to stimulate economic development by increasing the access of producers to markets and consumers (Goetz, 2011).

Increased economic integration and its mobility requirements, however, came with significant environmental, social and economic threats. The transport sector has a leading role in energy consumption; energy consumption from transport has grown by over 30% since 1990 (European Environment Agency [EEA], 2013). Emissions of greenhouse gases (GHG) from transport increased by 25% between 1990 and 2008 (EEA, 2011). Road transport accounts for 72% of all EU transport-related CO₂ emissions, which during 1990-2005 grew by 32% (van de Ven and Wedlock, 2008). Road transport congestion is also very costly: traffic congestion adds 6% to the EU road transport fuel bill, which is equivalent to 0.5% of the EU Gross Domestic Product (GDP) (Jorna, et al., 2009).

Studies projecting the next two decades do not portray a better future for these transport-related impacts, either. At a country level, transport is the sector with the fastest growing demand in the New EU Member States. The share of the transport sector in final energy demand in these countries is expected to increase to 25.4% in 2030 (EC, 2009). It has been reported that road freight transport is set to increase by 55% while passenger road transport will increase by 36% from 2000 to 2020 (van de Ven and Wedlock, 2008). More than two billion cars are expected to be on the road globally by 2030 (Sperling and Gordon, 2009). It is therefore not surprising for the EU transport policy to prioritise the curbing of transport emissions, primarily through shifting from road transport to other modes in urban contexts and focusing on the bottlenecks within the New Member States, as can be observed in the White Papers in 2001 and 2011 (EC, 2001; EC 2011).

What unites these macro-level economic and environmental problems is the rhetoric of the link between the European economy and the environment. In fact, transport emissions have decreased by 5% between 2007 and 2009 mainly as a result of global recession, lending support to the associations between the economy, the environment and the transport (EEA, 2012). As the economy grows, mobility increases, and so do the environmental impacts of the transport sector. However, given the development of emerging forms of mobilities and the complex interactions between them, such as the use of ICT and the social consequences of physical mobilities and transport systems, such reasoning remains too shallow to reveal the intricacies linking travel behaviour, macro-level developments and broad political imperatives with global economic and environmental governance.

Limiting the concept of prosperity to material indicators including economic and environmental outcomes is likely to lead to socially impartial outcomes. Social considerations of accessibility, distributional and equity implications are equally important and do not necessarily follow economic growth, as has been assumed (Jackson, 2009; Stiglitz, et al., 2009). Physical access to key social services can be regarded as a basic need met by improved transport services. However, due to socioeconomic disadvantages and other social divisions, not everyone can benefit from these accessibility impacts.
As a result, while earlier perceptions of transport policy focused on economic grounds only, issues relating to the environmental and social sustainability of transport have made transport’s role in moving toward sustainable development agenda more central. The Servicizing Policy for Resource Efficient Economy (SPREE) project hypothesises that servicizing systems, which are simply defined as systems of transactions, where value is provided through a combination of products and services, have the potential to contribute to delinking these environmental and social impacts of transport from economic growth. With this in mind, the project aims to identify the potential servicizing policy packages facilitating the transition from selling products to providing services toward absolute decoupling.

The major question, however, is not whether the absolute decoupling in transport will be achieved through servicizing, but how environmental and economic sustainability and social inclusion can be fundamentally integrated into our understanding of mobility patterns and transport systems through low-energy transport innovations to mitigate social, political and resource constraints. Accordingly, the issue of decoupling environmental impacts of transport from economic growth comes with several definitional (i.e. how to indicate decoupling in servicizing), methodological (i.e. how to measure decoupling impacts of a small-scale intervention) and conceptual issues (i.e. whether it is possible to separate social and environmental impacts in the context of servicizing).

In a sense, the underlying issue is how one defines growth and prosperity and starts deconstructing the narrow definitions of economic development (i.e. production), and eventually the social consequences of over-reliance on large scale economic systems and manufacturing industries. With this broad picture in mind, this report aims to conceptualise the role of servicizing systems in achieving sustainable and inclusive mobility in the EU as well as recommending research strategies to empirically test the economic, social and environmental impacts of servicizing systems in the mobility sector. Given the emphasis of the project on the mobility as a function/capability, it is important to go beyond the transport sector and consider mobility in all aspects.

1.2 Researching ‘Servicizing’ in Mobility

The SPREE project has four methodological steps to understand the decoupling impacts and societal benefits of servicizing systems (Figure 1):

- Conceptualisation and detailed definition of servicizing;
- Construction of a methodological framework employing Agent-Based Modelling (ABM) to stimulate the potential of servicizing systems in the water, mobility and agri-food sectors;
- Mobility case studies in the UK, Sweden, Israel, Finland and Spain;
- Construction of servicizing policy packages aimed at facilitating servicizing systems with environmental, economic and social benefits.
The role of the mobility sector in the project entails employing the generic conceptual and methodological framework provided in Work Package 2 (WP2) and WP3 (“Methodology development”) to construct mobility-specific methodologies to be able to finally evaluate the servicizing system and policies’ impacts in the case study countries. This is done through exploring the existing servicizing practices, understanding the role of ICT and eco-innovation in servicizing systems, conceptualising social aspects of servicizing in mobility and identifying potential servicizing policy paradigms that can lead to decoupling in the mobility sector.

In line with this pre-defined task allocation, the mobility-focused research in the SPREE project has three specific objectives: (a) To construct a generic conceptualisation of servicizing in mobility; (b) To identify the potential of adoption of servicizing in mobility; and (c) To identify the potential impacts of servicizing in mobility and to identify policy instruments categorising them according to their effectiveness and the level of implementation. There are several research challenges related to these objectives. These are discussed below by briefly presenting the methodologies and how the assumptions and the results link with the rest of the project.

1) To construct a generic conceptualisation of servicizing in mobility
   - What are the key elements to draw from the generic definition of servicizing to explore mobility-specific servicizing? What are the roles of ICT and eco-innovation?
   - What are the key environmental and economic aspects of and the key agents associated with the existing servicizing practices in the mobility sector?
   - What are the social aspects of servicizing in mobility?

These research questions require examination of the existing practices by identifying the pre-defined key elements of servicizing in these practices through desk research. This discussion feeds into the conceptual framework of social aspects of servicizing in mobility.

Links with other SPREE tasks: The continuum aspect of the generic definition of servicizing (WP2) forms the basis of the conceptual framework of servicizing in mobility. The output of this set of research questions finalises the generic ABM definition for mobility as well as informing the selection process of the mobility system to be investigated in country case studies.
2) To identify the potential of adoption of servicizing in mobility

- What are the availability, barriers and uptake of servicizing activities in mobility?

This research question seeks to identify the potential of adoption of servicizing in mobility in any geographical context. Starting with the identification of the potential travel markets in selected urban contexts is key to understanding how policymakers see the potential users of these services and what actually happens. Once this perspective is established, the barriers of the use of servized mobility systems are identified from both user and provider perspectives. The segmentation of the market given the institutional context, through desk research and expert interviews with planners, infrastructure providers, public transport providers and transport servizing operators, is the central approach to understanding the potential of adoption.

*Links with other SPREE tasks:* The conceptual framework and the initial desk-based research on the cities selected (Bristol and London in the UK case) are used to identify the expert groups. The system selection has provided a common understanding of servizing in the discussions. The lists of business and consumer groups, products, services and infrastructure providers, consumer income groups and relevant infrastructures are identified along with the required data input. The identification of these factors on two different scales (large and medium sized city) informs the first set of specific data collection methods (expert interviews) to be applied in country feasibility studies.

3) To identify the potential of impacts of servicizing in mobility

- What are the general methodologies of measuring the decoupling and social impacts of transport?
- How should they be altered to measure the impacts of servicizing in mobility?

This is the main outcome of WP5 (“Case study of the mobility sector”) and will be applied to the rest of the mobility research in the SPREE. The ultimate aim of this research objective is to construct a methodological framework for identifying the impacts of ‘moving along the servizicing continuum’ in car/bicycle ownership to be employed in the UK, Sweden, Finland and Israel cases. This report only provides the methodologies to identify the potential impacts of servizing in mobility. The methodology provided in this deliverable will feed into the generic methodology developed in the tasks 3.1 (“Methodology development for measuring economic and environmental impacts of servizing activities”) and task 3.2 (“Methodology development for measuring social impacts of servizing activities”).

The figure below illustrates the role of mobility sector in the SPREE project. The figure indicates how the SPREE Mobility Research (SMR) informs and is guided by the generic conceptualisation and methodology development. The aim is to provide a mobility-specific conceptual and methodological framework to be applied to case studies in the UK, Sweden, Finland and Israel. It should be noted that the UK case study has been employed to improve the mobility-specific generic conceptualisation and methodologies; therefore this deliverable will include some of the data/analysis on the UK case study, which will be presented in full as part of WP7 (“Country feasibility study”).
The collection of existing best practices and the identification of the main elements emerging from these practices have informed the conceptual framework, while the definition of servicizing provided by WP2 (“Conceptualization”) helped SMR to identify the generic conceptualisation of mobility. From a methodological point of view, the ontology development and system definition in terms of ABM has been an interactive process between the ABM team and the mobility team.

1.3 Deliverable Structure

Chapter 2 is entitled Conceptual Framework of Servicizing in Mobility. This chapter aims to provide a generic conceptualisation of servicizing in mobility. This is done through drawing on the key elements from the generic definition of servicizing in SPREE and reviewing the existing servicizing practices in the mobility sector. The social aspects are also identified in Chapter 2. The conceptual insights provided in Chapter 2 provide the basis of the approach to researching servicizing in mobility and inform the selection of methodologies for SMR to be conducted in the UK, Israel, Sweden and Finland.

Chapter 3, entitled Economic, Environmental and Social Measures of Servicizing in Mobility, provides an overview of the links between economic growth and transport development and the implications of these links for environmental sustainability and social inclusion. The chapter discusses how the instrumental and social aspects of servicizing elements identified in Chapter 2 can be integrated into the existing measures and what is necessary for development of the methodologies. The intricacies of the economic, social and environmental impacts of transport are tackled through identifying the specific measures relevant to understanding the impacts of servicizing in mobility. Chapter 3 serves as the first step toward SMR methodology to be applied in the case study countries.

Chapter 4 presents the SPREE Mobility Research Approach by starting with the identification of the system selected for investigation in the mobility sector of the project. Having identified the main elements and boundaries of the system selected, the chapter also discusses the important policy scenarios, drawing on the exploratory case study research conducted in London and Bristol. Specific details about the approach and the required methodologies,
including the structure of focus group discussions and expert discussions are included in Chapter 4.

Chapter 5 provides a concise summary of the documents pointing out the major steps followed in identification of the methodologies to be employed.
2. Conceptual framework of servicizing in mobility

The recent potential to digitise consumption practices through network technologies, further supported by state incentives and awareness campaigns, has made sharing practices and service provision easier for consumers and businesses. It is tempting to see this trend as analogous to the transition from industrialisation to a service economy in 1970s. However, recent developments in the sharing and service economy show that the rise of sharing practices and the growing emphasis on services is not indicative of the level of services in the economy, but indicative of the extent to which buying products can be replaced by buying services, or more broadly, to the degree of replacing individualism in consumption with a sharing culture. At first glance, the emphasis on replacing ‘buying products’ with ‘buying services’ may be consistent with the concept of a product-service system – a ‘marketable set of products and services capable of jointly fulfilling a user’s need’ (Goedkoop, et al., 1999). With this concept the authors offer grand narratives for defining a ‘functional economy’, in which function is considered to be the central determinant of consumer satisfaction (see Mont, 2002 and Stahel, 2010).

However, focusing solely on the economics and business models to increase the serviceability of consumer needs without considering the social and political implications brought about by sharing render business models or local community projects piecemeal or even only innovative ideas. Furthermore, the presupposition that these practices are inherently beneficial for all aspects of the economy on all scales has misleading policy implications. There is a lack of understanding of the ambiguity of their impacts, and the transport sector is no exception.

In addition to the industrial ecological conceptualisations of these emerging business models, investigating the complexities of the system of automobility sheds light on the practice of sharing in transport with reference to the hegemony of private cars (Dowling and Simpson, 2013), flexibility provided by private car ownership (Duncan, 2011), and spatial requirements of car-sharing (Zhou and Kockelman, 2011). Although this is extremely useful for conceptualising vehicle-sharing in practice, looking at alternatives to access to cars or other modes of transport, in terms of practices and perceptions, fails to understand automobility within wider institutional and organisational patterns.

With all these developments it should also be borne in mind that transport is historically shared and all mobility involves the sharing of spaces, which are politically and physically constrained. Considering the historical evolution of the societal idea of sharing and servicizing, the business ideas based on sharing and the emerging technologies and policy innovations should thus be clearly explained. As will be discussed in the subsequent sections, aside for the emphasis on servicizing as a business model and the role of ICT and eco-innovations in enabling servicizing models, the nature of mobility as a service itself and the complex social and political interdependencies between the aspects, practices and agents render the expansion of conceptualisation of servicizing in mobility inevitable.

What incentives exist for people, known to be ‘unsustainable by nature’ (Rees, 2010), to use transport services at the expense of losing ownership? Are these options always more desirable in terms of economic, social and environmental sustainability? These questions are broad in scope and lie beyond mobility-specific practices; in addition, any attempt to answer them is likely to yield several other questions. Acknowledging the importance of these questions and the limitations of any
attempt to provide answers for them is, therefore, the starting point to conceptualising the potential of a sharing culture and servicizing practices in transport.

2.1 Key elements of ‘servicizing’ in mobility

2.1.1 Servicizing in mobility as a continuum

While service and sharing thinking in transport and mobility services has been extensively discussed with an emphasis on altering consumption patterns to deliver more sustainable transport, servicizing is not a recognised research theme in transport studies. There is no definitive framework for servicizing in transport. Understanding the servicizing practices in the mobility sector, therefore, comes with several definitional and conceptual issues.

The generic definition of servicizing established in WP2 is taken as the starting point. In the SPREE project, servicizing is defined as a transaction where value is provided through a combination of products and services and where satisfaction of customer needs is achieved by the selling function of the product rather than the product per se and/or by increasing the service component of the offer (Mont and Pleyps, 2013). Thus, each offer represents a continuum of products and services, which can be further servicized. Figure 3 illustrates this continuum in the context of broad servicizing categories identified in the mobility sector by the SPREE project team.

For the purposes of the empirical investigation, how the potential of moving along the continuum is translated into a workable framework is of crucial importance. The initial list included vehicle-sharing (cars and bicycles), wireless charging stations for electrical vehicles, logistics and e-freight systems, and business practices like teleworking and telepresence. As is illustrated in the continuum, what distinguish these practices are the levels of ownership, products and services, along with the number of actors and infrastructure required.

Figure 3: Servicizing in mobility as a continuum

This generic definition provides a useful basis for understanding the features of business models that can be employed in servicizing mobility. Cost of ownership, development of business models

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1 This will be further discussed in Chapter 4 in the context of moving away from private ownership towards ‘mobility as a service’, where we identify the system-specific features of the mobility system chosen for investigation in the UK, Israel, Sweden and Finland.
including a mix of products and services, introduction of new actors to enable servicizing, and facilitation of the complementary infrastructure including ICT and long-term sustainability of service provision, are the key elements relevant to servicizing in mobility. Taken together, this provides a workable typology of business models and how they should be sustained in servicizing mobility:

- Optimise material component or the service component of the offer to reduce total life cycle costs including the cost of ownership of the material component;

**Ownership** is clearly an important variable in moving along the continuum, which entails different owner models including business-to-business (B2B), business-to-consumer (B2C) and peer-to-peer and/or consumer-to-consumer (C2C) (community-led or business-led) types in unison. By understanding the relationship between the business and user models, but also differences between the elements in the system and the types/extents of service provision, it is possible to begin to determine some of the intricacies in the different types of ownership and the business models that relate to the various points along the continuum.

- Develop/adapt business or value provision models to include services or to further servicize existing service offers,

**Products and services:** The dynamic nature of moving along the continuum renders the amount of products and services variable. Moreover, the life-cycle thinking in the generic definition of servicizing requires the examination of the changes in the use and end-of-life of products, which differ. While servicizing practices like teleworking and telepresence reduces travel need therefore do not entail any products, car-sharing practices still entail production elements.

- Create innovative partnerships for provision of servicized offers or/and expand the emergence of networks of actors

**Actors/agents:** The emergence of new actors and agents in enabling servicizing systems in mobility is one of the most important elements to be considered in conceptualisation of servicizing in mobility. Although the actors involved in the process will be further discussed in the following sections and chapters, there already seem to be variety of roles attached to the actors in the context of neoclassical economic thinking.

Consumption/use side includes the service users in general, be it companies and private consumers. Given the particular focus on the uptake, barriers, availability and perceptions of a given service, which includes the elements of both travel as a derived demand (i.e. necessary travel) and the intrinsic value of travel, social aspects are particularly evident in consumers (i.e. service users) in mobility. The switching costs of moving along the continuum in the mobility sector also have social considerations. Therefore, the perceived value of travel, that is to include both utility of sharing mobility services to enhance social capital and of private ownership, are both included in the network effects and service experience aspects identified in the interviews conducted as part of Task 2.7 (“The essential prerequisites of servicizing”).

**Providers and producers** include manufacturers, providers of shared vehicles, transport operators; insurance and infrastructure providers. Although business models are recognised to lie at the heart of servicizing (Blass, *et al.*, 2013), the mobility-specific conceptualisation of servicizing focusing on sharing and ownership emphasises the broad categories of actors rather than business model
themselves. The emphasis on life-cycle thinking renders the existence of vehicle manufacturers in the model inevitable, but there is also potential for these agents to morph their business models to remain competitive in a changing landscape and there is potential that they will offer more and more service options in the future. The importance of the production and provision side also brings the possibility of new groups of agents as experience in the process of containerisation in freight sector. The potential for new agents offering services not yet identified would also need to be factored into this category over time.

*Regulators.* Policymakers including both central and local governments play a crucial role. The extensive review of servicizing practices in the EU in the following sections reveals the diversity of organisation and institutional forms in different contexts. Together with the argument that societal changes and social relations are at the heart of servicizing in mobility, this diversity leads us to consider regulation part of an economy as a separate groups of actors.

- **Facilitate the development of supporting infrastructure and regulatory frameworks,** which often needs to be changed and/or optimised, including ICT software solutions and hardware solutions and systems.

*Spatial and temporal organisation.* The infrastructural elements identified by the generic definition of servicizing in the project are of crucial importance for the mobility sector. It could be either in the form of parking space (i.e. road infrastructure) or access to internet and mobile phone applications (i.e. ICT infrastructure). However, the mobility sector entails further spatial and temporal elements that space/time analytics should be at the heart researching servicizing in mobility. In relation with the infrastructure availability, spatial proximity (i.e. walking distance) for vehicle sharing is one of the central determinants of its usage. In contrast with public transport, car sharing, for instance, has the same spatial location with the existing ‘unwanted’ forms of travel methods including private car ownership so that it does not need a spatial diversion as is the case with trains and buses (Kent and Dowling, 2013). Finally, the centrality of time is equally crucial to understand particularly as a result of timesaving thanks to ICT and reduced congestion. The temporal issues also relate to the attention required for time management as sharing practices in transport sector are temporarily ground practices involving issues like time keeping, planning, investigating, exploring and intra-household negotiating.

### 2.1.2 Servicizing in mobility as an eco-innovation

It is challenging to conceptualise any type of ‘innovations’ in servicizing mobility as replacing ‘buying and selling transport goods’ by ‘selling and using mobility services’ has already been identified as sociocultural and business model innovations (Mont, 2002; Geels, et al., 2012). Furthermore, the central role of space in vehicle sharing systems makes it difficult to isolate the study of servicizing in mobility from theoretical intricacies relating to space, time and innovations (Storper, 2011). Such broader controversies should be kept in mind in the context of diffusion of servicizing innovations. But, the role of innovation has a specific typology in the SPREE project.

Firstly, it is understood not only as an eco-innovation, which is defined as “the production, application or use of a product, service, production process or management system new to the firm adopting or developing it, and which implies a reduction in environmental impact and resource use (including energy) throughout its life cycle” (Montini and Mazzanti, 2010, p.27). The motivations for
servicizing may be environmental, but not always. In such cases the motivation for servicizing is to create an offering that is higher in value than the product/service alone. Such value can be obtained by either reducing the cost associated with providing the service (thus earning more profits from the function being servicized) or by offering customers more functions per service (thus enable the service provider to charge more money for the service).

Secondly, eco-innovation is divided into two broad classes: product innovations integrated in the object that is being servicized (direct innovations); and product or process innovations that are aimed at enabling servicing in the mobility sector. These two classes are further divided into two categories: radical and incremental innovations. The essence of servicing is that clients' needs are met by delivering the function of the product instead of selling the product itself. Under conventional systems, innovations focus on the product or its production process. In the context of servicing systems, innovations refer to the product’s ability to support the 'function' of the system, which is a much broader concept. The demand for innovation under servicing may come from the end users (as before); the service provider (an entity that did not exist in the conventional system) or both. For example, embedded systems that enable the tracking of the location or condition of fleet cars/bikes are types of innovations that are aimed at supporting servicing system.

In some cases ‘system’ innovation can easily be defined as such. For example, integrated remote diagnostic sensors that allow service providers to control fuel levels; engine faults or the ability to reduce costs associated with handling the product end of life do not have any direct impact on the end user. However, some other ‘system’ innovations, more directly add value to the end user, such as integrated payment systems. However, distinctions are nonetheless important in order to classify between innovations, which are ‘system enablers' rather than being part of the effort to better serve specific customers’ needs.

For end users, the value is related to the benefit they receive from improvements in the product as well as from improving the service itself. For example, the ability to switch from a traditional car-sharing model (where picking and drop-off points are the same) to a free floating/point-to-point model is probably a trait of the system that customers will be willing to pay for. Such innovations are aimed at enabling servicing becoming a true alternative for the ownership model through tackling the holistic driving experience. Such a trait needs to be supported by innovations required to enable a system that can properly adjust location of cars vis-à-vis drivers’ needs or the introduction of driver free cars. For service providers, innovations are related to the benefits they can gain from operating the servicing system in a more profitable way. For example, integrated remote diagnostic sensors that allow the provider to control fuel levels; engine faults providing real time/location solutions; or the ability to reduce costs associated with handling the product end of life will be of great value to service providers.

However, the way that service providers calculate value is substantially different from the way end-users calculate value. While end users will pay a premium for new elements and features that meet their own specific needs, and thus will appreciate product variation, service providers will most probably value products that succeed to capture diverse needs in one single product enabling them to simplify the operation system and thus reduce the costs of service “production”. Also, it is expected that end-users (drivers or cyclists) will involve, in addition to cost/benefit consideration, some emotional consideration in valuing innovation (e.g. design, social status) while service
providers are expected to consider primarily (though not exclusively) the innovations that are contributing to the operational costs. Thus, it is expected that innovations that satisfy specific customer needs (e.g. engine performance, car design) but do not significantly change the functionally of the product will be much limited under servicizing systems as they increase the costs. It can be observed that all bicycles under certain bike-sharing system are having the same colour and shape as the types of cars used in car-sharing schemes are much limited.

From the managerial perspective, innovations are motivated by the desire of ‘innovators’ to extract extra profits from their costly and risky innovative activities (Clark and Guy, 1998). Servicizing in mobility should therefore be analysed in terms of its ability to generate value to consumers, value that will be translated into profits and other social and environmental benefits. The guiding questions should thus focus on the ability of servicizing to create more value to consumers than the traditional product-based solutions. The possibility of such situation to occur within the mobility sector emerges in the following situations.

- When buying the function/sharing the good enables customers to enjoy quality functions that otherwise they could not obtain (because of reasons such as high cost, scarcity of the good or the need to have supplementary infrastructure to enjoy the good);
- When buying the function overcomes problems that are associated with being the owner of the product (because of reasons such as ‘property’ taxes, high or time consuming maintenance cost, lack of storing/parking place);
- When servicizing creates other benefits such as reducing environmental impact (externalities);
- When indirect effects of moving to servicizing are being internalized/appreciated through e.g. environmental gains, ‘feel-good’ feelings, recognized personal image, etc.

It is assumed that business priorities and the will to generate profits will be the primary motivation behind the existing servicizing models. The motivations for establishing servicizing in mobility are only partly associated with environmental drivers (Rothenberg, 2007). In some cases the eco motivations may lead or at least support the move towards servicizing while in other cases environmental related consideration may be less relevant (White, 1999). The motivation for all servicizing innovations (direct/indirect; radical/incremental) is to create systems with value proposition that is higher than the value of the product and the service.

2.1.3 The role of ICT in servicizing in mobility

In all sectors of today’s economy ICT is playing the role of “general purpose technology”, similar to what the steam engine, railway, telegraph or electricity have historically played (Grübler 1998, Grübler, Nakicenovic, et al. 2002). In today’s “digital economy” information serves an economic lubricant accelerating the creation of wealth, similar to what the main inventions of the industrial revolution. Signs of decoupling between GDP growth and energy demand have been observed already in the early 1990s. For instance, the annual GDP change in the U.S. during 1992-1996 (largely a pre-Internet period) was 3.2% with annual increase in energy demand averaging 2.4%. For 1996-2000 (ICT industry accounting nearly one-third of GDP growth in the U.S.) the figures were 8% and 1% respectively (Sachs 1999), which as many suggested indicated that the economic growth shifted away from energy intensive into ICT-intensive service sectors (Bachmann, Aebischer et al. 1993,
Negroponte 1999, Romm, Rosenfield et al. 1999, Roome and Park 2000). A more recent study shows that, between 2002 and 2007 ICT industry contributed 16% to overall GDP growth while the sector itself occupied 6-7% of the global economy (BCG/GeSI 2012).

In transport and mobility the role of ICT is also very important. Overall, ICT makes mobility and transport systems “smarter”, rational, optimised and better oriented to societal needs and environmental challenges. Different ICT solutions have proven to be instrumental in optimising transportation and reducing its environmental (importantly carbon) footprint. ICT is used in optimising transport logistics, travel dematerialisation through tele-presence, traffic monitoring and control, computer simulation for planning improvements and the design of more energy efficient vehicles and many other applications (Black and van Geenhuizen 2006).

The generic roles of ICT in the mobility sectors are probably three – as an enabler, as a facilitator and as a factor for social inclusion. ICT’s role as an enabler is probably first and the most prominent one in terms of information management - allowing cost effective and timely collection, processing and sharing of information about transportation systems provided that adequate infrastructure and end user equipment are in place (Sustainable Development Commission 2010). Information management related examples of ICT applications in mobility sector include e.g. systems for urban traffic control (UTC) to coordinate traffic signal timings, variable message signs (VMS) to communication information to drivers via roadside signs, car park occupancy sensors, real time mapping and road guidance, automated vehicle access automated number plate recognition technologies for vehicle controls enabling selectivity in traffic permitting, etc. (van de Ven and Wedlock, 2008).

ICT also acts as a facilitator in reducing the costs of transactions which is very important in supporting serviczied mobility solutions. ICT allows reducing the financial and time related costs of finding the necessary information and allows easier and transparent financial exchanges between the supply and the demand sides. Examples of this could be search engines, service portals, online booking and account administration systems. Most importantly, ICT also allows to customised billing schemes with more accurate billing for just the services used, which could become a factor attracting more customers.

Thirdly, ICT solutions have the potential to act as factor of social inclusion empowering many more people to access more services and participate in service markets that become more affordable. It may empower people by providing them with the opportunity to express their opinions, share experiences and participate in shaping the markets.

An interesting categorisation of ICT roles is developed by the UK Sustainable Development Commission (Sustainable Development Commission, 2010), which suggested six categories of ICT role in optimising the mobility solutions and provided illustrative examples:

- **ICT as an enabler:** providing the travel information needed to make a journey;
- **ICT as a facilitator:** allowing online booking and payment or perhaps even facilitating travel avoidance through video conferencing;
- **ICT as a sweetener:** providing wireless internet coverage while travelling on bus, coach or train, or enabling queues to be avoided through ticketless payment systems;
- **ICT as a carrot:** pay as you go schemes that reward travelling at off-peak or lower risk times, or travel carbon footprint monitoring. This is an area that could be developed further with
concepts such as ‘green miles’ rewards operating in a similar way to air miles, but rewarding low carbon travel choices;

- ICT as a stick: congestion charging, safety cameras, high occupancy vehicle lane monitoring;
- ICT as a choice editor: journey planning tools, which are configured only to provide the lowest carbon options, or to highlight them.

The most profound roles of ICT in mobility are preventative (e.g. reducing the need for travel) and efficiency (e.g. time and the travel experience and through that influencing mode and choice). The latter role can be further subdivided into changing driver behaviour, changing vehicle behaviour, increasing vehicle loading factor and increasing loading factor (Figure 4).

**Figure 4: Categorisation of ICT roles in mobility sector**

In addition to these practical roles of ICT in servicizing in mobility, the broader conceptualisation of ‘integrated mobility services’ (IMS) better reflects the central role of ICT aspects in conceptualisation of servicizing in mobility.

Integrated transport is often recognised to be a preceding concept to services and can be described as a physical infrastructure, which is represented by a network of nodes and links. The links connect concentrations of people with multi-modal passenger terminals in the form of nodes. The multi-modal networks offer a multitude of actors that can provide complementary and competitive integrated services. ICT infrastructure is a part of integrated transport and represents an essential component of customer-driven service. Kemp and Rotmans (2004) define IMS as mobility services devised to reduce reliance on the private car by combining car use with other types of transport that are provided through mobility services. A related concept is ‘smart mobility’ which offers seamless accessibility at all levels, ICT infrastructure and is sustainable, innovative as well as safe (Harper, 2013).

The role of ICT in demand and supply sides of IMS should be distinguished: on the demand side, ICT is mainly used to inform, while on the supply side, ICT is mainly used to coordinate. According to Potter
and Skinner (2000) (cited in Harper, 2013), functional and modal integrations are intended to ease sustainable mobility by combining different modes of public transport. This integration type today must always involve many services provided by ICT (e.g. integrated ticketing and integrated timetable planning). An example could be, for instance, park-and-bicycle or park-ride-ride services that enable private transport users to utilise public transport and linking service in an easy and convenient way. Based on Preston (2012), Harper (2013) illustrates the use of ICT in the form of a ladder:

Figure 5: Integrated and disintegrated sustainable transport


The examples used in the ladder illustrate the organisational and operational difficulties and the potential complexity of the ICT solutions when offering an IMS. At the bottom are examples of simple integrations of traffic management (scheduling, ticketing) (e.g. Skåne region in Sweden (Skånetrafiken) or London Oyster card). At the top level are complexity levels, which can be exemplified by broader mobility solutions like parking spaces, education, social services and environmental policies are integrated. It should be noted that these are mainly physical integration that can be eased by ICT, but institutions clearly play a more important role.

2.1.4 Macro policy drivers

When market mechanisms are insufficient, political imperatives can act as an important driving force toward servicizing in mobility that could potentially become important determinants of absolute decoupling. In the European Union some macro-level policy initiatives have started to emerge in
form of strategies and action plans that explicitly stress the importance of shifting towards servicizing, including servicizing in mobility sector.

On the European level, there is considerable policy pressure on the Member States to reduce GHG emissions in order to fulfil their obligations under environmental protocols. The transport sector is one of the sectors where emissions are still growing and where targets are more difficult to reach. This forces governments to encourage investment in alternative, more sustainable transport schemes, such as conventional or electrified car-sharing or public transport systems. The tasks 2.2 (“Review of relevant EU directives and initiatives addressing servicizing”) and 2.5 of SPREE have extensively discussed these policies and the review of the existing practices in the next section will include more specific policy actions relevant to car- and bike-sharing. In addition to the lists in Task 2.2 and 2.5 (“Ex-post analysis of servicizing policy on the national level”), the following policy documents can also be considered as the macro-level guiding and motivating factors behind the transition toward servicizing systems in mobility.

**Green Paper - Towards a new culture of urban mobility**

Recognising the similar key challenges experienced by European urban areas, the Green Paper (EC, 2007) proposes the important policy step of comprehensively addressing the different dimensions of urban mobility. Putting people’s requirements at the centre, it stresses the need to implement an approach that should be as integrated as possible and should optimise the use of all modes of transport. Specifically, optimising the use of private cars and promoting walking and cycling as well as a closer look at freight transport are accepted as the main aspects of moving toward a new culture of urban mobility. Through the resolution on the Green Paper (EC, 2007), the EC confirmed that urban transport and urban mobility policy was a priority for all levels of government, include at the European level, and that the EU objectives set in the cohesion, environment, health and economic policies are not achievable if urban mobility is not appropriately taken into account.

**Action Plan on Urban Mobility**

The Action Plan (EC, 2009) proposes 20 measures as a guiding tool for national, local and regional governments toward achieving their goals for sustainable urban mobility. Consisting of 6 themes, namely funding, knowledge exchange, optimisation, greening, focusing on citizens and integrated policies, the most relevant measures with respect to servicizing in mobility are the use of ICT in reducing the need to travel, low emission vehicles, behavioural change through campaigning and knowledge diffusion.

**CIVITAS – Cleaner and Better Transport in Cities (EU Sustainable Mobility Initiative)**

The CIVITAS initiative provides tools and guidance to help cities implement sustainable urban transport strategies that are better integrated. CIVITAS primarily aims to achieve knowledge exchange amongst the CIVITAS cities. The policy measures have been identified through eight themes, namely mobility management, demand management strategies, clean fuels and vehicles, safety and security, transport telematics, collective passenger transport, car independent lifestyles.

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2 Please note that the collection of policy measures and the process of policy-packaging are not part of this report; an extensive discussion on the policy measures will be included in WP8 (“Policy agenda”).
and urban freight logistics. Car independent lifestyles are specifically identified as bike-sharing, car-sharing and car-pooling. The initiative provides several strategies that can be employed to enable sharing cars and bicycles as well as car-pooling. These will be discussed in the specific review of car-sharing and bike-sharing practices in the next chapter.

Overall, the Green Paper ‘Towards a new culture of urban mobility’, the Action Plan on Urban Mobility and the CIVITAS initiative are the main EU-level urban mobility strategies that are relevant to servicizing in mobility. To what extent these guidance notes have encouraged more sustainable forms of urban mobility through servicizing or not and their applicability in different geographical contexts are the main aspects that the mobility research in SPREE should deal with.

### 2.1.5 Summary of the key elements

This first section has provided a roadmap of the mobility research guided by the generic conceptual framework provided for all sectors by WP2 of the SPREE project. In short, servicizing in mobility should be regarded as a continuum. The strategies toward sustainable business models as described by Mont and Plepys (2013) are clearly applicable to mobility. The servicizing continuum in mobility moves along from transport goods to mobility services and covers reduction of the need to travel with changing levels of ownership, space/time, actors and products and services. These elements are in turn affected by ICT, eco-innovation and the EU’s sustainable development vision. This broad understanding will now be employed in the review of existing servicizing practices in the mobility sector. The use of ICT and eco-innovations in car- and bike-sharing will be identified as well as the ex-post analysis of the relevant policy tools that have been employed to enable servicizing or sustainable urban mobility in general.

### 2.2 Existing servicizing cases in mobility

The identification of the existing servicizing practices in each sector was the first step of constructing a generic definition of servicizing in the SPREE project (see Figure 3). In this section, we categorise the existing practices into car-sharing, bike-sharing, mobility of goods, public transport services and other servicizing methods such as teleworking that reduce the need for physical travel. Because the focus is on car- and bike-sharing given that the empirical investigation in the SPREE countries is of these two forms of servicizing, as will be explained in Chapter 4, the brief review of the other practices are included in Appendix A.\(^3\)

#### 2.2.1 Car-sharing

Car-sharing is recognised as one of the most popular examples of a sharing economy in general. Due to increasing negative impacts of car ownership and rising personal transport costs, the concept of sharing cars has emerged worldwide. Broadly, it involves two or more people sharing a car rather than driving alone as a means to decrease costs and responsibilities of car ownership (Shaheen and Cohen, 2007). First initiated in Zurich in 1948, car-sharing became popular in 1990s in Europe, the USA and several other countries. As of 2007, such schemes operate in approximately 600 cities.

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\(^3\) Please note that the review of other existing and potential servicizing opportunities appear in section 4.1.2 in the Water sector report (Deliverable 4.2) and in section 3 in the Agri-food sector report (Deliverable 6.2).
worldwide and include 348,000 members (Efthymiou, Antoniou and Waddell, 2013). The specification of the system is straightforward: the system users pay a combination of an amount for registration in the system database, a monthly fee and the cost of use, depending on the time used and/or the distance travelled.

Whether it is just a different business model or a radical socio-cultural change with regard to ownership and consumption, the size of the car manufacturing industry and its long-term vision of around 20–25 years render any change in consumption patterns visible. Despite the small share of car-sharing activities in London, which is around 0.1% of total trips, the key industry players, for example BMW, with its BMWi brand and associated activities, have already started looking for alternative branding as mobility service providers and are moving away from the identity of being solely car manufacturers.

Before we start exploring car-sharing practices further, one should note that car-sharing schemes come with basic definition issues, and it is important to clarify the characteristics of the systems and their corresponding definition requirements given their significantly different impacts on the economy, the environment and the society. In the UK, for instance, it is more common to refer to these systems as car clubs, while in North America car-sharing is the main phrase. Different forms of schemes with respect to cars include pooling, leasing and renting, informal sharing and borrowing.

Activities of car-sharing (car clubs in the UK) in B2C form include private companies offering car-sharing services to consumers. B2C car-sharing activities have significant implications for business models mainly in terms of goods and services provided; these mainly affect the automobile industry. The practice requires the traditional model of selling cars to change to providing services that replace ‘buying a car’.

- Traditional car-sharing systems are based on fixed stations and require users to bring the car back to their pick-up point or any other designated parking space (i.e. back-to-base services provided by Zipcar).
- Free-floating car-sharing systems (flexible/point-to-point services) (e.g. Daimler’s car2go and BMW’s DriveNow) allow users to take and leave vehicles at any point within the city limits. In contrast with traditional car-sharing, there are thus no fixed stations and in particular one-way trips of any length are possible without a booking requirement (Firnkorn and Müller, 2011). Kopp, et al. (2013) also defines this scheme as a station-independent scheme.

Car-pooling refers to a system in which people are encouraged to pick up others while driving to certain destinations including work and school. It can be organised by companies for their employees or it can be arranged by local governments for different neighbourhoods. In some cases, consumers can even arrange it between themselves.

Car-renting is operated by agencies and companies to rent cars for short periods of time. A car rental company usually has several local car rental branches. The fleet of cars available to consumers can be owned or leased by the car rental companies.
Below is a selection of examples of existing schemes:

- Inspired by the ‘European car club’ idea and founded in the USA, Zipcar is currently the world’s largest car-sharing company. It has branches all over the world, and according to figures provided by the company it includes more than half of the car-sharers in the world.
- As a subsidiary firm of Daimler AG, car2go provides free-floating car-sharing services in around 20 cities in Europe and North America. The company charges by minute and provides discounts for longer periods of using the car.
- Getaround provides a slightly different sharing scheme. Through an iPhone application or the company’s website, car owners and customers can find each other. The rates are set by car owners. The company also provides an insurance policy for car owners. Getaround acts as a mediator for peer-to-peer sharing.
- Bremen’s Car-sharing Action Plan, starting from a club of 30 people in 1990, grew to a market based car share company with more than 5 800 subscribers by 2010. It has 42 sites scattered around the city, with 160 rental cars estimated to have replaced more than 1 000 private ones. Bremen’s car-sharing system was selected as an ‘Urban Best Practice’ for the World Expo 2010 in Shanghai (‘Better City – Better Life’) for presenting an innovative solution to the parking problem in cities.
- Autolib’ is a French e-car sharing program launched in December 2011. Similar to a bike-sharing programme, Autolib’ offers around 200 cars to its around 65,000 members.
- The involvement of Transport for London (TfL) in the development of the London Car Club Consortium is a good example of the role of government in encouraging the establishment of car clubs. These include companies such as City Car Club, Zipcar and Hertz 24/7.

**Servicizing as a factor in innovation and competition**

The car manufacturing sector is highly competitive and its profit margins are continuously shrinking for most car companies. Therefore, car manufacturers are constantly looking for new means to innovate their technologies, processes as well as business models.

Servicizing innovation in the car sector presents a promising potential approach to address the stagnation of the car industry and its difficulty to overcome its dependency on massive capital investments that result in oversupply and limited profitability (William, 2007). This leaves limited room for radical innovations or even major improvements. Moreover, the growing demand for sustainability and emission reduction requires a radical redefinition of current consumption and production patterns that will rely on behavioural and system changes. Servicizing in the car sector, so called car sharing practices, can thus be viewed as a radical innovation by itself through its implementation requires various complementary innovations, which may be directly or indirectly connected to the car as product or the car sharing as the service.

The discussion on innovations that support servicizing in the car sector relates first and foremost to the changing relationships between the producer and the users. In the conventional models, these relationships are limited to the warranty period, after which the producer has no responsibility on the product; while under servicizing systems, producers remain responsible for the product and its functionality throughout its entire life cycle. This may have a significant effect on both technological innovations as well as on innovations that relate to the product design. It is expected thus that the
focus of the innovation activity will shift from product variation (aimed at creating market segmentation) to product durability and sustainability. For example, innovation aimed at reducing recycling or disassembly costs will become much more important as they were in the conventional model.

The current servicizing models in the car sector are still far from having an overall guiding approach. Instead, servicizing in the car sector represents an effort of different entrepreneurs to exploit alternative business opportunities that stem from ‘external’ factors such as pressures on policy makers to diminish the number of cars in the city centres, reducing emissions or simply supplying free parking places. In this sense, car schemes are more a combination of products (cars) and service than a full servicizing shift. Indeed, most systems make use of ‘regular’ cars with limited or no direct innovations that are integrated to the car and are not leaning on new car design approaches. Therefore, the ability of the current car sharing schemes to create value to the customers is much limited and as a result its diffusion rate is expected to be slow.

The following tables summarise problems that may hinder the supply or the demand for car-sharing. It relates to traditional car sharing models only. The table is divided into the demand side (users); the supply side (the service providers) and the car producers (which may be the same as the service provider).
Table 1: Innovations as solutions to barriers on the demand and supply sides

<table>
<thead>
<tr>
<th>Demand side</th>
<th>Actions/innovations required</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexibility</td>
<td>A to B rental</td>
<td>Service Provider</td>
</tr>
<tr>
<td></td>
<td>Intercity return option</td>
<td></td>
</tr>
<tr>
<td>Availability</td>
<td>Density of car stations</td>
<td>Local Government and Service Provider</td>
</tr>
<tr>
<td></td>
<td>Short notice rental</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reducing average time of waiting</td>
<td></td>
</tr>
<tr>
<td>Comfort</td>
<td>Variety of cars</td>
<td>Service Provider and Central/Local Government</td>
</tr>
<tr>
<td></td>
<td>Car cleanness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dedicated parking slots</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>Car level of maintenance</td>
<td>Service Provider</td>
</tr>
<tr>
<td>Status</td>
<td>Increase the image of car users</td>
<td>Local/Central Government</td>
</tr>
<tr>
<td>Cost and pricing</td>
<td>Develop clear and transparent cost models</td>
<td>Central Government and Car Producers</td>
</tr>
<tr>
<td></td>
<td>Subsidies aimed at integrating externalities in service price</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supply side</th>
<th>Actions/innovations required</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of managerial skills</td>
<td>Develop new managerial capabilities and organisational skills</td>
<td>Car Producers and Service Providers</td>
</tr>
<tr>
<td>Unfamiliar business models</td>
<td>Develop new business models</td>
<td>Car Producers and Central Government</td>
</tr>
<tr>
<td>New product design</td>
<td>Extending vehicle, parts and components life span</td>
<td>Car Producers and Central Government</td>
</tr>
</tbody>
</table>

The above tables can be translated into a set of questions aimed at analysing the barriers for servicizing and focusing on product, process or regulation that may overcome such problems. Significant parts of these problems can be addressed (or are already being addressed) by the use of ICT. Car-sharing companies utilise ICT in the form of mobile communication networks in order to streamline their operation of the network. According to GeSI’s SMART 2020 study (2008), the abatement potential of ICT use in car sharing is 0.14 GtCO₂e. The use of ICT in car sharing is varied ranging from booking a car to social networking.

An example of a small scale system is the Finnish enterprise City Car Club. This enterprise is privately owned and has been running since 1999, providing services in partnership with a telecom company, a financial service company and with a car dealer. The City Car Club follows the traditional car-sharing concept with additional technology innovations to facilitate the use for the customer. The car
is booked via mobile phone using SMS or mobile Internet. The car-lock is operated by a mobile phone so no physical key is needed. A credit card is provided in each car and is used when filling the tank so bill fuel costs could be avoided. This means that customer needs merely a mobile phone in order to use the City Car Club’s service. Liftshare, an example of a very large network of car sharing schemes, also uses ICT solutions to a large extent through website, booking systems, integration with large online social networks like Facebook, Twitter, LinkedIn and Youtube. Therefore, ICT is employed both in the use and diffusion of the car sharing practices.

**Prior evaluation of use and impacts of car-sharing schemes**

Although the initial motivation behind testing the role of servicizing systems in achieving decoupling implies the presumed positive role of servicizing in the SPREE countries, the evidence of the use and the impacts should be carefully reviewed to guide the research design.

**Characteristics of the existing/potential users**

There are specific segments of the populations that car-sharing services usually appeal to. The existing users mainly include people who live in one- or two-person, carless households, who are employed and highly educated, do not commute by car and are aged between 25 and 49 years (Rabbitt and Ghosh, 2013). The results of a survey conducted with 108 out of 205 car-sharing providers in Europe in 2009 (as part of an EU project on car-sharing) show that the user characteristics are similar across Europe (Loose, 2010). According to this survey, the users tend to be mainly male (with the exception of Switzerland, which had a balanced number of male and female users in 2009), aged 26–49 and with above-average formal education. The scheme participants tend to own fewer vehicles than the general population and usually have seasonal public transport tickets.

The outcome suggests that the lower socioeconomic classes are under-represented, which may be related to the assumption that in lower social categories, vehicle ownership is still regarded as somewhat of a status symbol. Other important findings of the survey concern geographical concentration of the existing users. According to the report, majority of the users live in the centre of the city or in densely built neighbourhoods surrounding the city centre. 12% of the users are reported to be located in more distant neighbourhoods in which large numbers of social housing units are often located. 5% of the users are reported to come from peripheral neighbourhoods, “those that often have larger numbers of tree-filled residential estates with detached single family homes” (Loose, 2010, p 30). One should note these interpretations of the figures (i.e. sociospatial understanding of the use) are based on untested assumptions. And because the surveys are not conducted with the users themselves and do not investigate the motivations behind the use, one should be cautious about interpreting these trends.

In addition to these EU-wide 2009 figures, a more recent study on Greece examined the temporal trajectory of the diffusion of car-sharing practices. Using three ordered probit models on a dataset of 233 respondents in Greece, Efthymiou, *et al.* (2013) showed that people who are more environmentally conscious are likely to join car-sharing schemes in the next few years following the introduction of the scheme. Those who join in the first year are found to be less environmentally conscious. The respondents who, on average, drive 100–150 km per day and make their social trips mainly by a taxi are more likely to join a car-sharing scheme. Such analysis of routine behaviour is particularly important given the consensus that practices are more likely to retain practitioners if
they allow scope for innovation, “provide some layers of symbolic significance and are somehow caught up in wider networks” (Shove, et al. 2012, cited in Kent and Dowling, 2013, p. 90). Building up symbolic significance embedded in wider networks tends to take time, which may explain the uptake of the services by environmentally conscious people at later stages of the diffusion. This is also in line with the claim that the longevity of the concept is dependent on recruitment of a cohort of committed practitioners at first (Shaheen and Novick, 2005). Although this study is important with respect to its focus on the temporal aspect of the practices, it should be noted that some findings are based on state-revealed preference methods, which may not necessarily in line with the observable trends.

In the UK context, annual surveys are conducted by Carplus. These surveys are conducted with all the traditional car-sharing companies and one peer-to-peer car-sharing company. According to the 2012 surveys, 61% of the car-sharing scheme members in the UK were male and 32% were female, which is consistent with a split of 54% male and 46% female driving licence holders in 2012. The majority of the members were aged 25–44, which remained consistent since 2010. These basic socio-demographic characteristics of the users are therefore in line with the European trends identified in 2009. In the UK context, 84% of the car-sharing scheme members were located in London. According to the corporate administrative survey, 61% of the scheme members in their companies used public transport for commuting, 28% used car-pooling and 23% of them used bike-sharing. This trend suggests that car-sharing is usually regarded as complementary to other forms of transport for daily travel.

There are several other studies conducted in non-EU regions (mainly the works of Susan Shaheen and her team on North America, Canada and Asia) and city studies (e.g. Cairns, et al., 2008 and Le Vine, 2012 on London/Birmingham) that yield useful insights on the characteristics of the users. The above can be taken as representative of the findings of these studies to a large extent.

**Reduction in car ownership and vehicle kilometres driven**

The environmental impacts of car-sharing are understandably associated with their role in the reduction of car ownership and vehicle kilometres (vkm) driven. Investigations of several car-sharing schemes were broadly found to lead to a reduction in the average number of vehicles per household. Through a geographic information system-based analysis of 13 US cities, Millard-Ball, et al. (2006, cited in Efthymiou, et al., 2013) found that many people cancelled a car purchase after joining a programme and each car-sharing vehicle replaces between 4 and 23 vehicles.

A survey of 6,281 residents in North America and Canada conducted by Martin, et al., (2010) shows similar positive trends in terms of car ownership impacts of car-sharing. They state that the rate of 0.47 vehicles per household dropped to 0.24 vehicles per household after joining a car-sharing scheme. They indicate it to be equivalent to a removal of 75,000–94,000 vehicles from the road. The trend is found to be similar in Europe: 14–40% of the car-sharing scheme members sold at least one car after joining a scheme (Loose, 2010, cited in Rabbitt and Ghosh, 2013). In the UK, the Carplus 2012 surveys report that for each car-sharing operator, approximately 6 private cars are taken off the roads and that 13% of the members reported that they got rid of their vehicles 12 months prior to

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1. An accreditation institution for car-sharing operators in the UK
2. The findings are presented separately. We do not discuss the data obtained from the peer-to-peer company in this report.
joining a scheme. Of these 57% had travelled fewer than 5,000 miles, and 23% had travelled 5–10,000 miles, highlighting that car-sharing schemes tend to attract those who already use cars less. However, the analysis does not really ask the question whether the schemes attract the people who gave up driving, which might be regarded as rebound effects.

The reduction in vkm was also pointed out early in the literature through surveys conducted in Switzerland and Berlin (Prettenthaler and Steininger, 1999). According to the Carplus surveys (Steer Davies Gleave, 2013), 29% of the members report a decrease in their annual car driver mileage compared with 21% of members reporting an increase. 36% state that vehicle kilometres driven have not changed. The average increase in annual mileage is 984 miles while the average decrease is 3,033 miles. These figures should however be carefully reviewed to understand whether they actually translate into environmental benefits, i.e. the decrease in vkm per car and the size of the car fleet is a more important environmental indicator.

**Reduction in GHG emissions, air pollution and congestion**

In line with the reduction in car ownership and vkm travelled, the environmental impacts were found to be generally positive. The vehicle choice is suggested to be an important factor in this respect: people tend to be more rational with their vehicle choice in car-sharing schemes than when buying a personal car (Personal, 2013). There are several differences in the specific CO₂ emissions of several car-sharing fleets in comparison to personal cars. According to the Momo Project survey results, the differences generally lie between 15% and 20% with the highest being almost 25% (Loose, 2010). Nine European car-sharing providers with more than 20 vehicles in their fleets show specific CO₂ emissions of 129.6 g/km. In contrast, the new cars sold in 2008 in 26 countries of the EU had specific CO₂ emissions of 153.5 g/km, which is 15.6% higher than the existing car-sharing fleets (Loose, 2010, p. 70).

The emissions analysis and profiling report conducted by Carplus also showed that overall the car club fleets in London meet the current (Euro 5) air quality standards (Steer Davies Gleave, 2013). The average carbon emissions of the car club fleets in London in 2013 are 31% lower than the British national average for cars and 15% lower than the British car club fleet average reported in 2012. The surveys show that car clubs with the most petrol and petrol-electric hybrid vehicles achieved the lowest average carbon emissions.

However, most of the existing positive evidence concerns traditional car-sharing forms. The impacts of free-floating car-sharing schemes (point-to-point services) are not well documented as they are relatively new in the market and the impacts are therefore difficult to observe. But according to estimates over a period of five years, Daimler’s car2go scheme, which provides point-to-point services, is expected to lead to CO₂ reduction per average car2go-user (Firnkorn and Müller 2011). However, it should be noted that this is only forecasting and based on interviews with 208 people using a hypothetical scenario. The lack of observable data in this area makes it problematic to make any assumptions for research design.

**Summary of benefits**

Overall, the TfL (2008) categorizes the benefits of car-sharing schemes according to the beneficiaries. Individuals are said to benefit from the scheme in terms of increased health benefits, increased
access to car, reduced costs (maintenance and depreciation concerns) and convenience particularly in terms of parking. Local governments and transport operators, on the other hand, reap benefits of car-sharing schemes in the form of reduced traffic volumes and congestion and better air quality as described above. According to the TfL (2008), developers benefit from the integration of their properties into local community by enabling residents to have access to vehicles and benefits, while businesses benefit from cost savings through better parking management and increased benefits for workforce.

Most of the environmental benefits and reduced car mileage have been discussed above. The limited empirical evidence suggests that car-sharing schemes bring tangible environmental benefits in the form of clearly reduced car ownership rates (reduced road congestion), some reduction of vkm travelled and a good potential for emission reduction related to the choice of car park. In terms of cost-savings for businesses and individuals, the recently calculated figures for Scotland provide some illustrations: car owners who travel less than 8,000 miles per year could save up to £3,500 a year by using a car club instead (Carplus, 2013a). The development of 12 car clubs in small towns and rural communities which would not otherwise be serviced by a car-sharing scheme by the Developing Car Clubs in Scotland programme clearly illustrates the importance of (perceived) accessibility benefits of car-sharing schemes.

Problems associated with car-sharing: spatial-temporal issues and protection

Space issues with respect to car-sharing relate to vehicle occupancy and parking space. Vehicle occupancy problems are likely to reduce the mobility-related climate impact of car-sharing schemes. The table below illustrates the environmental benefits of car-sharing assuming typical average vehicle occupancy rates, fuel efficiencies and GHG emissions per person- or vehicle-kilometre (Error! Reference source not found.). It is clear that the use of public transport options (i.e. buses) far outweighs the potential benefit of car-sharing (i.e. increasing vehicle occupancy rates). Public transport options appear to be most fuel-efficient and private cars the worst. Doubling the vehicle occupancy rate is then an effective measure to improve this indicator.

<table>
<thead>
<tr>
<th>Mode of transport</th>
<th>Maximum capacity (passengers per vehicle)</th>
<th>Average capacity (passengers per vehicle)</th>
<th>GHG emissions per vehicle-kilometre</th>
<th>GHG emissions per average passenger-kilometre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian</td>
<td>1</td>
<td>1.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bicycle</td>
<td>2</td>
<td>1.1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gasoline Scooter (two-stroke)</td>
<td>2</td>
<td>1.2</td>
<td>118</td>
<td>98</td>
</tr>
<tr>
<td>Gasoline Scooter (four-stroke)</td>
<td>2</td>
<td>1.2</td>
<td>70</td>
<td>64</td>
</tr>
<tr>
<td>Gasoline Car</td>
<td>5</td>
<td>1.2</td>
<td>293</td>
<td>244</td>
</tr>
<tr>
<td>Diesel Car</td>
<td>5</td>
<td>1.2</td>
<td>172</td>
<td>143</td>
</tr>
<tr>
<td>Diesel Minibus</td>
<td>20</td>
<td>15.0</td>
<td>750</td>
<td>50</td>
</tr>
<tr>
<td>Diesel Bus</td>
<td>80</td>
<td>65.0</td>
<td>963</td>
<td>15</td>
</tr>
<tr>
<td>Compressed Natural Gas Bus</td>
<td>80</td>
<td>65.0</td>
<td>1050</td>
<td>16</td>
</tr>
<tr>
<td>Diesel Articulated Bus</td>
<td>160</td>
<td>80.0</td>
<td>1000</td>
<td>7</td>
</tr>
</tbody>
</table>

Source: EC (2009)

The availability of dedicated parking space is one of the key aspects that can support and promote car-sharing. Particularly in traditional car-sharing schemes, on-street parking can be an issue as this is not available and free in all cities and countries. For instance, in the case of London, where 33
different London boroughs own roads, this becomes a more significant issue (TfL, 2013 and Reynolds, 2013). Shaheen, et al. (2010) examined the parking policies of car-sharing in the San Francisco Bay Area and suggest that as the scheme expands; the public entities need to consider formal policies to allocate the parking space for it.

More recently, complementary items like sharing parking space and sharing of other types of vehicles like electric car-sharing, along with associated services like wireless charging facilities, have emerged that may resolve issues of available space, but they are informal in nature and are very small scale in comparison to the wider parking industry. Nonetheless, the concept of shared parking spaces has recently become popular. The idea is an example of peer-to-peer activities and represents a business model, which enables home and business owners to rent their parking space for drivers as a means of cost-effective parking and private (individual) revenue generation. It also demonstrates that car companies are thinking strategically about new business models for the longer term. This model can be applied in the absence of a business, using social networks and communication technologies. For governments, land use is expected to be more efficient, so there may be significant planning implications in the medium to long term, while businesses can benefit from paying special attention to social networking sites when building their business models.

Another issue with respect to car-sharing is insurance. As pointed out in the previous section, the highest percentage of car-sharing users is between 25 and 35 years old. In general, car-sharing appeals mainly to specific segments of the population, who live in one- or two-person, carless households, are employed and highly educated, and do not commute by car. Such usage patterns, however, may be due to insurance restrictions, which do not allow members below 21 years of age. Moreover, insurers usually hesitate to cooperate with car-sharing operators because in many cases, the risks are not clearly defined (Cairns and Harmer, 2011). Pay-as-you-drive (PAYD) – usage-based/mile-based auto insurance – is suggested in such cases, where the cost of the motor insurance is dependent on the type of vehicle used, measured against time, distance, behaviour and place.

Rebound impacts should be carefully considered in car-sharing systems. Rebound effects refer to “increased consumption that results from actions that increase efficiency and reduce consumer costs” (Foster, et al., 2006, p. 8). In the SPREE project, they are considered to occur when “efficiency improvements lead to reduced price of the products and thus create incentive to increase volume of material products sold or use the money saved from efficiency on buying or engaging in more environmentally detrimental activities, e.g. flying, thereby undermining the efficiency gains.” (Month and Plepys, 2013). Although they might be built to increase efficiency and improve transport systems, transport infrastructure improvements are found to lead to increased traffic (Standing Advisory Committee on Trunk Road Assessment [SACTRA], 1994). This effect also applies to other demand policy and management measures including pricing, parking management and car-sharing.

In the context of car-sharing, this is mainly translated as ‘unintended impacts’ of measures aimed at moving away from vehicle ownership. If car-sharing scheme encourages people to drive (more) generated traffic is said to follow the introduction of a car-sharing scheme (i.e. as a rebound effect). Although the current empirical evidence for traditional car-sharing schemes supports the opposite as described above and there is already some evidence to support the positive impacts of flexible car-sharing schemes, it is still not easy to reach a conclusive agreement on the potential impacts due to dynamic and complex system reactions (Kopp, et al., 2013). This is particularly important for free-
floating schemes. Although the study on the profiles of 204 DriveNow users (free-floating car-sharing scheme) in Munich shows similar trends with those of traditional car-sharing schemes, the evidence on the impacts is yet to be explored (Kopp, et al., 2013).

DriveNow includes a defined operating area, where cars can be picked up and dropped off independently. The scheme includes the use of ICT for booking and checking availability. The authors conclude that although increased flexibility is likely to improve the image of car-sharing in general, the impacts of car-sharing are difficult to measure due to several interactions within the mobility system. This is a valid point given that there are, in general, several simultaneous transport developments in a given region that impacts of each action cannot be isolated. This calls for broader understanding of servicizing and looking at car-sharing schemes in conjunction with developments in public transport, ICT, and so on.

**Policy strategies for the uptake of car-sharing**

Policy makers’ interest in car-sharing dates back to the oil crisis in the mid-1970s (Cairns, 2004). Parking requirements and congestion can also be listed as motivations behind policy intervention to encourage car-sharing. However, the car-sharing market is a peculiar market in terms of the role of government. The fact that only a limited number of short-term renting schemes exist, and specifically those involving the car producers as part of the servicizing system, points out the deep gap between what is perceived as an important innovation, in both business and environmental perspectives, and its real economic value. It is the role of public policies to fill in such gaps once identified. Given the evaluation of use and impacts of car-sharing schemes and the problems associated with the schemes, public policy should broadly focus on the following issues.

**Allocation of parking spaces**

One of the challenging regulatory issues with respect to car-sharing is the parking space allocation as car-sharing companies depend on the availability of both on- and off-street parking bays. The uptake of car-sharing practices can increase by the offer of additional incentives such as reserved lanes and parking spaces (EC, 2010). Establishing parking infrastructure should also be accompanied by supportive land-use planning policies. Carplus estimated that the costs of supporting on-street parking infrastructure in urban local authorities in Scotland would require a budget of £850,000 (Carplus, 2010). Varying parking permit charges according to vehicle emissions can be used for allocation of parking space required for car-sharing (Steer Davies Gleave, 2013). Moreover, enforcement for parking regulation through fines is also suggested to be integrated into the system to make sure the designated park lanes for car clubs can be kept secure (TfL, 2008).

**Pricing strategies**

There are several pricing factors that have the potential to encourage the uptake of car-sharing schemes. Pricing policies in this respect can take the form of providing exemptions for the car-sharing providers from parking and congestion charges, providing subsidies and further increasing fuel taxation.

Congestion charging schemes, environmental zones and city centre tolls have always been employed as part of travel demand management plans with the aim of impacting on travel behaviour. They are also highly related to car-sharing schemes. A car club operator in London reported that changes to
the London congestion charge mean that its monthly bills will double, which would cause significant financial pressure, and it was disappointed that TfL had not agreed that its vehicles could receive the same discount as residents’ vehicles (Personal, 2013).

However, pricing schemes already entail public acceptability issues. In fact, acceptability is documented to be a major barrier to the implementation of pricing schemes (European Parliament, 2009). The research about a congestion charge trial shows that acceptance of the congestion charge was higher after the trial than before the trial, showing that acceptance of the congestion charge had increased because people experienced its positive consequences (Schuitema, et al., 2010). The acceptability of a scheme depends on a set of factors including demographic, attitudinal, and political factors as well as public involvement and perceived effectiveness.

Vehicle requirements

Environmental emissions of car-sharing fleets have been discussed in the previous section. It has been reported car-sharing companies use vehicles with emissions significantly lower than average cars in London (Cairns and Harmer, 2012). Introducing a half-yearly monitoring programme that would enable the government to monitor improvements in vehicle emissions is one of the policy suggestions to regulate vehicle requirements (Cairns and Harmer, 2012). The relationship between policy and vehicle and operations costs of the operators is strong. The recent communication between the TfL and the Carplus clearly illustrates this. The Carplus’ consultation response to TfL’s proposed lower g/km CO₂ threshold of the new Ultra Low Emission Discount is that this new thresholds would mean that pure electric vehicles and plug-in hybrids would become the only permissible purchasing options for car club operators in London. The response adds that as these vehicles are still in the developmental stages of becoming a commercially viable option, this could create additional costs for car club operators, result in short-term disruption of fleet rotation plans and ultimately hamper car club expansion (Carplus, 2013b).

Insurance and pay-as-you-drive (PAYD)

Vehicle insurance is a significant portion of total vehicle costs and is therefore an important factor in the uptake of car-sharing schemes. Car-sharing schemes usually offer both car owners and drivers full insurance. However problems arise between service provider and insurance company as the latter hesitate to provide insurance for the schemes. In addition to providing PAYD schemes, some legislative changes also help solve some of these issues. For instance, the schemes in California have benefited from the changes to car insurance arrangements in Assembly Bill 1871, which have made it easier for individual cars to be used in sharing schemes (Cairns and Harmer, 2011).

Other policy measures

Other policy measures include conducting activities aimed at raising the image of car-sharing users and supporting pilots in order to assist in testing new business models; establishing an accreditation system so that service providers comply with the above regulations; conducting awareness campaigns; supporting workplace travel plans; providing insurance and guidance; and carrying out required planning for integration into public transport.
2.2.2 Bike-sharing

Bike-sharing schemes are systems, in which bicycles are provided for short-term rental between docking stations, enabling bicycle usage for point-to-point trips without having to own a bicycle. This way, individuals have access to bicycles when necessary without having to bear the costs and responsibilities of bicycle ownership. Bike-sharing schemes are also known as ‘smart bicycles’, bicycle transit, bike-sharing and public-use bicycles (Midgley, 2011). The concept of bike-sharing is almost five decades old. Throughout its evolution, making the bicycles in the schemes distinguishable has been an important feature. The uses of mobile technologies and increasing the schemes’ interoperability with other modes have been added in later years. The figure below illustrates the evolution of bike-sharing schemes through four generations.

The first generation of bike-sharing schemes was launched in Amsterdam in 1965. This ‘White Bicycle Plan’ involved providing 50 white bicycles that were unlocked and free to use. Due to theft and damage to the bicycles, the system stopped. The first generation also included systems in France (1974) and the UK (1993). Introducing a coin-operated system, the second-generation bike-sharing schemes started in Copenhagen in 1995. This coin-deposit bicycle system kept the distinguishing features of the bicycles and added scattered docking stations and most importantly coin systems. The third generation of bike-sharing added the use of advanced information technologies to track movements to address security issues. The fourth and current generation of bike-sharing schemes aims at integrating the schemes with public transit and the use of cleaner technologies (e.g. electric bicycles). This generation also includes incentives programmes that encourage the users to return the bicycles to station where demand is higher.

Figure 6: Four generations of bike-sharing schemes

<table>
<thead>
<tr>
<th>First generation bike sharing</th>
<th>Second generation bike sharing</th>
<th>Third generation bike sharing</th>
<th>Fourth generation bike sharing</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Unlocked</td>
<td>• Specific design and colour</td>
<td>• Use of information technologies</td>
<td>• Use of information technologies</td>
</tr>
<tr>
<td>• Free</td>
<td>• Designated docking stations</td>
<td>• Special design bikes</td>
<td>• Special design bikes</td>
</tr>
<tr>
<td>• White</td>
<td>• Charge introduced to unlock the bikes</td>
<td>• Fixed docking stations</td>
<td>• Fixed docking stations</td>
</tr>
<tr>
<td>Problems: Theft and damage to bikes</td>
<td>Problems: Theft due to customer anonymity</td>
<td></td>
<td>• Linked with public transit</td>
</tr>
</tbody>
</table>

Sources: Shaheen and Guzman, 2011; Efthymiou, et al. 2013; Fishman, et al., 2013

Although they date back to 1960s, it is only in the last decade that the schemes have become very popular and expected to attract more users. As of 2011, there are approximately 140 bike-sharing schemes in 165 cities with around 240,000 bicycles. The schemes are located across Europe, China, Australia, North America, Latin America, South Korea and China (Shaheen and Guzman, 2011).

Spicycles Project (2009) lists the common elements most bike-sharing schemes have in common:

- Automated process for rental and return and use of smart cards
FP7 Project: SPREE
SERVICIZING POLICY FOR RESOURCE EFFICIENT ECONOMY

- Easy and fast access and fixed stations
- Customer registration using deposits, no anonymous use
- One-way capability
- High net density
- No charge for first 30 minutes

Role of ICT and eco-innovations

Innovations in the context of bike-sharing are mainly in the form of policy solutions to potential problems. For cycling to play a part in alleviating the urban mobility problem, bike-sharing programs must provide a proper solution for the morning and evening peaks (Kumar, Teo and Odoni, 2012). This solution needs to be affordable, safe, reliable, comfortable, and available throughout the different seasons and in different cities’ topographies as other modes of transportation. Table 3 summarises problems that may hinder the supply or the demand for bike-sharing. It is divided to the demand side (the cyclist) and the supply side (the service provider). The problems yield a set of related questions that should be confronted in order to increase the uptake of the bike-sharing schemes.

Table 3: Innovations required for bike-sharing

<table>
<thead>
<tr>
<th>User need/problem</th>
<th>Actions/innovations required</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>More stringent traffic regulation and improvements to the existing system (lights, junctions, lanes)</td>
<td>Local Government</td>
</tr>
<tr>
<td>Geographical conditions</td>
<td>Availability of electric bicycles</td>
<td>Service Provider</td>
</tr>
<tr>
<td>Availability</td>
<td>Online data Density of stations</td>
<td>Service Provider Local Government</td>
</tr>
<tr>
<td>Comfort</td>
<td>Bicycle design Variety of bicycles Cleanliness</td>
<td>Service Provider Bicycle Producer</td>
</tr>
<tr>
<td>Connectivity</td>
<td>Stations in connection to other transport modes</td>
<td>Local Government</td>
</tr>
<tr>
<td>Provider need/problem</td>
<td>Actions/innovations required</td>
<td>Responsibility</td>
</tr>
<tr>
<td>Availability</td>
<td>Integrated GPS Pricing/Incentives</td>
<td>Service Provider Bicycle Producer</td>
</tr>
<tr>
<td>Product End of Life</td>
<td>Recyclable</td>
<td>Bicycle Producer</td>
</tr>
<tr>
<td>Reliability</td>
<td>Remote fault sensors Bicycle design</td>
<td>Service Provider Bicycle Producer</td>
</tr>
<tr>
<td>Bicycles Price</td>
<td>Improved production processes</td>
<td>Infrastructure Provider Local Government</td>
</tr>
<tr>
<td>Stations price</td>
<td>Improved production processes Regulations</td>
<td>Infrastructure Provider</td>
</tr>
</tbody>
</table>

From the above table several questions regarding the sensitivity of users and service providers and the relative importance of different technological/service/governance innovations can be drawn. For the user side - all questions should refer to innovations that create value in a way that will cause more users to buy the service or alternatively for existing users to pay more for the enhanced service. For service providers, questions are focused on reducing operational costs or the ability to provide
better service. As long as the answers (of both the users and the service providers) will refer to issues that require major changes it is expected that the diffusion pace will be slower.

ICT in bike-sharing is used in the form of information provision as in the London Cycle Hire scheme. ICT becomes even more important in schemes without fixed docking stations. During the autumn of 2013, a project called ReKola was launched in Prague enabled by a smartphone app, which enables users to find a bicycle and receive a lock code to unlock the bicycle. The concept is a community-based bike-sharing scheme without fixed bicycle stands. The bicycle can be used for whichever route the user needs and then the bicycle is locked to a lamp and the locations are uploaded through the app. The bicycles are donated recycled old bicycles, which are all painted in pink. The initial investment is relatively low and amounts to approximately 7000 CZK (€260, 2013) for 150 bicycles.

**Evaluation of use and impacts**

The benefits of cycling are well documented in the existing literature ( Handy, et al., 2014). The motivation for the majority of the bike-sharing programmes derives from these benefits of cycling and the desire to make cities more sustainable by facilitating mode shift and eventually positive environmental impacts and reduced congestion. The health benefits of the bike-sharing schemes are also frequently mentioned. Shaheen, et al. (2010) summarises these benefits as flexible mobility, emissions reductions, individual financial savings, reduced congestion and fuel use, health benefits and support for multimodal transport connections. There are, however, safety and accessibility issues that have been mentioned in the existing academic and grey literature. Referring to the existing schemes, we briefly review these strengths and weaknesses in turn.

**Mode shift and associated environmental and health benefits**

It is implicitly recognised that the ultimate motivation behind bike-sharing schemes is the desire to reduce car ownership and usage and to encourage cycling. The existing impacts show a different trend, however. Owning a car and subscribing to a bike-sharing scheme are not necessarily substitutes. In fact, they turn out to be complementary: according to a survey conducted by Shaheen, et al. (2010), the members of the Hangzhou bike-sharing schemes, the world’s largest scheme with around 60,000 bicycles and 2,400 bicycle stations, exhibited a higher rate of car ownership than non-members. The trend of low transfer rates from car journeys to public bike-sharing schemes seems to hold in other urban contexts including Dublin, London and Washington, D.C. (Fishman, et al., 2013).

Although the relationship between car ownership and usage and bike-sharing systems is weak, the substitute role of bike-sharing schemes in other modes is more evident. The results of Shaheen, et al. (2011) show that 80% of the Hangzhou scheme members switched from public transport and 30% of them shifted from taxis. According to the study, cycling has generally increased: 1.5 years after the scheme was introduced in Hangzhou, 30% of its members use it for most of their trips. After the introduction of Paris’ Velib, the largest scheme in Europe with 20,000 bicycles and 1,800 racks, cycling has increased by 70% (Shaheen, et al., 2010). The share of cycling in Barcelona increased from 0.75% to 1.76% following the launch of Bicing in 2007. In London, 17% of people decided to buy their own bicycles following their experience with the London Cycle Hire. 48% of the people weren’t cycling at all before the introduction of the London scheme (Burr, 2013).
The direct environmental and health benefits of mode shifts (reduction car use in particular) and increased cycling in general have not been made explicit. Shaheen, et al. (2010) showed that bicycles in Velib make 78,000 trips of 20 minutes and 312,000 km per day, which, they claim, is equivalent to 57,720 kgCO₂ if motorised. This should be considered in conjunction with the voluminous literature on the health benefits of cycling (Oja, et al., 2011).

**Integrated transport, flexible mobility and barriers of uptake**

One of the main benefits of fourth-generation bike-sharing schemes is seamless urban transport by easing the links between public transport and bike-sharing. The schemes in Beijing and Shanghai are integrated with the metro system with around 55% of the users in both cities combining the two modes (Yang, et al., 2010, cited in Fishman, et al., 2012). According to a study on Melbourne, there is a positive correlation between the proximity to the station and docking station activity (Fishman, et al., 2012). A study by LDA Consulting (2012) also confirms that more than half of the respondents used the bike-sharing scheme in Washington, D.C. to access trains. In London, short-term users of the schemes can use the bicycles through chip and PIN payments. Starting in 2010, the scheme was extended into East London and Shepherds Bush. TfL found that around 35% of this scheme’s members substitute it for public transport use, easing the congestion on board public transport during peak hours (TfL, 2010).

Providing more flexibility is one of the strengths of bike-sharing schemes. This is seen in the convenience provided by combining it with public transport and the existing evidence shows that the majority of the users combine the scheme with use of the metro and bus systems. Commuting and speedy access to the city centre constitute a significant share of trips (Shaheen, et al., 2012). However, the research also shows that a reason for the low uptake amongst lower-income groups could be the distance of low-income neighbourhoods to docking stations and metro stations (Ogilvie and Goodman, 2012). Therefore, although integration with public transport is likely to improve effectiveness, there are land-planning issues to consider in terms of distribution of benefits of bike-sharing schemes.

**Safety and bicycle redistribution**

One of the main issues with bike-sharing schemes is the safety issue. In addition to general fear of cycling, this is related to the physical environment. Inadequate cycling facilities and infrastructure were found to be concerns of potential and existing users of the schemes (Wiersma, 2010). On the other hand, helmet requirement has been found ineffective. The low level of memberships in the Melbourne scheme is usually attributed to the helmet requirement in the scheme (Shaheen and Guizman, 2011). In Minnesota, where there are no helmet laws in the bike-sharing scheme, only 14% of the respondents reported that they wore a helmet (Fishman, et al., 2012). The focus group discussions in Brisbane, Australia show that safety remains a major issue both amongst members and non-members (Fishman, et al., 2012).

Another issue is bicycle redistribution, which refers to the process of relocating bicycles, where they are demanded most (Shaheen and Guizman, 2011). Trucking with ICT is mainly used for redistribution of bicycles as well as providing incentives for users to return the bicycles to busy docking stations.
Policy requirements

Bike-sharing in general aims to encourage cycling rather than attracting the existing cyclists. The policy motivation behind bike-sharing is therefore to plan it as an introduction to cycling. As a result, it is crucial to consider bike-sharing as a type of policy intervention and part of public transport. In contrast to car travel, an increase in cycling (and bike-sharing) is dependent on an urban environment that is actually safe and friendlier for cyclists. For the case of greater uptake in bike-sharing there is need of wider bicycle promotion initiatives to be in place. Here, we briefly discuss the main cycling plans that promote the use of cycling and bike-sharing in general.

National and city-level cycling plans

The European Conference of Ministers of Transport (ECMT) (2004) defines the goal of national cycling plans as to raise awareness and to ‘de-marginalise’ cycling as a sustainable mode of transport. The ECMT (2004) emphasise that the scale of these plans demonstrates political will and commitment at the national level, thereby pushing cycling policies higher up on the policy agenda. This is done through articulating common objectives, goals, and a set of specific, integrated, coordinated actions among the different national ministries and agencies (horizontally), among national, regional and local authorities (vertically), and in partnership with industry, cycling associations and other stakeholders (ECMT, 2004). Bike-sharing schemes should therefore be considered as part of these large-scale cycling plans.

Examples of impacts from the city-level cycling plans

Plan de la bicicleta de Sevilla (2007): Following the implementation of cycle infrastructure for cyclists (i.e. building eight urban cycle paths, a total length of 77 km) over a short period of time, the number of cyclists increased from 13 800 in 2007 to 50 000 in 2009 (Danklefsen, 2010). The municipality achieved this exceptional result by implementing a strong bicycle policy. The provision of bicycle infrastructure has been supported by complementary policies including closure of the city centre to motorised traffic and provision of funding for school projects to create safe school paths and integrating traffic calming measures in school districts (Danklefsen, 2010).

Ferrara, Italy: The Municipality of Ferrara implemented measures including the introduction of a bike-sharing scheme and an innovative cycling plan, provision of cycle parking facilities and bicycles for workplaces between 1995 and 2010. As a result, the city has a 30% bicycle use of all daily trips (Danklefsen, 2010).

Groningen, Netherlands: Groningen is regarded as one of the best practices in cycling planning. The measures employed in the city with regards to cycling include the provision of an extensive and safe network of cycle routes through an integrated traffic policy and investing 23 million euros in bicycle facilities the period between 1989 and 2000 as well as introducing city cycling planning early in 1990s (Fietsberaad, 2009).

Odense: Constituting 187 000 inhabitants, Odense is Denmark’s third-largest town and has a high percentage of bicycle use – 26% of all trips are by bicycles. The European benchmarking programme Bicycle Policy Audit reveals Odense to be the town with the best European bicycle policies. That is mainly due to a four-year pilot programme implemented in Odense from 1999, with financial assistance by the Ministry of Transport (Fietsberaad, 2009).
Accessibility, safety and security measures

Safety is the most important issue to be dealt with in public policy. There are several successful safety measures taken in the EU. The Danish Ministry of Transport provides planners and designers with guidance on safe cycle infrastructure design. Provision of cycle training schemes is another measure to be employed by the local governments (Bicycleability project, 2005). In Strasbourg, Brussels and Kiel, there are one-way streets with two-way cycle lanes resembling the bicycle transit in bus lanes in London (2009). Reducing the speed limit of cars to 30 km/h also helps to control vehicular traffic in residential and school districts and places without a bicycle track. Reducing car speeds makes road humps or other kinds of barriers between cyclists and motorists, which require significant investment, unnecessary. In Freiburg, cyclists and pedestrians benefit from these traffic calming measures and 90% of residents live within a 30 km/h area (Danklefsen, 2010).

Overall, the main measures to increase the uptake of bike-sharing and cycling can be summarised as the integration of the schemes into long term transport plans with traditional public transport; integration of the schemes into the public transport revenue-sharing agreement; interoperability; regulations about allocation of public spaces; use of ICT; integral policy-making and addressing safety issues (ECMT, 2004; Spicycles, 2009). While the recognition of cycling and bike-sharing as part of urban transport plans is crucial for increasing the uptake of bike-sharing in cities, the institutional and cultural contexts in which this is done has important implications for the impacts of the policies. The cycling plans in cities like Amsterdam and Copenhagen, which already have strong cycling cultures, can be carefully reframed to offer lessons for other cities. For instance, cycle hire scheme in London is largely considered as a promoting tool to promote bicycle culture in the city. The existing use of ICT in ticketing systems or existing ticketing and payment systems in different contexts also yield different responses to any integration plans. Bearing institutional and cultural differences in mind, policy measures to promote cycling and bike-sharing will be discussed more extensively in the policy-packaging process of the project.

2.2.3 Summarising the existing practices

This section has discussed the car-sharing and bike-sharing practices bringing together the key elements drawn from the generic definition and demonstrated how the existing practices can be placed within this general conceptualisation. Mobility of goods, public transport and non-transport actions like tele-working have also been regarded as servicizing practices by the project team, the brief overviews of these practices in light of the generic servicizing definition are provided in Appendix A. According to the discussion, the existing practices entail varying levels of ownership emphasis, the number of actors, the level of product and service combinations, the importance of spatial and temporal aspects.

To summarise the servicizing aspects of car- and bike-sharing together with the other practices in Appendix A, it can be observed that ownership issues are most evident in car-sharing. The level of ownership is less of an issue in bike-sharing as owning a bicycle does not entail any status or as much flexibility as owning a car provides. Car-sharing needs the highest number of new actors including accreditation bodies and service providers, while bike-sharing only needs a bike-sharing provider and servicizing. Spatial aspects like walking distance to parking zones are most important with car-sharing and bike-sharing. Car-sharing, bike-sharing and goods mobility have significant time management aspects within the temporal aspects that include reliability, availability of cars and the proportion of
walking and driving time. In freight transport needs logistics collaboration companies as new actors. Servicizing in goods mobility and telepresence are highly dependent on the use of ICT and it is car-sharing that requires several business and policy innovations. Understanding the relative roles of these aspects in the existing practices is important to emphasise the concept as a continuum and part of an integrated mobility as a service.

2.3 Conceptualisation of social aspects

Mobility systems consist of a multitude of complex interdependencies amongst behavioural, cultural and institutional contexts and in contrast to the economic and environmental aspects of servicizing systems in mobility, the identification of social aspects is relatively much more difficult. First, it is almost impossible to isolate the social impacts from the economic and environmental impacts as the distribution of the economic and environmental benefits directly affects the systems’ social impacts. Second, the concept of sharing entails several behavioural changes even if it is induced in the form of a business model. Accordingly, any normative conclusion on social (dis)benefits of servicizing systems in mobility without fully exploring the potential social aspects in general could be misleading. It is therefore imperative to understand the objective social aspects of servicizing asking what is actually happening on the social grounds in the transition towards servicizing in mobility.

To some extent, such social aspects of the transition towards servicizing in the mobility sector have been identified as a sociotechnical transition (STT). Sharing practices have been conceptualised as cultural and sociospatial niches in the context of moving away from high-tech solutions to research niches that require soft policy measures (Nykvist and Whitmarsh, 2008; Geels, et al. 2012). As such, an STT approach would include sharing practices in mobility both as part of a broader transition including both economic and environmental aspects of the transition and include behavioural aspects through analysing it through practice as a unit of analysis.

However, identifying sharing and servicizing in mobility as a STS has several limitations. For instance, the multilevel perspective (MLP) on servicizing proposed by Geels (2002) would conceptualise the transition from ‘producing and owning’ to ‘sharing and providing’ in mobility through the interactions between niche-innovations, landscape changes and regime destabilisation. Broadly, it might be explained by the implications of unsustainable patterns of consumption and environmental and economic landscape shocks resulting in regime destabilisation, which open up new avenues for niche-innovations such as using mobile communication technologies in the transport sector and community-led projects like local car clubs for sharing cars and parking spaces to be scaled up.

But, consider scaling up niche-innovations like the use of mobile communication technologies in vehicle sharing. While the totality of transport users, firms, national and local public bodies constitute the process of employing mobile technologies towards a sociotechnical regime enabling a sharing culture, the MLP does not really consider the concept of agency (e.g. transport user) as ‘reflexive and discursive’ or the habitual behaviour of (Schwanen, et al., 2011). For example, there may be accessibility and cognitive issues with respect to use of technologies by transport users. The complementary approaches like practice theory and behavioural approaches that aim to address this lack, on the other hand, ignore the institutional embeddedness and sociospatiality of the car sharing companies (MacKinnon et al., 2009) and assume pre-determined political interests, which do not necessarily hold (Acemoğlu and Robinson, 2012; Rodrik, 2013). Moreover, they ignore the
governance implications of the ‘dispersed nature of transport’ showing no respect for administrative boundaries (Marsden, 2010). Accordingly, the consideration of servicizing through an MLP leaves out crucial institutional and governance characteristics of the transition that impact on the social aspects of vehicle sharing.

Given that the policy-packaging process of the SPREE project particularly emphasises the role of perceived fairness and acceptability of single policy measures as crucial determinants of an effective policy package, it is important to incorporate the concept of distribution and acceptability in identifying the social aspects (Matt, et al., 2013). The literature on social development, transport and mobilities literature provide useful insights to identify the social and (inclusive) governance elements of the transition towards servicizing. The three broad social aims of sustainable development, namely social progress, equality of opportunity and justice (with regards to policy outcomes) provide a useful starting point (Commission on Social Justice, 1994; Social Exclusion Unit, 2003). The identification of the social impacts of transport in terms of these three main goals is already well documented in the literature as will be discussed in the next chapter. Here, we combine these normative policy targets for social development with a political economic framework to provide a basis for constructing social measures for servicizing in transport.

We presuppose that the use of neoclassical economic thinking, which dominates most of transport policy evaluation literature, should be deconstructed by exploring the complexities within three pillars of public economics – ‘consumption’, ‘production’ and ‘regulation’. Such thinking requires that the changes in user and business practices should be embedded within culture and institutional contexts. The practical implications of this conceptualisation consequently inform the research design of this study by expanding the ‘business model’ definition of servicizing.

Drawing on Harvey’s (2009) political economic framework of ‘inter-related activity spheres of capital circulation’, we suggest a set of relations between the key actors based on the previous discussions on the servicizing systems. Harvey suggests that a mere cursory glance at the developing indicators of wellbeing and prosperity shows that the determinants of any (economic) practice and capital circulation include a set of polarized views. These views range from technological, geographical and institutional determinisms to the emphasis on different types of identities including class and gender. He criticises these polarized perspectives by highlighting that it is misleading to focus on a single aspect of an economy.

This helpful framework suggests that the practices regarding daily consumption practices, mental conceptions of the world, relationships to the natural world, social relations, production and labour processes, institutional and administrative arrangements and technologies and organisational forms are the main activity spheres through which capital circulates. He uses this concept to illustrate what happens if capital becomes stuck in one of the spheres. The focus of our attention in this framework is the circulation of practices and activities that are relevant to trends helping users move away from owning in the context of transport and mobility needs and wants. It is important to read the complexities within the aforementioned activity spheres by grouping the key actors identified earlier into consumption (consumers/users and public), production and provision (producers/manufacturers and service and infrastructure providers) and regulation (central and local governments) aspects in order to emphasise the neoclassical economic thinking prevalent in transport policy evaluation (Akyelken, 2013).
Public discourse and individual ‘mobility capitals’

The analysis that seeks to clarify what is and analysis that seeks to identify what action should be taken are identified as positive and normative policy analysis, respectively (Robert and Zeckhauser, 2011). Policy motivations behind the sharing practices should therefore be the starting point to explore the social aspects of servicizing in transport. If the starting point is taken as car-sharing becomes beneficial in all contexts, the analysis clearly misses the former policy analysis. Overall, the normative motivation behind most sharing practices makes the agents’ decision-making mechanism even more complex as the normative dynamics of any systemic change is unstable in nature, even more so for the transition to a sharing economy.

This is mainly because the implications of normative ideals of sharing to reduce social exclusion and environmental unsustainability through car use reduction and equal access to cars cannot be predicted without studying the context thoroughly given that these mobility systems are dynamic and complex and include several actors (Koop, et al., 2013). Consider the private ownership of a car. One of the social exclusion issues concerning private car ownership is affordability i.e. not everyone is able to afford to own a car (Lucas and Jones, 2009), which should also be viewed from the total costs of ownership perspective. The potential increase in environmental emissions, congestion and air pollution (brought about by car ownership) would be considered negative environmental impacts. But, moving towards car-sharing, renting and pooling with the aim of curbing these negative social and environmental impacts might have unintended consequences. Making access to cars easier might encourage individuals who are public transport users and/or cycle to use cars, therefore increase total car use and increase these negative impacts further. Although the review in the previous section indicates that this has not been the case so far, as will be discussed in analysing some of the statements by the policy-makers, this may be the case with floating car-sharing schemes, for which there are no observable impacts.

The cultural contexts are equally important in determining how certain social groups can reap the benefits of sharing. Traditionally, it has long been considered that women have multiple roles at home, workplaces and within their community. The type of trips women make (e.g. short and complex trips due to household roles as suggested in the gender and mobility literature [e.g. Uteng and Creswell, 2008]) may not be consistent with sharing vehicles as they are likely to require full flexibility. However, any support regarding childcare or more equal household division of labour have the potential to help women be more flexible with their trips enabling them to move away from private car ownership. The role of cultural contexts on social roles and institutional support are important determinants of user behaviour.

The provision of sharing activities without actually understanding user and consumer behaviour may thus be problematic. The role of public is particularly important, as the choice between private ownership and sharing is not reducible to individuals/users themselves only, nor fixed to one mode. How individuals travel and the importance of value derived from travelling itself compared to other preferences is likely to be dominated by their mental conceptions of the world, which is largely comprised of the general public discourse and the political discourse, i.e. how the politicians think they will resolve public policy issues.
Through the cases of the Carbon Trust in the UK and Energy Transition project in the Netherlands, Kern (2011) suggests a useful typology to understand the relative impacts of discourses, interests and institutions on the impacts of policies.

Table 4: Discourses, interests and institutions

<table>
<thead>
<tr>
<th>New discourse reflects existing interests</th>
<th>New discourse and existing institutions are mutually supportive</th>
<th>New discourse challenges existing institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little of no policy change</td>
<td>Policy change in line with new discourse</td>
<td></td>
</tr>
<tr>
<td>Path-dependent evolution of policies</td>
<td>Radicals policy changes</td>
<td></td>
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</tbody>
</table>

Source: Kern (2011)

Examining the low-carbon system innovations in the Netherlands and the UK, he concludes that the UK case falls somewhere between the ‘little or no policy change’ and ‘policy change in line with new discourse’, implying the weaker roles of discourses. The Netherlands, on the other hand, shows a path-dependent evolution of policies, where institutions and the new discourse are consistent with each other, but interests are changed as a result of discourse.

This typology is useful for understanding both the mental conceptions of the world (the so-called public discourse, or something affected by the political and public discourse) and the political discourse in the context of servicizing in transport. The former has significant implications for perceived acceptability of sharing and servicizing practices. Although this will be discussed more extensively looking at the case studies of London and Bristol, it could be argued that local projects, business ideas or community-led informal projects, in particular, have the potential to change the paradigm at least in certain social groups. A focus group discussion held in North London with a mix of car-poolers and non-car poolers from a variety of social background reveals that the participants, car-owners, who are already involved with informal schemes, are found to be more interested to hear more about the car clubs. The role of business ideas in inducing innovations with social impacts is also evident on the business models and trends in entrepreneurship. For instance, the idea of shared parking space proposed by a university student in Sheffield that turned into a profitable business has encouraged university students to develop further ideas.

Moreover, in the context of informal car-pooling and lift-sharing schemes, the notion of ‘What is mine is yours!’ in the collaborative consumption discourse (Botsman and Rogers, 2011) represents a misleading approach for non-car owners. The notion of altruism implied in the sentence ‘What is mine is yours’ is problematic if the lower social classes are considered beneficiaries and the others ‘givers’. The role of consumers and the overall societal perception, public opinion on transport usage in particular, should be reflected through a shift from ‘What is mine is yours!’ to ‘What is yours is ours!’ . Implied in this shift is the concern that sharing should occur as part of the consumption culture, not thanks to the ‘goodwill’ of some.

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6 The full details of the focus group discussion and the analysis of the findings will be part of the WP7 (“Country feasibility study”).
With the aim of incorporating cultural attributes, the concept of agency in general, into innovation studies, Geels and Verhees (2011) discuss the role of meaning and interpretations attached to agents through a case-study on Dutch nuclear energy. Shortly, they argue that the Dutch nuclear energy has received legitimacy through popularity in the earlier stages of their journey, but this was not maintained in the later stages, which halted the expansion of nuclear energy after 1970s-80s. Such discussion, however, remains limited to describing the cultural attributes through stages of ‘innovation journeys’ and does not include their impacts that would reveal more about the nature and the role of agents in STTs.

In the context of servicizing, it is neither the journey itself nor the cultural meanings attributed by the actors that increase the legitimacy of innovations, but the cultural dynamics created through or imposed upon the actors. The counter culture created alongside the journey also needs to be explored. The key issue is that taking the evolution of innovations as a journey (i.e. focusing on the process of moving from producing to selling services) entails the emphasis on innovation process itself. The counter-hegemonic relations within the journeys may not be necessarily explained by a linear process, but a series of diversion paths through institutional/organisational inertia or force. Even before that, the type of innovation journey is not applicable to servicizing in mobility, because as alluded to above, how actors attach meanings to servicizing practices should be considered in conjunction with the needs to carry out the daily activities and wider institutional developments occurring simultaneously in all spheres of governance and social life.

Following this, in addition to the role of discourse in shaping mental conceptions of the world, how people perceive the role of servicizing or any other forms of transport on their wellbeing (due to public and political discourse or their competencies/aspirations) has been extensively theorised in the mobilities literature. A series of behavioural (e.g. Ballinghall, et al., 2012), institutional (e.g. Banister and Berechman, 2000) and sociocultural (e.g. Ohnmacht, et al., 2009) explanations can be employed to understand the transport user practices in the context of mental conceptions of the world; this is likely to expand the factors affecting daily travel and consumption practices - the outcome of the consumption side in the neoclassical economic framework.

The implications of ‘motility capital’, which refers to the capacity or potential to move, provides a clear understanding of how these complex sociospatial complexities can be explained (Kaufmann, et al., 2007). According to the ‘motility capital’ framework, access, competence and appropriation are the key elements of mobilities, which are clearly linked social and cultural elements of the context mobility practices occur (Kaufmann, et al., 2004). Therefore, if it is not appropriate to use a car sharing service, or if not owning a car is not consistent with the aspirations of the users (due to the role of car as a symbol of social status in lower social grades), and if the user is not capable of using the services (due to disability or lack of space), the potential of sharing is likely to disappear within the demand realm. Or, it will result in socially undesirable outcomes. Implied is the need for a detailed look at the interactions between capacities and aspirations in different contexts that determine the conditions under which travel occurs.

It is already clear that mental conceptions of the world are inadequate to determine levels and nature of demand as other activity spheres such as social relations significantly influence them. Social relations are one of the most relevant activity spheres to mobility practices through widening social networks. In fact, it is widely recognized that geographical distance is not as important in
determining social relations as it was in the past. This is emphasised in the concept of network capital, which refers to social consequences of mobilities influenced by several factors ranging from physical accessibility to access to virtual mobilities (Urry, 2007). Relational in nature, network capital’s broadening conceptualization of social capital sheds light on the connection between social relations and mobilities, in this case how social relations are determined by sharing and owning, and vice versa. The main counter-argument is the concern over ‘dependency’ in sharing practices in transport. In fact, this takes us back to mental conceptions of the world, where the aspirations and behaviour of the individuals might differ depending on their existing practices (i.e. whether they are involved with informal schemes or not).

Moreover, the linking aspects like the use of ICT is important in determining the options available to transport users as it has been recognized as a major potential contributor to demand management used by producer and service providers. The consumption aspect includes several equity issues in the use of technological services: not everyone benefits from these developments equally or not necessarily in the direction towards sustainable transport (Kenyon, 2006). How it is reflected in production of new technologies and organisational forms in the providers’ corporate governance, which is one of the main activity spheres on the production side, is multidimensional that will be discussed on the production and provision side.

Overall, the implications of public discourse on servicizing and the existing mobility capitals of the potential users bring additional insights into social aspects of servicizing in mobility.

- Perceived acceptability of servicizing in mobility generally depends on the existing social relations and mobility habits of the potential users.
- The altruistic tone of sharing goods as implied in the concept of collaborative consumption limits the fair distribution of mobility goods and activities.
- Isolating the servicizing activities in the mobility sector is likely to hinder the cultural and institutional contexts in which they operate resulting in misleading conclusions on how the users and non-users are actually affected over time.

Production and organisational forms and institutions

Influencing the mental conceptions of the world and the social relations and hence daily consumer practices is not limited to the private sector. Production of new technologies and organisational forms with respect to servicizing are also connected with production and labour processes. The use of labour, labour market conditions, social protection, education, vocational training and skills are significantly associated with different manufacturing and sales models. Although our starting hypothesis was the opposite in terms of describing the uptake of servicizing, this trend might be considered similar to moving from the manufacturing sector to traditional services sectors like banking, which led to establishment of strong developmental associations inducing different industry practices (Berk and Schneiberg, 2005), which in turn brings further social inequalities.

It is because the relationship between government and businesses in the sharing economy (e.g. in terms of providing incentives for making businesses more service-oriented) is not (or cannot be) necessarily well-structured enough to include all social complexities on the consumer/user side. For example, the current targeting of the young professionals by the car club industry in the UK as they are found to be more likely to be ‘rational’ with respect to transport needs and therefore use vehicle-
sharing systems should be carefully reviewed. The trend is evident in the increasing number of car-sharing schemes in university cities like Cambridge and Oxford. It may not necessarily be the case, but such action plans have the potential to ignore other social groups or may well lead to motorised transport as the main travel method if it is not accompanied by complementary measures by the local governments, i.e. ensuring that there are enough designated parking spaces in deprived neighbourhoods. This becomes even more important given that in lower social grades car ownership is more likely to be regarded as a status symbol (Loose, 2010).

Businesses motivated by governments or governments encouraged by businesses to open up a specific market for sharing through servicizing models might hinder the process of equal diffusion of servicizing in society. For instance, producers focusing on business models where servicizing and sharing are encouraged are likely to improve and maintain relations with insurance providers. These new/niche businesses or those able to change towards services stand to benefit, but there will be traditional and powerful businesses, which cannot adapt that stand to lose from a mainstream/large scale switch to servicizing. Yet, how this process takes place and how it works in harmony with community interests are also linked to social pressure and government regulation in achieving inclusive growth.

Another issue on the institutional and organizational side is the tax collection process that may change as part of the transition towards servicizing. Sharing as a concept potentially goes against the business interests of the manufacturing sector that are interested in selling more and some interests (not all) of the government from the point of revenue as a result of changes in tax collection. The leasing arrangements between car manufacturers and service providers and the arrangements of provision of incentives and exemptions (e.g. with regards to parking costs and charging) between providers and local governments also constitute crucial social aspects of servicizing in mobility.

With respect to production of technologies and organisational forms in the context of economic geography of vehicle sharing, the importance of virtual mobilities becomes more evident with the increasing role of multifaceted nature of proximity and the conception of space. Different types of mobilities and their impacts on travel needs are extensively studied in the mobilities literature (Kenyon, 2006; Urry, 2007). Small-scale IT innovations in transport have the potential to benefit from virtual mobilities. But, the role of local interactions is still important if knowledge transfer is to happen particularly in the context of spin-off ideas through learning networks for car-sharing for commuting amongst firms given their organisational routines. As an emerging sector, car-sharing industry is more likely to benefit from business use rather than individual use. However, how the businesses/organisations learn to benefit from these practices is equally important.

The importance of power dynamics is already outlined in discussing social relations and mental conceptions of the world in determining the feasibility of servicizing in transport. Although in a democratic governance system, individuals can organize themselves to induce a change in consumption and travel patterns as in the case of many collaborative consumption activities like starting car clubs, the aforementioned equity considerations should also be dealt with the distributive power of the state, which is generally recognised as the predatory theory of the state (North, 1981) that the state is an instrument for transferring resources from one group to another.

The path-dependency of institutional argument also deserves special attention. Assuming that equilibrium economic institutions are a result of the exercise of de jure and de facto political power,
Robinson and Acemoglu (2008) suggest that there is always a possibility that traces of past institutions might be preserved, and this may affect the way institutional frameworks are built. The overall argument is that institutions are not exogenous or historically predetermined, but they seem to persist for long periods of time. This may render the changes taking place in the car manufacturing industry as a change of business model only, not a change of ownership as is promoted.

Taking into account this complex nature of institutions, production and organisational forms and the role of discourse on sociocultural dynamics, two messages arise in the context of servicizing in transport. First, it is important to identify the level of governance required for the smooth operations of servicizing on both the demand and the supply side. This requirement however represents a significant challenge given the governance arrangements under which the current system is maintained. All levels of governance are involved in the current ownership model of private transport, yet this management of the current transport infrastructure has evolved with a fragmented landscape of jurisdiction (land use, local road and highway management, parking are all managed at different scales), making large scale shifts away from current practices from an institutional perspective difficult to foresee.

Institutional change will need to involve a multi-level governance effort, with new roles and responsibilities clearly assigned across scales, but it will also require collaboration from existing and emerging economic players – on the production and consumption side – and also the public, not just as a voting mass, but also as collaborative consumers and engaged citizens to deliver such wholesale change. Leaders –governmental, business and community – are also likely to be required to move towards more collaborative mobility – ultimately there needs to be more feedback within and between the inter-related activity spheres to enable the level of interaction needed to sustain a switch to sharing. Having an accreditation institution, which acts on the basis of the service participants’ feedback through annual user and provider surveys (e.g. Carplus in the UK), is likely to make governance more inclusive. Therefore, the levels of governance and the number of actors should be regarded as crucial social aspects the servicizing systems.

Overall, the discussion on the processes around and the implications of production and organisational forms and institutional arrangements amongst governments, service providers and manufacturers reveals that there are wider and governance-related social aspects of servicizing in mobility. The implications of the transformational thinking about production and servicizing for social impacts like employment depends on the social processes and the institutional contexts in which servicizing occur. Targeting certain social segments by the service providers and the government’s reaction to it is part of the social process with further social implications. It is therefore imperative to extend the definition of social aspects into dynamics of levels of governance and the role of the actors in it, i.e. whether they are full informed of and involved in the process.

2.4 Conclusion: conceptual framework

This chapter consisted of three steps:

- First, the implications of the key elements of servicizing identified in the generic definition were explored for the mobility sector.
• Second, the existing practices were reviewed (with a focus on car- and bike-sharing) by exploring the key elements identified and the policy actions to encourage car- and bike-sharing.

• Finally, the social aspects were identified through a cultural and political economic framework examining both micro- and macro-level factors.

These parts constitute the conceptual framework of servicizing in the mobility sector. The key elements including ownership, product and service combinations, number of actors and spatial and temporal ordering attach the existing practices into different parts of the servicizing continuum. The relative importance of these elements is particularly significant as illustrated by the upside down triangles. Based on these key elements, economic and environmental aspects can be easily identified (and influenced) by ICT, eco-innovations and infrastructure, which in turn identify the physical and resource constraints.

The discussion of the social aspects and political issues (justice and equity issues with respect to social progress) reveals that mobility capitals and political economic institutions influenced by public, political and business discourses, respectively, identify the cultural and political/institutional constraints. The implications of public discourse on servicizing and the existing mobility capitals of the potential users bring additional insights into social aspects of servicizing in mobility. It has been shown that perceived acceptability of servicizing in mobility generally depends on the existing social relations and mobility habits of the potential users. And the altruistic tone of sharing goods as implied in the concept of collaborative consumption limits the fair distribution of mobility goods and activities. Moreover, isolating the servicizing activities in the mobility sector is likely to hinder the cultural and institutional contexts in which they operate resulting in misleading conclusions on how the users and non-users are actually affected over time. In addition, the discussion on the production and organisational forms and institutional arrangements amongst governments, service providers and manufacturers has shown that there are wider and governance-related social aspects of servicizing in mobility. The implications of the transformational thinking about production and servicizing for social impacts like employment depends on the social processes and the institutional contexts in which servicizing occur.

The consideration of the wider social aspects is therefore imperative to extend the definition of social aspects into dynamics of levels of governance and the role of the actors in it, i.e. whether they are full informed of and involved in the process. This will extend the methodologies to measure the social impacts of servicizing as the multi-faceted nature of complexities in consumption is interlinked with the production and organisational frameworks, which an agent-based approach may not be adequate to explain. Overall, the conceptual framework constructed in this chapter help identify what is actually happening without any presumed beliefs about the uptake of servicizing systems in the mobility sector.
Figure 7: Conceptual framework of servicizing in mobility

1. Key elements of generic definition of servicizing business models in the mobility sector

<table>
<thead>
<tr>
<th>Car-sharing...</th>
<th>Bike-sharing...</th>
<th>Goods mobility...</th>
<th>Public transport...</th>
<th>Tele-presence...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership</td>
<td>Spatial and temporal</td>
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2. Integrating social and political aspects into economic and environmental aspects

- Institutional and administrative forms
- Production and organisational forms
- Technological and organisational forms
- Mental conceptions of the world
- Daily consumption practices
- Social relations

- Mobility capitals
  - Political economic context
  - Public discourse
- Infrastructure
  - Eco-innovations
  - ICT

- Impacts on vehicle ownership and distance travelled
- Infrastructure requirements
- Eco-innovation requirements on the demand and supply sides
- ICT requirements for abatement of costs and facilitation of the service

Identification of the political, cultural, resource and physical constraints
3. Economic, environmental and social measures of servicizing

3.1 General methodologies for measuring decoupling in transport

In this section, a broad overview of decoupling indicators and measures of social impacts of transport is provided, on the basis of the generic methodology development of the effects of servicizing conducted in the framework of WP3 ("Methodology development"). Without identifying the key challenges of researching the impacts of transport, any attempt to construct methodologies for measuring the impacts of servicizing in mobility remains limited. This broad overview of how transport’s impacts are measured is therefore crucial for employing the existing methods in understanding servicizing in mobility. We start by looking at environmental and economic impacts and provide a synthesis of the decoupling in transport literature. We then identify the social impacts of transport and the existing methodologies in the policy and academic agenda. We conclude this section by integrating the identified social impact measures into the understandings of decoupling pathways in transport.

3.2 Economic and environmental aspects: decoupling mobility

*Delinking Transport, Economy and the Environment*

As discussed in section 1, infrastructure has been at the heart of development and growth agenda. The role of transport infrastructure in economic development has been repeatedly emphasised through its economic productivity impacts (Aschauer, 1989; Torrisi, 2009). Although the direction in which transport infrastructure affects economic productivity and whether the benefits are distributed evenly from geographical and social perspectives (and indeed the regional disparities are found be potential outcomes of infrastructure building if not supported by complementary actions), the image of infrastructure as an economic development indicator has remained prominent. This fundamental link between the economy and transport is well-known and documented (Goetz, 2011).

Despite the centrality of infrastructure in transport policy and its role on the growth of nations, the role of transport has expanded to cover transport as a system and mobility as a practice. Over the past century, the transport of people, goods, and information has increased enormously, reflecting the clear economic and societal benefits of transport. The global economy functions through (international) travel and trade, and there exist important positive feedback loops between transport and the economy, as growth of one stimulates the other. As well as allowing other economic sectors to function, transportation (i.e., the infrastructure, logistics, and information systems that manage and direct the actual movement of vehicles, ships, and airplanes) has become an important sector in the global economy in its own right (Banister *et al*., 2011).

The range of impacts that the transport sector has on the environment is as well-known, but perhaps less understood. Unravelling the complex linkages in the relationship between transport as a means to deliver economic growth, as a contributor to economic growth and the associated environmental impacts resulting from these activities is extremely complex. So too then is the complexity in determining the impact that large-scale shift to servicerized mobility system would have on these
positive feedback loops. Previous studies have demonstrated that increasing transport rates have outpaced improvements in environmental technology for transport (Stead, 2001). Also that the relationship between emissions, energy use and transport has remained ‘flat’ over a 30 year period for both passenger and freight transport – but the links between transport energy use and economic growth have not been broken (Tapio, et al., 2007). The reliance of the transport sector on fossil fuels remains significant – in 2010 around 60% of all oil was consumed by the sector (IEA, 2012) and the sector’s share continues to grow. And of significant importance is the fact that much transport demand is derived from other economic activity (Gray, et al., 2006), so logically, economic growth needs to be realised with “less” transport, or at least without a proportional increase in transport activity (Gray, et al., 2006).

Several concepts have been developed to achieve this aim and as explained by Tapio, et al. (2007), the diversity of approaches for considering the same issues has resulted in contested terminology with concepts being described with different meanings by different authors. Finel and Tapio (2012) suggest that the concepts of eco-efficiency (business strategy to search for environmental improvements that yield parallel economic benefits), de-materialisation (decoupling of the specified environmental harm from material production), and immaterialisation (decoupling of both material production and consumption from economic production) and decarbonisation (delinking the carbon intensity of the economy) should be used collectively to capture and discuss the need for decoupling.

Other distinctions made in transport and economics literature to explore decoupling theories include Tapio’s (2005) coupling, decoupling and negative coupling which can further be broken down into weak, strong and expansive/recessive degrees depending on the extent of increase or decrease of chosen variables (see Figure 9). The OECD also reference common terminology such as ‘absolute’ and ‘relative’ decoupling (2006), where absolute decoupling is defined to be achieved when resource use declines over time while the economy grows and relative decoupling occurs if resource use decreases at a lower rate than economic growth (Schutz and Bringzu, 2008).

Figure 8: Different aspects of decoupling

Source: Tapio, (2005)
This decoupling of the link between transport growth and economic growth is seen as a fundamental contributor to delivering more environmentally sustainable transport policy, whilst he suggested that the environmental benefits of decoupling will be modest, Mackinnon (2007, p. 4) went as far as to describe it as “one of the holy grails of transport policy-making”. This can be seen in the language of the 2011 EU White Paper, which describes as a ‘paramount goal’ for its vision for a competitive and sustainable transport system is to deliver transport which uses less and cleaner energy, and reduces its negative impact on the environment.

Many scholars have focused attention on considering freight transport in their discussions of decoupling (Sorrell, et al., 2009; Koopman, 1995; Schleicher-Tappeser, et al., 1998; Kveiborg and Fosgerau, 2007; McKinnon, 2007). But decoupling is an equally important consideration for passenger transport and understanding these relationships is central and perhaps more important in the context of this project, in terms of the conceptualisation and testing of servicizing in the mobility sector. Although as Banister and Berechman (2001) illustrate, the opportunities are harder to envisage and that decoupling is likely to only be effective in combination of strategies to reduce the volume of traffic, distance travelled, measures to increase efficiency whilst also maintaining economic growth.

Ballingall, et al. (2003) made the distinction between ‘production transport’ and ‘consumption transport’ to define clearer parameters for decoupling policies to allow for interactions between different forms of transport to be considered. Production transport can be considered as activities related to the production of goods and services and essential household sector activities. Consumption transport refers to transport for non-essential purposes (Ballingall, et al., 2003). The divide suggests that as a cost to production, there is an incentive for business to seek reductions in transport use. But as a household’s income grows, it becomes likely to consume more – including more transport. The work of Ballingall, et al. (2003) posits that in theory then decoupling in the production sector may actually lead to an increase in travel in the consumption sector mainly due to substitution effect, and that the resulting impact on overall transport activity is ambiguous and has important implications for decoupling policies. In terms of understanding the linkages between the environmental and social impacts of decoupling, understanding how mobility can be servicized in a way which limits this increase in ‘mobility consumption’ through accumulation of wealth is key.

Some existing studies to examine whether decoupling is witnessed in various transport contexts deliver similar results. As mentioned above Tapio, et al. (2007) found that no decoupling was evident in the EU between 1970 and 2000. In the Finnish context under investigation, Tapio’s (2005) data observed weak decoupling of road traffic volume from GDP and strong decoupling of the CO₂ emissions from road traffic (and GDP) in Finland between 1990 and 2001. He suggests that the high price of cars, an increase in fuel price elasticity and the emphasis of the high tech sector were contributing factors in encouraging these changes in the Finnish context. It could be held that these features need to be present in policy to enable decoupling to occur.

The recent ‘peak car’ phenomenon has been linked with decoupling transport growth from economic growth. Kenworthy (2013) calculated the car kilometres driven to generate one unit of real GDP in local currency in 1995 and 2005 for each metropolitan area in 42 cities in Asia, North America, Europe and Canada. According to the results, in all regions except Asia, the car kilometres driven dollar of GDP have declined from 1995 to 2005, with the European cities showing on average the
least decline. Kenworthy (2013) links this decoupling with the growth of service economy, the urban youth culture and the use of social media as well as revival of the use of public transport, particularly rail passenger transport. Although the study does not consider other factors that may affect the relationship, the overall picture suggests that in wealthy cities car vehicle kilometres decoupled from car use growth.

Additionally, Metz (2013) proposes that we have entered a fourth phase of travel in which the per-capita growth of ‘daily’ travel has ceased, especially in urban areas. He suggests that this slower growth and plateau in total movement levels could be translated into a levelling off or even reduction of cars being used in cities. Consequently he surmised that population growth, aging and urbanisation will be important demographic considerations, especially in terms of the amount of travel and the modes used. The trend is still far away from absolute decoupling, but for the purposes of the SPREE project these illustrations and the highlighted inferences about likely future trends are particularly important with their relationship to service economy and reduced car vehicle kilometres.

**Decoupling indicators**

Although a common conceptual understanding of decoupling can be achieved, agreeing on the right measures of decoupling is not so easy (as presented in task 2.6: “The interface between supply and demand side policies in terms of addressing absolute decoupling”). CO₂ emissions have been often used as environmental assessment decoupling indicators. Tapio’s work is not alone in its approach to focus on carbon dioxide (CO₂) emissions as a measure through which decoupling could be demonstrated. Other literature follows a similar approach (Grey, et al., 2006; Tapio, et al., 2007; Finel and Tapio, 2012).

However, improving CO₂ can in some cases make other impacts worse – for example diesel is a more efficient fuel compared to petroleum, but in terms of air pollutants and particulate matter is worse. Similarly the environmental impacts of land use changes, biodiversity etc. cannot be reflected upon by solely using an emissions-based measure, but such impacts are more complicated to accurately gauge. These sorts of trade-offs need to be considered in any approach taken to consider absolute decoupling in transport. For the time being, the close correspondence and ease of comparability between energy use (particularly oil/petroleum) and CO₂ will see such assessments continue to be preferential in terms of indicators to determine decoupling. Indeed, energy use (as opposed to emissions generated) and transport volumes were examined by Stead (2001).

The OECD’s (2006) work on developing decoupling indicators also demonstrates an emissions-based approach to considering environmental impacts (see below). And although there are several environmental issues which need to be addressed simultaneously before transport policy can be considered sustainable, it is perhaps more straightforward to quantify such impacts rather than other perhaps less direct impacts like land use change – because the links between road building – for example – and increased economic output are perhaps less linear. Banister and Berechman (2001) too emphasised that policy should be seeking to reduce the transport intensity, and that dematerialisation – or the reduction of physical materials used could make a fundamental impact. In the context of servicizing mobility, selling fewer vehicles and offering mobility as a service – as in car sharing, is a clear means to demonstrate dematerialisation in practice, but other examples abound. This clearly applies to the case of transport as most LCA studies show that the operation stage is usually the most important stage of transport impact (Chester and Horvath, 2009).
According to the OECD’s (2006) work on decoupling, indicators should be used to describe changes in environmental pressures over time, and then compare them to changes in economic “driving forces” over the same period of time. The following indicators were identified by OECD (2006) for decoupling the transport sector, which may be considered by the SPREE project as also comparable with the other sectors under consideration:

- Economic indicators of transport versus GDP: considers growth rate of passenger and freight transport
- Environmental impacts of transport versus GDP: considers CO₂, CO, NOₓ, VOC emissions and PM not land use, material flows or other environmental impacts.

Both economic and environmental indicators can be measured in absolute terms or per capita (Finel and Tapio, 2012). In the case of emissions, this could also be measured in terms of intensity, referring to output per unit of production/consumption.

**Ex-post policy analysis of strategies for decoupling**

The centrality of decoupling of transport growth from economic growth in EU transport policy is evident in the Transport Council’s statement that "it is necessary to ensure that economic growth can continue without necessarily entailing traffic growth with an increase in the negative effects of transport". At the outset, the relative decoupling in terms of energy consumption from transport has been achieved between 2000 and 2009 (8% increase in energy consumption from transport while the GDP grew by 12%). However, the fall in energy consumption is mainly attributed to the 2008 economic downturn. Several reasons can be provided to explain why single policy measures have not succeeded to contribute towards absolute decoupling in transport. Before exploring the effectiveness and implementation issues with the main policy domains (see also task 3.3: “Methodology development for evaluation of policy impacts”), there are broader issues to consider in terms of policy evaluation.

First, there are definitional issues. The selection of key indicators for measuring decoupling impacts is of crucial importance to understand what is decoupled from economic growth. According to Stead and Banister (2006), the EU White Paper 2001 assumed that it was possible to decouple transport from economic growth without the need to restrict the mobility of goods and people implying that efficiency measures like increasing occupancy and load factors would be adequate to achieve decoupling. The existing behavioural and technological strategies, however, have the potential to hamper the need for mobility of goods and people. Moreover, the problem with the transport growth should be better defined to understand what needs to be controlled. It is, therefore, essential to understand the interdependencies amongst the negative outcomes of transport growth, mobility implications of economic growth and transport growth itself. Finally, there are issues as to what is included in the broad scope of transport – the propositions are very different depending on whether the ‘traffic’ under consideration was solely land-based, or if aviation and shipping were also included. Defining the scope of our transport, its energy consumption and subsequent environmental impacts is extremely important, not just for decoupling, but also in terms of what can therefore be delivered through a shift to more service-based mobility.
The operational aspects constitute the second group of concerns with respect to decoupling. The selection of policy instruments to achieve decoupling should be context based. According to the ASI approach, CO₂-intensive transport systems are avoided followed by a shift towards decoupling of transport growth from economic growth and improvements through fuel economy, clean energy and behaviour change (Banister, et al., 2011). However, how the shift works in transport can work in many ways: Givoni (2013) describes three pathways towards low carbon mobility. The technological fix approach can decouple transport from emissions. Glocalization can decouple economic growth from transport. Or a radical pathway can be adapted to completely change lifestyles in which there is no need for economic growth hence no increase in transport growth. Therefore, decoupling in transport sector can be considered as a combination of different pathways towards low carbon mobility.

The policy evaluation in terms of decoupling of transport from economic growth should consider these conceptual and operational issues. If it is the negative environmental impacts of transport that the policy targets, success of a policy could be measured in terms of the extent to which growth in the environmental variable is reduced (in percentage terms), below that of the economic variable. However, not all are causally linked. Fundamentally important to achieving decoupling is the acknowledgement – as made by Stead (2001) that policies and actions outside of the transport sector may be the key to delinking economic growth from environmental impact – such as energy taxes and land use planning.

Decoupling can take place with full-cost pricing that is inclusive of environmental externalities (Panayotou, 2003). As exemplified by the energy and transport sectors, the EU decoupling policy consists of demand management through full cost pricing and the development of more environmentally-friendly alternatives by promoting technological innovations (Panayotou, 2003). Stead and Banister (2006) particularly stress the importance of ICT, land planning, behavioural changes and organisational changes given the increasing importance of governance and technological developments. In their concluding remarks, Tapio, et al. (2007) suggests a number of strategies that could be employed at an EU level to work towards decoupling transport growth from environmental impacts:

- Restricting the rate of growth in transport volumes
- Promote the use of public transport, walking and bicycling
- Manage the urbanisation process in line with these target:
  - Allowances for sustainable modes
  - High functional density of communities
- Include transport in CO₂ emissions trading
- Pricing measures mainly fuel price increases

Overall, these strategies can be broken down into four categories: (i) pricing: internalisation of externalities, (ii) infrastructure investment: the EU New Infrastructure Policy, (iii) behavioural measures, and (iv) land use planning and (v) regulatory measures. Analysis of the policy measures under these domains will be included in the policy packaging work package of the project. Their impacts on decoupling should be analysed in conjunction with the policy implications of the review of car- and bicycle-sharing practices in the previous chapter. The first insights will be provided in the
policy paradigms to encourage the uptake of servicizing systems in the final chapter of this document.

Implications of policy strategies for SPREE

The SPREE goal of achieving absolute decoupling implies that all environmental impacts are considered in the delinking between economic growth and resultant detriment to the environment. But as discussed above, CO₂ as a catch-all does not reflect this. However, it is likely that each of these concepts discussed above do in fact have a role to play in achieving resource efficiency in the mobility sector. It is therefore important to keep in mind the importance of these relevant terms. In fact, as will be discussed later in this chapter and in the final chapter, the relevance of these terms changes given the scale of analysis carried out in selected countries.

More importantly, most of the work on decoupling has occurred at the national or supranational (EU) level to date. There are challenges in terms of considering such efforts ‘absolute’ since the interactions of transport across scales, modes and systems are too complex for the bounds of this project. Therefore, the SMR goal is in fact to contribute to achieving absolute decoupling. However, in both the LCA approach and ABM (Agent Based Modeling), there are particular areas where decoupling can be considered to which SPREE could add great value and insight to the transport decoupling debate.

Another challenge to employ the abovementioned methods for the project is the consideration of the issues, which cut across freight, and passenger transport, such as competition for space, resources etc. and SPREE should be mindful of this. In fact, the decoupling trends in passenger and freight transport have largely diverged over the last decade. It is, therefore, important for SMR to consider competition with freight transport in terms of resources and space even if we are to focus on passenger transport in the context of cars and bicycles. Moreover, the impact that the aviation and maritime transport industries are having on total transport related emissions and broader environmental impact that are often not considered in the scope of policies, projects or initiatives is a challenge which needs to be acknowledged. Efforts to promote servicizing, even at the most ambitious scales will likely have little positive contribution to reduce the total environmental impact of the transport sector, or on delinking transport growth with economic growth.

Moreover, as was outlined above, the literature and work that has been done in decoupling to date offers SPREE and the SMR some useful guidance about the areas into which focus could be placed and the corresponding tools to use. To recap, the price of cars, fuel price elasticity, role of the ‘high’ technology sector were seen to be contributing factors to encourage decoupling. Population growth, rates of aging and levels of urbanisation were all important demographic considerations in determining whether the rates of daily movement are likely to rise, plateau or stagnate. These are the types of factors, which can help to make the link between the environmental and economic impacts with the complex social factors that can have important contributory, or knock-on effects on policy focused on achieving decoupling or to promote servicizing.
3.3 Measuring social impacts of servicizing in mobility

3.3.1 Social impacts of transport

Despite the significant sustainability threats of transport for society, the discourses around economic growth, the environmental impacts of transport infrastructure and the social aspects of transport have rarely crossed paths. Social sustainability has been isolated from the research on the development impacts of transport. This is somewhat alarming given that increased motorisation as a result of increased road networks is likely to result in continued and growing social inequities between different population groups, with the consequence of increased social exclusion and reduced social wellbeing and quality of life, leading to breakdowns in community cohesion and greater overall inequality (Banister and Wright, 2005).

In this section, we first identify the existing social impact measures of transport in the academic literature and the policy agenda. We then integrate the insights on the social aspects of servicizing in mobility in the previous chapter.

Existing indicators of social impacts of transport

The role of transport in social development is a long-debated issue in the policy agenda. Traditionally, it has been recognised that economic development would have a trickle-down effect on social development. As a consequence of this, social equity considerations have been largely ignored. Given that the relationship between transport and economic development is subject to several conditions, the implications for social development are even more difficult to understand. The increasing evidence on social aspects of transport suggests that new evaluation and appraisal methods are required for socially sustainable transport policy-making.

There are already well-defined indicators to understand the impacts of transport interventions on the three social pillars of sustainable development, identified as social progress, equity (equality of opportunity) and justice in terms of policy outcomes. Lucas, et al. (2007) identified five core indicators to assess the social impacts of transport projects and policies in the UK, which were later complemented by governance elements (2013). Below is a summary list of the core indicators based on these two studies and how they can be linked with the three social pillars.

Measuring the role of transport in social progress

Social progress mainly refers to poverty, housing and crime, unemployment, education and health. The UK Department of Transport (DfT) identifies social impacts to “lend themselves to assessing the social change processes invoked by the introduction of a transport intervention”. According to DfT, cohesion, stability and services, people's way of life, the quality of the air and landscape, health and well-being and personal fears and sense of security can all reflect the social progress. The core indicators of the transport appraisal frameworks developed by Lucas, et al. (2007) and Lucas, et al. (2013) to identify a set of transport-specific social indicators are as follows:

1. **Transport poverty** can be measured by affordability of transport services relative to income for households below the poverty line.
2. **Accessibility** can be measured as weighted journey times to key destinations relevant to employment, education, health and food.

3. **Safety** is indicated by adult and childhood pedestrian casualties by social class.

4. **Quality of life** can be measured as a percentage of residents living within 1 000 m (or 15-minute) ‘safe walk’ to key destinations by relevant social groups.

5. **Housing availability** is measured by the lowest 10% value of house prices within x minutes (based on average population local journey times to employment within any given location) to the town centre and key centres of employment.

6. **Health and wellbeing** is an important social indicator. However, it is not straightforward to measure. It is suggested that this should include protection from road deaths and injuries, freedom from pollution and other adverse effects such as noise, major roads dissecting communities, traffic congestion, and promotion of healthy travel and absence of social exclusion.

**Social equity and distributional impacts of transport**

Social equity impacts refer to the distributional impacts of the above indicators. The DfT assumes that distributional impacts “relate to the extent to which there are differences in the impacts of interventions across different groups in society.” Although affordability, housing availability and levels of car ownership can already be used in expressing equities with income distribution, Lucas, *et al.* (2007) point out these indicators should still be disaggregated depending on the country context. For instance, the poverty line may differ depending on the country.

**Social justice implications of transport policy outcomes**

The social justice implications are defined as the equality of opportunities and benefits resulting from policy outcomes. In addition to integrating the above indicators into policy, the following indicators are identified to complement the core indicators:

1. **Equal opportunity to participate in society** is subject to measurement issues. It is required to include availability, accessibility and costs of transport (for present and future generations and all sectors of the population).

2. **Transparent and accountable transport governance structures** are also among the key indicators of social impacts of transport. This may include availability of public enquiries, referenda and engagement exercises, community representation within transport organisations and decision-making with respect to investments and finance.

3. **Access to decision-making processes and recourse** to legal justice includes governance and planning structures, which allow bottom-up, community decision-making processes to occur, e.g. local community for a community-led local transport plans.

4. **Integration** can be acknowledged as a cross-cutting agenda for bringing together all these indicators with other sectors. The key sectors to include are housing, city planning, public utilities, health, education, environment and social welfare.
Tools for measuring social impacts of transport

There is no standardised set of methods to assess social impacts of transport. This is mainly due to the importance of context and the fact that this has been dealt with in a variety of disciplines. Markovich and Lucas (2011) list three main issues in the academic literature on which methods to employ to measure the social impacts of transport, which can also be applicable to assessing the social impacts of servicizing in mobility.

1. As with all impact analysis areas, the quantitative versus qualitative methods debate remains vivid in this topic. While quantitative methods can be helpful to measure noise exposure and accidents, several scholars suggest that social impacts of transport can only be captured through a variety of qualitative research methods including focus group discussions, in-depth interviews and visual materials to help guide participant discussion (Lucas, 2011).

2. Markovich and Lucas (2011) criticize the validity of neighbourhood surveys to capture all social effects. Forkenbrock, et al. (2001, cited in Markovich and Lucas, 2011) claim that neighbourhood surveys can be used to deduce the attributes of neighbourhoods which can then be incorporated into transport planning. The neighbourhood surveys have therefore been used for identifying issues regarding community cohesion and forced relocation. Some scholars (e.g. James, et al., 2005, cited in Markovich and Lucas, 2011) point out that these surveys are limited to identify trip diversion and delay and road safety, therefore cannot reflect all social impacts.

3. The existing literature lacks an emphasis on distributional effects as part of social impacts. It can be argued that in studies assessing the environmental effects of transport, distributional effects of transport policies are considered to some extent. However, there is no overarching theoretical or methodological framework, in which distributional impacts can be considered in full.

Given these general observations with regard to methodologies for measurement of social impacts of transport, it can be concluded that different indicators of social impacts of transport can only be captured by a combination of methods. Measuring the distributional impacts is even more complex given that they should be considered in relation to environmental and economic impacts. As DfT points out, there are points of overlap between social, economic and environmental impacts, because economic and environmental impacts can have social consequences and vice versa. How different social groups are affected by environmental impacts, for example, is a social issue that needs to be a cross-cutting theme across the three types of impacts of servicizing in mobility.

The international development agenda has also suggested several policy guidelines that can be employed for ex-ante evaluation and appraisal of transport projects. The World Bank guidelines on social analysis in transport projects (World Bank, 2006) particularly stress the importance of participatory governance. According to the guidelines, the project identification and design as the first step. The second step is the project appraisal step, followed by negotiations and approval. The crucial aspect of the guidelines is full consideration of social diversity and gender, institutions, rules and behaviour, stakeholders and social risk at every stage of integration of social aspects into transport analysis.

At the national level, the Dutch Overview Impacts Infrastructure and the UK DfT’s Transport Analysis Guidance (WebTAG) are the most comprehensive tools to integrate social aspects into transport
policy and planning. Established in 2000, the Dutch Overview Impacts Infrastructure includes indirect, direct and external impacts in monetary values. WebTAG on the other hand includes more variables including environment, safety, economy, accessibility and integration. In line with Markovich and Lucas (2011), Geurs, et al. (2009) also point out the complexities in measurement of social impacts and claim that although both Dutch and UK assessments cover a wide range of social impacts, the consideration of local impacts, social justice and weighting criteria is inadequate.

### 3.3.2 Measuring the social impacts of servicizing in mobility

The challenge for constructing methodologies for social impact measures is already evident from the identification of social aspects of servicizing in mobility and the existence of diverse methodologies in assessing social impacts of transport in general. Although social impacts cannot be isolated from the social aspects, social aspects are not necessarily related to social impacts only, but economic and environmental ones, too. It is therefore crucial to distinguish between social aspects and social impacts.

In explaining this distinction, we should briefly revisit the concepts of objective and subjective measures discussed in Task 3.2 (“Methodology development for measuring social impacts of servicizing activities”) and Deliverable 3.1 (“Evaluation procedure for policy outcomes”) of the SPREE project. Chenoweth (2013, p. 3) explains that “the concept of quality of life is subtly different from well-being.... whereas well-being is based upon subjective experience, quality of life refers to the extent to which a person’s life is desirable”. Furthermore, he points out that the quality of life can be broken down into individual and societal quality life, where the former relates to how well individuals live, while societal quality of life relates to stability in society. As rightly pointed out in Deliverable 3.1, although they require different methodologies, these measures usually overlap and the concept of equity should also be reflected in the social impacts of servicizing in transport.

Taken together, these insights clearly confirm and complement the mobility-specific social impacts described above. While the wellbeing and quality of life discussion relates to social progress aspects of measuring social impacts of transport, the concept of equity is included in the social justice, equity and distributional impacts. The key challenge is how to combine these arguments together with the existing servicizing practices discussed in Chapter 2 to construct a workable methodological framework for measuring social impacts of servicizing in transport.

It is first important to incorporate the understanding of objective versus subjective measures and the distinction between individual and societal quality of life. Although both concepts (wellbeing and quality of life) can be discussed in different ways in transport studies, given the emphasis on the three pillars of social development in transport we started with, we limit our understanding of social impacts as being “objective versus subjective” and “direct versus indirect”. We then combine it with the discussion on the governance and social aspects of servicizing in mobility in Chapter 2.

In identifying the social aspects of servicizing in mobility, the key factors determining the including mental conceptions of the world, daily consumption practices, production and organisational forms, institutional and administrative arrangements and social relations have been discussed in the context of servicizing in mobility. Shortly, while having key elements like ownership and spatial and temporal ordering as the main elements of the discussion and drawing on the existing practices, the cultural insights drawn from the mobilities and the governance implications through the changing political
economic trends all reveal political, cultural, resource and physical constraints. How these constraints should be dealt within the three social pillars of social development lead us to more specific social measures to identify and measure servicizing in mobility. Different institutional contexts and political regimes are likely to lead to differing social outcomes of servicizing systems.

1 Public discourse: The perceived fairness and subjective measures like social identity are highly influenced by discourses shaping mental conceptions of the world and social relations of individuals. Although these also have a temporal perspective (that perceptions change over time), for the purposes of this project, we only focus on perceived fairness. Subjective measures like environmentalism are also highly influenced by the public and political discourse.

2 Levels of mobility capital: Most objective measures including affordability, accessibility and safety are closely related to access, competence and aspirations of the users and the social consequences of the changing mobility patterns. Increased access to cars and how this leads to increased accessibility to social services and less dependency should be the main focus.

3 Political economic implications: Employment impacts of transition from producing transport goods to selling mobility and governance elements including accountable governance and public participation can be defined in terms of the political economic implications of the servicizing practices. In terms of mobilising policies, the geographical outcomes and liveability are significantly related to whether the policies toward servicizing in mobility are transferred taking into account the contextual characteristics including local institutions and culture.

In light of these links between the social aspects and the social indicators, the social impact measures to be employed in the case of servicizing are further classified into both direct and indirect and objective and subjective measures. Affordability, accessibility, liveability and safety are direct and objective measures, while the other objective measures like the employment impacts, integration with other sectors and geographical outcomes of the transport interventions are all indirect. Social identity measures like environmentalism and ownership to some extent can be considered indirect, while participation, accountable governance and healthy lifestyle are directly affected subjective measures. How they can be measures in the context of servicizing will be explained in the following chapter.

Table 5: Typology of social impact assessment measures of servicizing in mobility

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
<th>Indirect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Affordability</td>
<td>Employment impacts</td>
</tr>
<tr>
<td></td>
<td>Accessibility</td>
<td>Integration with other sectors</td>
</tr>
<tr>
<td></td>
<td>Liveability</td>
<td>Geographical outcomes</td>
</tr>
<tr>
<td></td>
<td>Safety</td>
<td></td>
</tr>
<tr>
<td>Subjective</td>
<td>Public participation</td>
<td>Social identity</td>
</tr>
<tr>
<td></td>
<td>Accountable governance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health</td>
<td></td>
</tr>
</tbody>
</table>
3.4 Measuring decoupling and social impacts of servicizing in mobility

This section presented a discussion of the existing methodologies in measuring decoupling and social impacts of transport and mobility as well as the identifying the key challenges and implications of using these indicators and methodologies for servicizing in mobility. In doing so, ways of addressing physical and resource constraints (to inform decoupling indicators) and social and political constraints (to inform social impact indicators) have been discussed. The below figure illustrates the key indicators to consider in researching servicizing in the mobility sector. Having identified the cultural and institutional constraints, the social impact assessment should bring two dimensions, i.e. whether the impacts are direct and indirect and whether they are subjective and objective.

In addressing the physical and resource constraints, economic and transport growth measures should be altered to reflect the servicizing-specific changes in the system. The Stiglitz Commission (2009) extends the definition of economic development to two components, namely current well-being and sustainability. The authors extensively address the issues with GDP as a measure of economic performance. The main drawback of GDP as an indicator of development is its sole focus on market production defined in money terms. The report recommends consumption and income as better indicators for measuring ‘material living standards’. In light of this recommendation and because servicizing systems constitute only a small part of the economy and the geographical scope of the project is rather limited, the total economic revenue and (household) income generated from transition towards any servicizing system is suggested to be a valid measure of economic progress.

Figure 9: Methodological framework
In the project, we attach strong importance to not isolating the decoupling effects and social impacts as they may occur on different scales and there are clear interactions between them. The wide literature on the wider societal/economic benefits of transport involves holistic consideration of economic, environmental and social impacts of servicizing in mobility.

Given that there will be policy scenarios to be examined at later stages of the project, it is important to understand different pathways toward absolute decoupling through servicizing. Based on Givoni (2013), we propose to use a combination of the following pathways to understand how the relative changes occur amongst the environmental and social impacts measures, transport growth and economic growth and impacts:

- **Wellbeing from economic growth**: In discussing the shortcomings of GDP as a measure of prosperity, Stiglitz, et al. (2009) strongly emphasise the role of household income and subjective wellbeing. They refer to job, health, education and other instrumental variables to indicate subjective wellbeing. The social aspects and the associated social impacts identified above can be therefore considered subjective wellbeing and objective social measures.

- **Economic growth from mobility**: Economic growth in a servicizing system refers to sustaining the same economic revenue if there is less production and more selling of services. Both employment impacts and the total revenue should be delinked from the mobility needs.

- **Mobility from environmental impacts**: This final pathway indicates that the environmental impacts from mobility, namely emissions and fuel use from mobility, should be decoupled from mobility.
4. The SPREE Mobility Research Approach

The research approach to mobility in the SPREE project consists of three steps:

1) conceptualisation
2) potential of adoptability
3) potential of impacts.

In light of the conceptualisation and the generic methodologies constructed in the previous chapter, this chapter provides a workable framework to guide the rest of the mobility research in the project illustrating it through the UK case. This will be the basis of the case study research to be conducted in Sweden, Israel and Finland and the transport policy-packaging process. Specifically, the potential of adoption of servicizing will identify the causal modelling by pointing out the institutional and sociocultural settings of the medium-sized and large cities selected for adopting servicizing systems in the countries.

We start by presenting the conceptual rationale behind the selection of our system. Through the fieldwork conducted in identifying the potential of adoption in London and Bristol, we present a workable definition of the mobility system followed by specific methodologies to be employed in the case studies.

4.1 SPREE mobility system: preliminary definition

The system chosen for study within the mobility sector is the potential to move along the servicizing continuum between vehicle ownership, through the currently available methods of sharing to passenger transport in particular city contexts. It is entitled

‘From owning to sharing in car and bicycle use across European contexts’

The empirical work will focus on moving away from private car ownership towards serviced vehicle use mainly concentrating on car-sharing and bike-sharing. Specifically, the mobility system under investigation will be car-sharing and bike-sharing schemes in combination with other travel options with the aim of moving away from private car ownership. Although the relative importance of car and bike-sharing may vary across the countries, it is recommended that the focus will be on replacing car trips. This implies that in the case of more emphasis on bike-sharing, the diversion from and substitution of car trips should be assessed. The following diagram depicts how the chosen system is considered. The definition of the selected system is specifically based on tasks 2.3 (“Establishing a common understanding of the notion of servicizing”), task 2.7 (“The essential prerequisites of servicizing”), Deliverable 2.2 (“Joint conceptual framework of concepts”).

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7 The definition of the selected system was already sent to SPREE project officer (PO) on September 2013.
The continuum between car ownership and car sharing was chosen because it was seen as an area through which comparisons could be derived from both different contexts, including large cities versus smaller towns, but also due to the potential for interesting comparisons to be made across the selected country contexts in the project (UK, Israel, Sweden and Finland).

The researchers’ expertise in these areas was seen to be a valid reason to consider this system over and above some of the others that were identified. Similarly the likely availability of data was seen as an important factor for the selection of this area of focus. Significantly, the potential for the large scale adoption and roll out of particular schemes towards the service end of the continuum makes this an interesting area to study. The flexibility to gain perspectives on national systems in local contexts and local systems alike makes it potentially easier to obtain some knowledge on the context-specific conditions of the systems, which allows for consideration of the replicability and transferability of potential systems.

The selection of this continuum as a study in the project also addresses the problem of decoupling in transport. Although the challenges of achieving absolute decoupling in the mobility sector have been emphasised and the objective of absolutely delinking all economic growth with transport growth beyond the system level deemed unfeasible in the context of the project, by considering the car ownership>vehicle sharing spectrum as a whole we can begin to understand the potential that exists to move drivers away from purchasing towards rental and shared use, which helps us go some way to removing the economic linkage between purchase and use. In doing so, the role of servicizing in macro policy packages aimed at decoupling are also identified together with pointing out the relative importance of context-specific conditions and universal demand managements tools.

In addition to the mobility-specific discussion, the SPREE management team has provided an evaluation table for all sectors (Table 6). This has provided general insights into the potential impacts of the existing practices as the basis for selecting one system to be further investigated. These gradings have only been used as preliminary assessment based on the researchers’ expertise. As will be seen in the following sections several of the factors will be clarified to more accurately reflect on the evidence offered. Therefore the elements listed in this table illustrate the hypothetical evolution of our understanding of the selected systems. A final version will be provided once the data gathering is finished (table 6 below presents the selected car and bike sharing system, while the other cases are depicted in appendix A).
Table 6: SPREE Cross-sectoral Evaluation matrix for choosing one servicizing system per sector

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Car sharing</th>
<th>Bike-sharing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type (B2B/B2C/C2C)</td>
<td>B2C</td>
<td>B2C and G2C*</td>
</tr>
<tr>
<td>Scalability potential</td>
<td>low</td>
<td>low</td>
</tr>
<tr>
<td>Local vs. global solution</td>
<td>local</td>
<td>local</td>
</tr>
<tr>
<td>Potential to reduce impact (high/medium/low)</td>
<td>medium</td>
<td>medium</td>
</tr>
<tr>
<td>LCA data availability</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Is it an existing example or a new idea?</td>
<td>existing</td>
<td>existing</td>
</tr>
<tr>
<td>Interconnection between project cases</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Scale of policy packages effect</td>
<td>all levels</td>
<td>all levels</td>
</tr>
<tr>
<td>Consortium expertise exist</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Acceptability potential by consumers/businesses</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td>Policy’s ability to influence the system’s implementation</td>
<td>high</td>
<td>medium</td>
</tr>
<tr>
<td>Potential to mitigate undesired social implications</td>
<td>medium</td>
<td>high</td>
</tr>
<tr>
<td>Potential to improve social indicators</td>
<td>high</td>
<td>high</td>
</tr>
</tbody>
</table>

Note- G2C – government-to-consumer

Each of these systems was seen to have a high potential to improve social indicators. It was seen that policy’s ability to influence the systems implementation was high and the systems were also viewed to have a high potential for acceptability consumers and businesses. When considered as a system there is high potential for reducing impact and also for scaling to the national level – although this will need to be informed by the focus groups conducted in different countries. Potential to mitigate undesired social implications needs more investigation in the context of the continuum as there are many factors to consider, this particular element of investigation is perhaps the most complex. Contributing insight into this area of the issue is another where there is enormous potential for SPREE to deliver state-of-the-art thinking. Novel and innovative business models are emerging in the area of car sharing and due to the fast-changing developments taking place, there is a high demand from policymakers and established businesses alike for deeper understanding of the implications of these new approaches. By examining these areas in our focus groups and surveys that will inform the model, this is likely to be a contribution that SPREE can make which is useful and highly interesting to stakeholders engaged in the project and further afield.

We now turn to the key elements of servicizing identified in the first chapter of this document to define this chosen system (moving away from car ownership to combinations of car- and bike-sharing and other travel methods).

**Ownership.** Servicizing can take place both on supply and demand side, i.e. it can focus on systems of provision, e.g. production processes or servicizing products in the design stage, as well as on consumption systems, i.e. the way product functions and services are offered to and used by
consumers. As discussed in the first chapter, the first thing to note about this definition is that servicizing is a continuum; there is a degree of ‘serviceability’ of a product, which implies that a service can be further servicized. This continuum between products and services entails changing the basic notion of economic value from ‘exchange value’ to ‘utilisation value’ (Stahel, 1994).

The business models through which servicizing activities can be delivered vary depending on different sectors. B2B and B2C are the most common forms of servicizing business models, while C2C, which illustrates collaborative consumption, and business-to-government (B2G) models are newly emerging transaction models (Stahel, 2010).

But from a mobility user’s perspective, there is a further specification needed. Mobility in broad terms is itself a service, but there is also a utility of ownership inherent in the sector. Although sharing and providing services can be considered mutually, especially given the multitude of actors, sharing also entails giving up the utility of ownership from a user point of view. Therefore, utility derived from use and ownership should be considered separately. In fact, the continuum between products and services can be replaced by ownership and sharing, respectively, in the mobility case and therefore how services are used in mobility, should be translated to ownership-sharing continuum. It is possible to illustrate the potential in particular city contexts to move along the servicizing continuum between vehicle ownership, currently available methods of sharing through to passenger transport (Figure 1). Reviewing existing practices along the continuum for cars and bicycles sheds light on the main aspects of sharing practices. These, in turn, provide a list of the relevant actors and other institutional elements that should be considered when constructing the conceptual framework.

More importantly, integrating vehicle sharing practices into public transport systems makes the boundaries of the existing practices to be clear-cut. It is suggested that bike-sharing practices can only work if they are included as part of a public transit systems (Shaheen, 2013). This has spatial, social and temporal implications to consider when planning vehicle sharing systems.

Given the emphasis on ‘moving along the continuum’ with specific focus on sharing and pooling of cars and bicycles, we are interested in different owner models including B2B, B2C and C2C types in unison. Due to problems with data availability and modelling, we narrow down our focus to formal car-sharing and bike-sharing schemes only although we include the discussion on pooling in our focus group discussions to improve our understanding of social and governance aspects of moving along the continuum, particularly with respect to what can be learnt from the informality of community-led projects. Self-organisation of informal schemes will therefore likely to remain under the radar but is probably a significant contributor along the continuum.

**Products and services.** The main products and services we focus on are cars, bicycles, car sharing and bike-sharing services. The focus on cars and bicycles as products can change according to the country context and sharing services are expected to be complemented by public transport and informal pooling services where possible. The life-cycle thinking in the project requires the examination of the changes in the use of products and also of changes in production and end-of-life. We therefore narrow down out focus on cars as products. Although this may contradict with our ultimate aim of providing mobility as a service without any modal thinking, it justifies leaving out virtual mobilities, public transport and freight sector. The question becomes what is the potential of moving along the servicizing continuum away from using cars towards sharing and pooling.
It was decided to include both bike-sharing and public transport as part of the continuum as opposed to a distinct area of investigation, because they are very much connected systems within the mobility sector and it is fair and logical to posit that stakeholders will view these elements as a package of options within the same transport system as opposed to distinct offerings. There are also fascinating social considerations to be explored relating to public transport patronage and cycling in the context of the continuum and incorporating these into the process allows for these to be explored alongside the understanding that can be gleaned on car ownership. Initially, we argue that servicizing in mobility is a function of social relations therefore it is impossible to isolate the social aspects and social impacts of servicizing in transport. Moreover, because economic, environmental and social impacts are interlinked with each other, it makes better sense to evaluate them all together. This complexity of aspects and impacts of different servicizing systems makes it difficult to focus on a single system.

As cycling is inherently resource efficient due to its non-motorized nature; bicycle ownership and bicycle rental are not seen as distinct in the methodology. The ownership and usage patterns of bicycles are likely to be very different to car ownership and usage patterns. Therefore, bike-sharing is looked at in the context of displacing car trips. Similarly public transport in and of itself could be investigated as a standalone, but it is far more interesting to consider it alongside car ownership and car-sharing. Indeed one element of the state-of-the-art here is in the consideration of these issues as part of a decision making system. However, we also consider the difference between bicycle ownership and bike-sharing from a consumer behaviour perspective as owning sharing given the relatively low prices of bicycles is still interesting for the research purposes. Whether this distinction is integrated into the modelling will depend on the country-specific countries.

**Actors**

Due to the complex nature of vehicle sharing (mainly in terms of space-time and ownership), important actors emerge to consider when drawing the system boundary of the moving away from private car ownership through car- and bike- sharing systems. These include central and local governments; service users (individuals, firms); car-owners; non-car-owning user (driver/passenger); non-driving user; service provider; insurance and infrastructure provider; producer/manufacturer; employers and employees.

_Consumption/use_ includes car/bicycle owners and non-car owners (the latter particularly refers to pooling activities including lift-takers); scheme subscribers. Given the particular focus on the uptake, barriers, availability and perceptions of a given service, which includes the elements of both travel as a derived demand (i.e. necessary travel) and the intrinsic value of travel, social aspects are particularly evident in consumers (i.e. service users) in mobility. As discussed in the previous chapter, employers are crucial consumer groups (consuming business groups in terms of ABM).

_Providers and producers_ include manufacturers of vehicles; providers of shared vehicles; public transport operators; insurance and infrastructure providers. In addition, developers significantly benefit from increased accessibility as a result of services provided by car clubs operating close to residential areas that cannot be reached otherwise.

_Regulators_. Although the regulators will not be included in the model given that societal changes and social relations are at the heart of servicizing in mobility, this diversity leads us to consider
regulation part of an economy as a separate groups of actors in the mobility-specific conceptual framework.

**Space and time.** As discussed in the first chapter, vehicle sharing in general comes with analytically difficult space and time issues such as occupancy, capacity and infrastructural issues, proximity and service reliability that need careful attention. According to our initial conceptualisation, designated parking areas, service reliability, capacity and occupancy are the main elements that need to be considered to understand the adoptability of the system. The extent of consideration of time management in the services provided and the temporality of the uptake of these services constitute the role to temporality in the system under investigation.

Parking space and infrastructure usage has been addressed with further servicization. Shared parking space has become a popular idea, which illustrates C2C activities, which can be applied informally without the existence of governments and businesses by using social networks and communication technologies. However, further servicization to cure spatial and temporal issues can also induce more travel. For example, ensuring that there are bicycles available in docking stations where they are demanded most is a key success factor of the scheme. However, the solution to redistribute bicycle between docking stations induce more physical travel by truck. Transport for London’s solution to this is to provide incentives for users to return the bicycles to the popular docking stations in London. The initial land planning also plays an important role. This implies that policy innovations and soft measures like providing incentives have the potential to decrease physical travel.

### 4.2 Selection of indicators

Based on the discussion in the previous two chapters, we propose to use the following economic, environmental and social measures to provide a workable framework to assess the impacts of moving along the continuum between private car ownership and combinations of car- and bike-sharing and other alternative travel methods.

**Economic measures**

The total revenue and disposable income change in relation to car-sharing businesses in the selected countries is chosen to be the economic indicator of moving along the servicizing continuum. This total revenue and income should be calculated as the sum of the revenue of the car-sharing business (i.e. producing business groups), the savings/loss in household income due to changes in consumption bundles and revenue collected by the government. If the car-sharing business is making a profit in other countries, this measure can be replaced by profit margins. Moreover, if the focus is on bike-sharing providers, the revenue should be changed accordingly. The economic indicator can be generally defined as the total revenue change as a result of moving towards servicizing systems.

The potential economic indicators include the city-level/regional GDP, urbanisation/agglomeration and total production in the city. There are two reasons we propose to use the above measure as opposed to these broader economic measures. First, as discussed in the previous chapter, the recent conceptual and methodological criticism on the focus on monetary value of production to measure wellbeing and prosperity suggests that consumer-centred approach to measuring wellbeing is more
preferable. Looking at household income/consumption, company and government revenues (assuming that government revenues would be used for the public’s good) is consistent with this critique. Second, what is under investigation in this project is only a small segment of the market, i.e. in London, which is the largest European car-sharing market, the mode share of car-sharing is around 0.1% and there are only 3–4 key players that are making marginal profits. It is therefore logical to narrow down the economic indicator to sector-specific economic value from the macro-level economic progress.

**Environmental and transport growth measures**

Transport growth in the context of moving away from car ownership toward car-sharing and bike-sharing can be indicated by the number of cars, total car mileage driven, share of total shared trips in total mileage driven and travel speed. However, there will be different combinations of car-sharing and bike-sharing and other travel methods in different countries and the products to be examined from a life cycle perspective are expected to be different depending on the way they will be analysed in different countries. In the UK, we only focus on cars as products, but still include other forms of travel in the consumption bundles. The reason for this is that the bicycles produced for the London cycle hire scheme are provided by a Canadian firm and the model does not allow us to take into account the impacts of freight transport. Given these production and institutional differences in the country case studies, we suggest to use car mileage driven (km) as the common transport growth measure in all countries.

The environmental impacts of this transport measure will be indicated by both CO₂ equivalent GHG emissions and air pollutants (CO, NO₂, SO₂ and PMs) and fossil fuel use. The fossil fuel use can be more important if electrical vehicles are also under investigation. We do not include electrical vehicles in the UK case. Land use is also an important indicator as parking space is one of the most crucial aspects of vehicle-sharing systems. However, data may be difficult to obtain in the UK case. We therefore narrow our focus to environmental emissions.

**Social impact measures**

The social impacts of moving away from car ownership toward car- and bike-sharing should be categorised into direct/indirect and subjective/objective measures as illustrated in Table 5.

These indicators can be integrated into five in the context of servicizing.

1. **Consumer groups according to age, income, household size and mobility needs, assets and habits** should be identified. The distribution of the benefits should be equal amongst these different social groups. The survey results and focus group discussions will provide information on the role of socio-demographic characteristics and geography on the distribution of benefits of moving away from private car ownership. Geographical differences should also be analysed (qualitatively) from the policy equity perspective in terms of who gains and loses in the case of policy transfer of the system setups between regions.

2. The desired social impact in terms of affordability should be the reduction of total household expenditure on travel to below 10% of income (zero for low-income households). The main determinant of this indicator is the cost of vehicle-sharing relative to the total cost of owning,
which can be assessed against income. If feasible, this should be considered together with the above indicator.

3 In addition measuring access to a vehicle, accessibility can be measured by the change in journey times to employment, education, primary health care providers and social activities and living within a 15-minute ‘safe walk’ to designated parking spaces and docking stations. This way, it can also be related to liveability of a neighbourhood.

4 Constituting an important part of wellbeing, a healthy lifestyle can be indicated by how the individuals feel as a result of moving away from private car ownership toward active travel and higher levels of physical activity. More specifically on health, the increase in the level of physical activity (walking to the car can be included in the case of car-sharing) can be used. Finally, related to health, safety can be measured by the reduction in number of child and adult pedestrian casualties by social class and the levels of population exposure to traffic-related noise and air pollution (especially children and older people).

5 Governance and political economic aspects can have four main indicators. In terms of employment impacts of moving from production-led growth to a service economy, it is ensured that the job losses and gains (and its distribution amongst social groups) are also accounted for as a result of moving away from the focus on car manufacturing toward selling mobility services. Equal access to decision-making is also subjectively identified by how the citizens’ will to participate in local planning measures changes. Accountability of transport governance can be indicated by the transparency of pricing regimes and the deals between the service providers and local governments. Regarding integration, it is ensured that the cross-sector (dis)benefits (including impacts on education and health sectors) are also identified during the transitions toward car-sharing and bike-sharing.

4.3 Potential of adoption

The section presents further information on the recommended approach to SPREE Mobility Research illustrating it through examples from the UK case and discussing the implications of the UK case for the policy-packaging process and the country feasibility studies. The identification of the potential of adoption is particularly important for identifying the country-specific features to inform the model and data collection stage.

4.3.1 Approach

The identification of the potential of adoption starts by exploratory case study research as well as selecting the critical case(s) for the uptake of servicizing in mobility in the selected countries. Employing two different understandings of case study research might seem inconsistent, but is useful. The exploratory case study is defined as “the investigation of distinct phenomena characterized by a lack of detailed preliminary research, especially formulated hypotheses that can be tested, and/or by a specific research environment that limits the choice of methodology” (Mills, et al., 2009, p. n/a). The reason why the first step of country case studies is identified being ‘exploratory’ is that the research should start by identifying the potential of adoption, that is to say, by exploring the potential markets (i.e. population targeted and the trip purposes) and to classify the country-specific actors (e.g. whether an accreditation system exists or not) in the selected countries.
Although the first step of case study research is to explore the country-specific servicizing markets in the selected countries with a focus on the selected car- and bike- sharing systems, the SPREE project still has a specific phenomenon to understand. Given that the generic conceptualisation of servicizing in mobility in the present study already identified the potential success factors for proliferation of sharing systems in mobility, we propose to choose cases on the basis of expectations about their information content. We therefore propose to use an information-oriented selection process (Flyvbjerg, 2011). Given that the empirical insights drawn from the country cases will be employed to provide general policy packages and the time constraints, we also need to be careful with the generalisations that can be made of the cases. For this, Flyvbjerg’s (2011, p. 230) conceptualisation of critical cases allows us to infer that ‘if this is (not) valid for this case, then it applies to all (no) cases.’

Although the selection of cities in the UK will be explained in detail in the UK country report as part of WP7, the following characteristics of the cities are the main reasons behind the selection of London and Bristol:

- We consider that the system will be investigated on a metropolitan/city scale as the current usage of sharing schemes is more frequent in urban contexts (Bardhi and Eckhardt, 2012).
- We have chosen to focus our attention to a large city and a medium-size city to observe if different behavioural aspects can differ depending on the geographical scale.
- Bristol is a medium-sized British city, well known for its adoption of green policies (as evidenced in the city being names European Green Capital for 20158), while London is a typical global city and is the largest car-sharing market in Europe (Kennedy, 2013). Finally, London and Bristol are both congested.

Following the identification of the main actors and aspects as outlined in our conceptualisation, the aim of the first round of fieldwork was to identify the potential of adoption in the UK case. A thematic analysis of expert interviews on car-sharing and bike-sharing in the UK has been used to complement the initial literature review of the existing practices discussed in the first chapter. The approach involves conducting exploratory case study research that brings additional conceptual insights to the specific modelling definition and policy scenarios. Expert interviews have been used here to serve two purposes: i) illustrating what our conceptualisation stresses, and ii) complementing the key elements of our methodological framework for further empirical analysis.

13 semi-structured interviews were carried out during September–November 2013 in London and in Bristol (Table 5). The participants in this study were academic, policy and industry experts.

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8 http://www.bbc.co.uk/news/uk-england-bristol-22910214
Expert interviews were chosen with the aim of reaching ‘a close dialogue’ between research and practice (Clark, 1997). Expert interviews are defined as a way of making tacit knowledge more explicit, and they were therefore appropriate given the objective of enhancing the existing conceptual frameworks (Audenhove, 2009). The possibility that the experts also participate in these discourses therefore requires careful consideration. On this point, the kind of knowledge that has been created from the information obtained from the interviews should clarify how such criticism could be overcome.

An expert is defined as a person who has privileged access to information about groups of persons or decision processes (Meuser and Nagel, in Audenhove, 2009). Therefore, we started by identifying the people who have unique knowledge about the key aspects of the car-sharing and bike-sharing in London and Bristol.

<table>
<thead>
<tr>
<th>Type</th>
<th>Organisation</th>
<th>Title/Division</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy expert</td>
<td>Transport for London (TfL)</td>
<td>Strategy and Planning</td>
<td>London</td>
</tr>
<tr>
<td>Academic expert</td>
<td>Transport Research Laboratory (TrL)</td>
<td>Senior Research Fellow</td>
<td>London</td>
</tr>
<tr>
<td>Industry expert</td>
<td>BIXI Bicycle Scheme (BSS)</td>
<td>Founder</td>
<td>Montreal</td>
</tr>
<tr>
<td>Policy expert</td>
<td>Bristol City Council (BCC)</td>
<td>Group Manager - City Transport</td>
<td>Bristol</td>
</tr>
<tr>
<td>Bus company</td>
<td>First Group (FG)</td>
<td>Interim Managing Director</td>
<td>Bristol</td>
</tr>
<tr>
<td>Academic expert</td>
<td>Susan Shaheen (SS)</td>
<td>Expert on bike-sharing</td>
<td>California</td>
</tr>
<tr>
<td>Academic expert</td>
<td>Scott Le Vine (SLV)</td>
<td>Expert on car-sharing</td>
<td>London</td>
</tr>
<tr>
<td>Accreditation Organisation</td>
<td>Carplus (CP)</td>
<td>Chief Officer</td>
<td>Leeds</td>
</tr>
<tr>
<td>Car-sharing operator</td>
<td>Car club operator</td>
<td>Head of Locations</td>
<td>London</td>
</tr>
<tr>
<td>Car-sharing operator</td>
<td>Car club operator</td>
<td>Head of Business Services</td>
<td>London</td>
</tr>
<tr>
<td>Cycle hire firm</td>
<td>Cycle the City (CtC)</td>
<td>Owner</td>
<td>Bristol</td>
</tr>
<tr>
<td>Car-sharing company</td>
<td>City Club (CC)</td>
<td>Managing Director</td>
<td>Bristol</td>
</tr>
<tr>
<td>Policy expert</td>
<td>British Parking Association (BPA)</td>
<td>Director of Policy and Public Affairs</td>
<td>London</td>
</tr>
</tbody>
</table>
Table 8: Types of knowledge obtained

<table>
<thead>
<tr>
<th>Knowledge targeted*</th>
<th>Information obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Knowledge</td>
<td>Specific knowledge in the field; details on operations, laws, etc. on the field</td>
</tr>
<tr>
<td>Process Knowledge</td>
<td>Information on routines, specific interactions, processes</td>
</tr>
<tr>
<td>Explanatory Knowledge</td>
<td>Subjective interpretations of relevance, rules, beliefs; ideas and ideologies and their inconsistencies</td>
</tr>
</tbody>
</table>

*Categorization is based on Audenhove, 2009

In short, policy and industry experts provide technical knowledge on car-sharing and bike-sharing; the industry experts provide process knowledge on the method of setting up the scheme and how to attract the potential users; and finally policy and academic experts provide subjective interpretations illustrating explanatory knowledge.

The interviews should follow the semi-structured interview format: there should be predetermined questions with further questions that emerge during the conversation (Whiting, 2008). Although the questions should be determined depending on the country context, the table in Annex A illustrates the interview guidelines to be followed for the first step of the research. The data analysis involves the recognition of emergent themes in the data and understanding of how these narratives inform the potential of adoption of vehicle sharing in the selected countries. The following section briefly discusses the clustering of the conceptual labels into categories that help improve the UK-specific conceptual mapping and eventually the ABM definition. The exercise should be repeated for the other countries in order to guide the data collection (in the basis of task 3.5: “Development of data collection methods”). Next section provides a general illustration of this approach in the UK case.

4.3.2 Identification of barriers, uptake and availability

Markets, Users/Consumers and Governments

Definitional issues

One of the key challenges is how car-sharing practices are defined globally. This has significant implications for marketing practices of firms and identification of the potential impacts by policy makers. There are different terms available to identify the existing sharing and servicizing activities:

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9 Due to time constraints, the interviews should also aim to obtain the specific business and economic information identified for the countries.
namely car clubs, car-sharing, car-pooling, lift sharing, ridesharing, cycle hire and bike-sharing. Some of these terms are often used interchangeably in different country contexts as already defined generally in Chapter 2. In the UK context, traditional forms of car-sharing practices as known in the North America are called ‘car clubs’ while the bike-sharing schemes are called cycle hire schemes (Kennedy, 2013).

The interviews with all industry, academic and policy experts reveal that the most significant confusion comes from variable designs of car-sharing practices with potentially different environmental, economic and social impacts. Types of car clubs with respect to their parking requirements should be distinguished as parking is still found to be one of the most important key determinants of uptake of sharing practices. The current evidence shows that although the traditional car clubs in London do not encourage more car usage, the impacts of floating car clubs (e.g. BMW’s DriveNow and Daimler’s car2go), which provide point-to-point services, are considered to be less clear.

With respect to informal car-pooling, which are usually known as ridesharing and car-sharing in the UK context (Kennedy, 2013), safety and insurance are found to be the key issues, which puts regulation at risk. Although small-scale community-led projects (e.g. Hackney CarClub) seem to work well, as they are more personal, the regulatory bodies find it difficult to provide support for private car-pooling companies if they do not provide solutions with respect to insurance and safety.

- Implications for the Israel, Sweden and Finland cases: The country case leaders should clarify how the practices in their respective countries are defined for the correct representation of the behavioural and cost structures of the different schemes and comparability of the country case studies for policy packaging.

- Implications for methodologies and policy-packaging: It is important to distinguish between the cost structures of floating and traditional forms of car clubs in the country models, as the parking regulations will be different. Regulatory issues with regard to car-pooling activities are likely to inform policy-packaging processes in terms of the role of the central and local governments.

**Market situation**

The recent mergers and acquisitions, movement of key players and the level of government involvement in the market reveal that the car club markets follow a different trend involving a mixture of public and private bodies. Taken together, two general trends can be observed in the UK car club market.

First, while the earlier years of the market included small start-ups, the market has started to welcome big players including car manufacturers and car rental companies. Currently, the small start-ups either leave the market, or they are acquired by the big players (e.g. StreetCar being acquired by Zipcar and Zipcar merging into Avis Group). The market is therefore dominated by big players including Avis, BMW (DriveNow is to launch later this year) and Daimler (car2go has just been launched).

Second, despite London being the largest market in Europe and TfL being very supportive of the car club businesses, the London market is still in its infancy, i.e. car club members constitute 0.1% of the
car mileage driven in London. The existing players in both London and in Bristol are marginal businesses or are making losses despite the early initiatives launched in both cities: Bristol City Council has been involved with car clubs since 2000, while car clubs were introduced in the London market in 2003 as part of the congestion charging mitigation measures. In both cities, the government is quite supportive. In fact, both markets were provided with ‘a pump priming grant’ and then left on their own.

‘... a change in ownership, but no change in business model yet. Still operating the same model... the car manufacturers, who are well known for their long-term vision of 20–25 years, are aware that car industry is likely to shrink... are therefore on the search for new ideas.’

TfL (2013)

Despite the positive attitude of TfL, the above quote implies that sharing activities as a form of transport innovation do not represent a significant change in business models. Therefore, this form of innovation can be seen as a natural expansion of the current business models rather than moving along the continuum between private car ownership and using mobility as a service in general (bike-sharing, public transport). This can be related to the variety of trip purposes served by these services. This reasoning also strengthens the importance of both objective and subjective social measures in researching car- and bike-sharing.

The above statement also signals the changing trends in the car manufacturing industry. Although the traditional modes of car rental are still popular, the car industry with its longer term vision (20–25 years) is aware of the changing consumer preferences and new business models and has started to look into different ways of doing business rather than just producing cars (e.g. BMW identifying itself a mobility provider, not a car manufacturer; Daimler and BMW buying car clubs and other start-ups). For the first time in the history of the car industry, the manufacturers face the challenge of having to understand how people use their vehicles rather than just selling them.

From this perspective, it might be tempting to identify this trend as a paradigm shift. However, given the trends in institutional and organisational support with the aim of influencing future behaviour with social implications, the trend can as well be only changing direction rather than changing itself. The former is implied in the car-sharing businesses targeting university students (by opening branches in Oxford and Cambridge, for instance), so that when they move to London, they continue their habits of using car clubs rather than buying a car. From a social perspective, the distance between low-income neighbourhoods and docking stations and designated parking spaces is associated with the low uptake amongst individuals with low income. However, in Bristol one of the most successful car club areas is in a low-income neighbourhood where access to a car was previously low. Such social complexities are not clearly defined.

• Implications for Israel, Sweden and Finland cases: Identification of the variety of travel market in the case study countries is key to country research design in terms of identifying the consuming business groups. Understanding the general trends in the market, on the other hand, guides the categorising of the producing business groups (i.e. car club operators).
• Implications for methodologies and policy-packaging: Identification of the market trends was particularly useful in terms of identifying public bodies as consuming business groups in the UK case, while determination of trip purposes is used for categorising consumer groups and producing business groups are categorised according to their revenue. Due to modelling and data collection constraints, consuming business groups will not be included in the model, but should be part of the qualitative research. How the marketing strategy of the operators aims to affect the discourse of young people over their lifetime is worth noting. This should be carefully examined from a social equity perspective.

User perspective

The interviews and the existing data reveal the key trends in terms of car-sharing and bike-sharing usage in urban contexts in the UK. Despite the businesses’ emphasis on their efforts to target all market segments in order to expand the market, the figures and the expert interviews reveal that the car-sharing market is mainly dominated by young professionals aged 25–35, who can afford a car, but do not want the hassle of owning one. With respect to bike-sharing, 35% of the current users have not cycled before. Bike-sharing scheme subscribers are also targeted towards mainly young professionals aged 25–34. Bristol is generally seeing (wealthy) people replace their second car, but there is also evidence of success in giving access to cars to those formerly without. According to the experts, with the vibrant cycling culture in Bristol, provision of parking is good but set to increase.

The car-sharing operators in particular identify their customers as ‘rational transport users’, emphasising that most car club members are heavy public transport users and they use car-sharing as a substitute mode, where public transport cannot be facilitated. From TfL’s perspective, the usage amongst the empty nesters in London should be explored given the increasing trend of old families (mainly old retired couple with no children) living in urban areas instead of moving to suburban areas as was the case in the past. In the car-sharing market, geographical considerations are as important as the demographics. For instance, the circular travel within outer London cannot be facilitated by public transport and there is also more space available, rendering car ownership cheaper in outer London. This may lead to a trade-off relationship between mobility and space, therefore should be carefully considered.

The current usage of both car-sharing and bike-sharing is also evident in the marketing and advertising trends of the existing businesses. In addition to targeting the university cities, the services are mainly advertised in areas close to the metro stations with the aim of using it as part of the public transport scheme. The business strategy of the operators is aimed at encouraging business use to increase more demand during the weekdays as most of the current use is at weekends.

• Implications for the Israel, Sweden and Finland cases: Both the targeted group of users identified in the existing data and how the potential users are ‘imagined’ in the eyes of businesses are important in identifying the actions available to producing business groups and in categorising the consumer groups.

• Implications for methodologies: Age, gender, income and the size of the family are all found to be crucial in identification of the consumers. The types of trips being replaced by the existing users and their mobility assets (i.e. whether they own a car/bicycle and how many
cars/bicycles they own) are equally important. These in turn inform the ABM country definition of the systems.

**Government perspective**

The role of government in the car-sharing market is uncontested and evolves in different ways to conventional forms of government intervention like charging and taxation. Governments use a variety of tools to address the lack of shared mobilities in urban contexts. While intervention in bike-sharing is more straightforward as it is mainly considered a form of public transport, how car clubs should be supported is less clear. This is evident in the senior TfL official claiming that the London city officials are still on the search for a well-defined regulatory framework for car club market. This ambiguity in the role of government may be due to both the existence of various forms of car clubs and the cross-sector interactions including the car-sharing industry, car manufacturing industry, insurance industry and parking and telecommunications infrastructure.

In London, TfL is very supportive of car clubs in terms of both integrating them into public transport and providing necessary guidance for the businesses. Bristol City Council is also supportive of car clubs and is looking to invest in bike-sharing in the future following the failure of a limited private pilot in the city. All interviews in Bristol thus far have mentioned the new mayor as a strong advocate for sustainable transport – cycling and car clubs look set to improve during his time in office. In Bristol, there are also plans to greatly expand the current offering (in part due to new residential parking commitments the council is making) with many more cars added to the fleet. Pressure on current car clubs to purchase new vehicles when not making a profit with the existing fleet is putting the car clubs in a difficult situation.

The expectations of the car-sharing industry to have exemptions from the urban charges call for the public policy to play a bigger role in the industry. This is most evident in the discussion around the recent revisions to the London congestion charging scheme. The revisions include creating a new Ultra Low Emission Discount to replace the Greener Vehicle Discount and Electric Vehicle Discount and increasing the penalty charge from £120 to £130 (TfL, 2013). Recently, a car club operator reported that changes to the congestion charge mean that its monthly bills will double, which would cause significant financial pressure (at the time of the conference) (Personal, 2013). The problem with car clubs is that the government cannot make exemptions amongst different types of sharing. The policies required by the businesses (i.e. congestion charging exemption) are not feasible as there are serious issues with providing subsidies for floating car clubs (i.e. they remove the hassle of parking and may discourage people from using public transport toward car clubs).

The dynamics of the bike-sharing industry is rather different. The differences in the successes in setting up a bike-sharing scheme in London and in Bristol are also worth noting. In Bristol bike-sharing was tried and failed, primarily due poor location choice for infrastructure installation, the council remains positive about getting the new proposed scheme right. Cycling provision is seen as important in the city and improvements are being made to the current infrastructure.

Ayotte (2013) rightly claimed in an interview that ‘bike-share is an institutional product’ and if large corporations and government workplaces do not encourage the habit, the business concept is not likely to survive despite the pressures in the landscape. Administrative, institutional and organisational arrangements are found to be equally important: designated parking spaces can only
obtained through TfL providing funding for the London boroughs. In Bristol, provision of cycling infrastructure is seen a priority, though ownership is currently the dominant model due to the lack of a city-wide scheme. Small-scale private schemes are in operation and the council is looking to ‘institutionalise’ sharing within the city in the future – there is pressure to ‘get it right’ so progress is steady, not being sped up. All these different institutional and organisational patterns are important to consider in all contexts.

Finally, the dispersed nature of the transport policy domain is another issue that is not explicit in the current conceptualisations. Although the vehicle-sharing programmes and businesses in London target young people/families without children, the increase in empty nesters in urban areas (especially in London) points to a potential user segment, which TfL is already focusing on, as already mentioned above. In addition to changing family structures and living conditions, changes in the legislation in private property development have turned out to be an important trend that has an impact on vehicle-sharing. It is expected that in the near future new developments will have to have a car club on site. In Bristol, there are wealthy sections of the public who choose mainly to cycle and get public transport – they do not have a car, or will remove a second car from the household.

- Implications for Israel, Sweden and Finland cases: This is one of the most distinguishing factors in the case study countries. The institutional setting is important for understanding not only the potential but also implementation and effectiveness of the policy measures to comprise the final policy package recommendations. Exploring the key role of government reveals the type of policies to be tested in different contexts. It is clear from the above discussion that exemptions from congestion charging and vehicle regulations are crucial policies to investigate.

Several other themes emerged from the expert interviews that will be discussed fully in the understanding of the UK market in WP7. To summarise, it is not possible to layer the actors and processes. It turns out that there are several interdependencies between different groups of actors. The initial starting point of these soft forms of innovations is still not clear, but the increasing awareness at industry level plays a huge role.

4.3.3 Case study ABM definition

The ABM definition for the UK case was constructed through expert interviews and desk-based research. Although the case-study definition of the ABM is based on Deliverable 2.2 ("Joint conceptual framework and formalization of concepts") and on the discussion of this report and is already available in the SPREE Wiki website, the full definition will be provided in Deliverable 5.2 ("Sector specific agent based model definition for the mobility sector).

Overall, there are four critical aspects that should be considered in the ABM mobility case definition:

- Consuming business groups are important in the UK case as the majority of the revenue of the London car clubs comes from large organisations like public bodies and universities. Although this necessitates the inclusion of consuming business groups in modelling, due to data collection constraints, the ABM will not consider consuming business groups.
• Because a Canadian bike-sharing provider provides the bicycles of the London cycle hire scheme, we include bike-sharing only in the consumption bundle and indicate it in the other costs.
• The existing businesses in the UK are only marginal businesses. We therefore categorise these into firms making a loss and firms making a marginal profit. However, given the small number of businesses in the country, we identify the service providers in units rather than groups.
• Although both back-to-base and point-to-point car-sharing models exist in the UK, the latter has just been launched. Due to lack of observable data, we do not include it in the case study definition.

4.4 Policy paradigms: background for policy packaging

The review on car- and bike-sharing in Chapter 2 identified the general policy domains that can be employed to encourage the uptake of these sharing schemes. In this section, we provide a brief overview of effectiveness and implementability of these six policy domains (see Deliverable 2.1 “Concept summary of the notion of policy packages and its applicability to servicizing”) and Deliverable 3.2 (“A procedure to develop synergetic policy packages and a procedure for assessing their political acceptability”). The empirical evidence on the impacts of these measures will be fed into the policy scenario modelling. Overall, six policy domains have been identified:

1. Infrastructure provision and regulations
2. ICT developments and fuel technologies
3. Market and environmental regulations
4. Safety
5. Pricing and taxation
6. Soft policy measures, e.g. education, marketing, awareness campaigns

The main roles, type/genre/pre-conditions/temporal dimensions of these policy domains will be identified as well as the stakeholders involved, the supporting policies to increase their effectiveness and acceptability, the potential unintended impacts and the empirical evidence on their economic, environmental and social impacts.

1st Policy domain: Infrastructure provision and regulations

<table>
<thead>
<tr>
<th>Type</th>
<th>Demand/supply side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholders</td>
<td>City councils, infrastructure provider</td>
</tr>
<tr>
<td>Geographical</td>
<td>Region-wide and city-wide</td>
</tr>
</tbody>
</table>

Policy measures

• Parking/planning regulations
• Regulation in high-occupancy vehicle/bus/sharing lanes
• Development/zoning codes
• Time of day use restrictions
Policy actions

- Abolish minimum car parking standards
- Introduce maximum car parking standards
- Introduce minimum bicycle parking standards at work-places
- Implement bus lanes
- Restrict car use from 7 to 10am in 500m radius from rail stations
- Introduce park and ride facilities
- Reduce parking availability in residential areas
- Improve walking and cycling facilities
- Redistribution of bicycles to docking stations, where demand is high
- Provide incentives to take bicycles back to docking stations, where demand is high

Main role: To ensure efficient and equitable use of parking space and infrastructure for integrated servicing systems

Pre-conditions:

- Availability of physical space
- Well-defined responsibilities within the existing institutional system

Temporal dimension: Provision and building infrastructure is a long term measure, while regulations can be both short-term and long-term

Supporting policies

- Enforce entry restrictions to bus lanes
- Ensure car clubs are considered in development control and controlled parking zone reviews
- Encourage public involvement
- Subsidies for car club/bike-sharing parking zones in low income neighbourhoods

Impacts: Impacts of infrastructure and parking regulations/improvements on car- and bike-sharing are diverse. Reducing local parking availability increased car trip cost by 10 minutes in local areas in San Diego and San Francisco (Chatman, 2008). Abolishing minimum parking requirements decreases the ratio of parking spaces to cars and increases the price of parking (Shoup, 1999). In terms of bike-sharing, for every additional linear mile of bicycle lanes per square mile were found to lead to a 1% point increase in bicycle commuters (Dill and Carr, 2003). In Seville, following the improvements of cycle infrastructure for cyclists tripled the number of cyclists.

Unintended impacts: Excessive parking space provision for car clubs might have adverse impacts on parking space availability; disagreements amongst the stakeholders may occur depending on the institutional structure; docking stations for bicycles may be biased towards high income neighbourhoods, where there are more public transport stations.
2nd Policy domain: **ICT developments and fuel technologies**

<table>
<thead>
<tr>
<th>Type</th>
<th>Supply side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholders</td>
<td>City councils, central government, car-sharing provider, bike-sharing provider, public, research and technology experts</td>
</tr>
<tr>
<td>Geographical</td>
<td>Local/regional/national</td>
</tr>
</tbody>
</table>

**Policy measures:**

- Use of mobile technologies, e.g. mobile phone applications
- Regenerative breaking
- Subsidising R&D activities on electrical vehicles
- Hybrid buses
- Keyless technologies
- Membership tracking
- Provision of real time information on vehicle and parking availability
- Integrated GPS
- E-commerce and e-services
- R&D investment on developing fuel technologies
- Availability of electric bicycles

**Policy actions:**

- Provide funding for developing mobile phone applications for all car clubs
- Provide funding for developing mobile phone applications for the local cycle hire system
- Introduce a GPS-enabled service like OnStar for turn-by-turn directions and automatic crash response
- Provide incentives and parking priorities for electrical car sharing schemes
- Develop links with public transport ticketing system
- Make links with the train operating services

**Main role:** Simplify use of car-sharing and bike-sharing systems

**Pre-conditions:**

- Existence of well-defined networks for sharing schemes
- ICT skills

**Temporal dimension:** Mobile apps are short term measures, can be updated as more services are added to the network. R&D activities on EVs ad hybrid buses are long term measures.

**Supporting policies:**

- Provision of free training for those who cannot have the basic ICT skills
- Monitoring the privacy issues
- Ensure transparency of pricing mechanism
**FP7 Project: SPREE**

**SERVICIZING POLICY FOR RESOURCE EFFICIENT ECONOMY**

- Subsidising the provision of equal access to technologies

**Impacts:** Simplified ticketing for public transport increased bus use in the UK by 1-5% (combined with other improvements) (Richter, et al., 2009). The stop-start “micro-hybrid drive” technology eliminate unnecessary fuel consumption and emissions whilst idling, while in-car technology means lost keys are no longer an issue (Carplus, 2011).

**Unintended impacts/bottlenecks:** Not everyone has the same levels of ICT skills; technology failure; complex pricing systems with integrated ticketing systems; requires strong negotiations with different transport operators including train, busses, car-sharing and bike-sharing providers.

### 3rd Policy domain: Market and environmental regulations

<table>
<thead>
<tr>
<th>Type</th>
<th>Supply side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholders</td>
<td>New actors needed. City Councils, Central Government, Legal Public Bodies, Car-sharing providers, bike-sharing providers</td>
</tr>
<tr>
<td>Geographical</td>
<td>Local/regional/national</td>
</tr>
</tbody>
</table>

**Policy measures:**

- Vehicle type/size/emission regulations
- Provision of advertising space
- Bicycle design/weight regulations
- Corporate travel management system
- Provision of an accreditation system
- Emissions profiling of the service providers
- Carbon rationing
- Emission tailpipe standards
- City-level/nation-wide cycling planning
- Closure of the city centre to motorised traffic
- Flexible working systems
- Teleconferencing
- Company car regulation
- Regulating PPPs between sharing companies and local/national governments
- Sponsorship (esp. bike-sharing)
- R&D activities on driverless cars
- Funding scheme users’ survey
- Public transport subsidies - new business models

**Policy actions**

- Make the existence of an accreditation system compulsory
- Prohibit the use of car club vehicle must be older than six years old
- Prohibit the use of car club vehicles that do not meet high emission (Euro) and safety (NCAP) standards
• Provide city-wide and nation-wide cycling plans to raise public awareness
• Conduct annual emissions profiling

Main role: Ensure the environmental standards of vehicles used in the sharing schemes and promote cycling

Pre-conditions

• Well-defined institutional settings
• Possibility to introduce new actors (accreditation organisation)

Temporal dimension: Long-term and short-term

Supporting policies

• Provision of cycling training
• Provision of subsidies for car-sharing providers with low emission vehicles

Impacts: Following the restrictions on the vehicles used for car-sharing schemes, the average carbon emissions of the car club fleets in London in were found to be 31% lower than the British national average car (Carplus, 2013). Cycling plans provide cycling-specific guidance both for demand and supply side hence increase public awareness resulting in sustainability benefits (See section 2.2).

4th Policy domain: Safety

<table>
<thead>
<tr>
<th>Type</th>
<th>Demand and supply sides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholders</td>
<td>Local councils, insurance providers, service providers, traffic enforcement bodies, infrastructure providers</td>
</tr>
<tr>
<td>Geographical</td>
<td>Local/regional</td>
</tr>
</tbody>
</table>

Policy measures

• Driverless cars
• Satellite navigation guidance
• Insurance premiums
• Provision of PAYD insurance
• Cycling training
• Driving training
• More stringent traffic regulations
• Helmet policy for cyclists

Policy actions

• Reduce speed limit of cars to 30 km/hour close to cycle lanes
• Provide local eco-driving and cycling training schemes
• Introduce usage based insurance (mile-based auto insurance)
• Introduce helmet requirement for bike-sharing schemes
Main role: Ensure safe cycling and driving in sharing schemes and avoid risks for users and providers

Pre-conditions

- Well-educated public for the uptake of training
- Research and technology base

Temporal dimension: Short-term

Supporting policies

- Invest in education to increase awareness of safety
- Increase public participation due to differences in perceived safety issues that hinder cycling

Impacts: Although these measures all have the potential to increase safety and hence reduce risks, helmet requirement for bike-sharing schemes is found to deter participating in the scheme as observed in the Melbourne case, where it is compulsory to wear helmets (Shaheen and Martin, 2010).

5th Policy domain: Pricing and taxation

<table>
<thead>
<tr>
<th>Type</th>
<th>Demand and supply sides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholders</td>
<td>Local councils, central government; vehicle producers, EC, service providers, users</td>
</tr>
<tr>
<td>Geographical</td>
<td>Local/regional/national</td>
</tr>
</tbody>
</table>

Policy measures

- Congestion charging
- Road pricing
- Parking charges
- Varying parking permit charges
- Infrastructure charging (to providers)
- Membership costs
- Fuel/emission tax
- VAT differentiation
- Vehicle purchase tax
- Registration taxes
- Guidance for clear and transparent cost models
- Company car taxation

Policy actions

- Introduce congestion charge of €20 in central part of the city
- Subsidize car clubs that use low emission vehicles
- Selective exemptions from congestion charging
- Subsidies aimed at integrating externalities in service price
Main role: Internalise external transport costs

Pre-conditions

- Accountable transparent transport governance
- Existing strong institutions

Temporal dimension: Short-term

Impacts: According to the Green Transport Package of 2008, the implementation of a charging scheme leads to an overall reduction in environmental external cost of about €1 billion per year. The impacts of the existing pricing/charging schemes are varied. What strikes most amongst the pricing schemes, urban congestion charging schemes in particular, is the importance of the process of implementation (Givoni, 2011). The rejection of the scheme in Edinburgh and Manchester is usually associated with the lack of a trialling period as was done in Stockholm, in which the scheme was accepted. Such acceptability measures are crucial factors on determining the role of a charging scheme as part of vehicle-sharing plans.

6th Policy domain: Soft policy measures

<table>
<thead>
<tr>
<th>Type</th>
<th>Demand side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholders</td>
<td>Users; employers; local governments; ICT providers; service providers</td>
</tr>
<tr>
<td>Geographical</td>
<td>Local</td>
</tr>
</tbody>
</table>

Policy measures/actions

- Travel awareness campaigns
- Home shopping
- Driving licensing
- Peer-to-peer promotion/incentives
- Trialling
- Travel plans for work places
- Personalised travel planning
- Public transport marketing
- Encouraging the concept of shared parking space
- Encouraging informal car pooling
- School travel plans
- Funding school projects

Main role: Impact on behavioural and psychologies trends in travel behaviour

Temporal dimension: Short-term

Impacts: Cairns, et al. (2008) report that work place travel plans typically reduce commuter car driving between 10–30% and that the typical cost to the local authority for promoting workplace travel plans was £2-4 per affected employee per year. In the UK, a reduction of at least 18% in the
A proportion of commuter journeys being made as a car driver was reported. It is equivalent to at least 14 fewer cars arriving per 100 staff (Cairns, et al., 2008). School travel plans cut school run traffic by between 8–15% on average. Personalised travel planning reduces car driver trips by their target group of 7-15% in urban areas, 2-6% in rural and smaller urban areas (Richter, et al., 2009).

### 4.5 Research design summary

This section summarises the workable framework under which the decoupling and social impacts of moving away from car ownership towards car-sharing and/or bike-sharing and/or combinations of these systems can be evaluated.

The system chosen for study within the mobility sector is the potential to move along the servicing continuum between vehicle ownership, through the currently available methods of sharing to passenger transport in particular city contexts. The empirical work will focus on moving away from private car ownership towards servicing vehicle use mainly concentrating on car-sharing and bike-sharing. Specifically, the mobility system under investigation will be car-sharing and bike-sharing schemes in combination with other travel options with the aim of moving away from private car ownership. Although the relative importance of car- and bike-sharing may vary across the countries, it is recommended that the focus will be on replacing car trips. This implies that in the case of more emphasis on bike-sharing, the diversion from and substitution of car trips should be assessed.

#### Potential of adoption

The first step of the research is to identify the potential travel markets and the role of government in the chosen combination systems of car- and bike-sharing through expert interviews and desk research. This will identify the country-specific changes to the ABM definition of the mobility case given the focus of the integrated system. Although it is suggested to focus on car-sharing and include multi-modal trips including bike-sharing and public transport as part of consumption bundles as is done in the UK case, the policy packaging process allows country-specific characteristics to be reflected in different consumption patterns.

#### Potential of impacts

**Economic and environmental assessment: decoupling indicator**

The decoupling indicator for the mobility sector in this project is identified as the emissions/energy use per unit of revenue and income from car club sector growth (or vkm driven if bike-sharing is the focus depending on the country system definition).

**Total revenue and income from car club sector growth** is indicated as the sum of:

- Revenue of the car clubs
  - Vehicle upfront cost
  - Vehicle replacement rate
  - Fuel cost
  - Maintenance (cleaning, changing tyres and oil) and insurance cost
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- Road/park charging and roadside assistance
- Transport for vehicles and fuel
- Operating/Labour costs
- ICT costs

- Household income savings/loss (calculated from the surveys)
- Government revenue generated/lost (congestion charges/exemptions; parking charges/exemptions)

System boundary for environmental assessment (life-cycle analysis) includes

- all direct inputs and outputs from use and end-of-life
  - use (driving and maintenance - car model, driving style and trip type)
    - fuel consumption
    - energy consumption for heating and cooling
    - energy consumption by auxiliaries
    - energy from average distance travelled an speed
    - maintenance of parts/tyres and energy consumption of servicing stations
  - end of life (recycling and disposal) mainly including use of transport services for taking vehicles back to car leasing companies/car dealers

- indirect inputs including
  - transporting vehicles from manufacturers/car leasing providers to service providers, and
  - transporting fuel
  - energy consumption from staffing and advanced technology systems.

Behavioural and policy dynamics and social impact assessment

The social progress, equity and justice indicators are identified as follows.

1 Consumer groups according to age, gender, income, household size and mobility assets and habits should be identified. The distribution of the benefits should be equal amongst these different social groups. The survey results and focus group discussions will provide information on the role of socio-demographic characteristics and geography on the distribution of benefits of moving away from private car ownership. Geographical differences should also be analysed (qualitatively) from the policy equity perspective in terms of who gains and loses in the case of policy transfer of the system setups between regions.

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For the LCA, the units of energy and emissions should be MJ/km and CO$_2$eq/km, and the air pollutants to look for are CO, VOC, NOx, PM10, PM 2.5 SOx. The functional unit is identified as 1 km driven under average European conditions. The data collection will include inventory data gathering only. The production phase is beyond the remit of the SPREE ABM definition.
2 The desired social impact in terms of **affordability** should be the reduction of total household expenditure on travel to below 10% of income (zero for low-income households). The main determinant of this indicator is the cost of vehicle-sharing relative to cost of owning, which can be assessed against income. If feasible, this should be considered together with the above indicator.

3 In addition measuring access to a vehicle, **accessibility** can be measured by the change in journey times to employment, education, primary health care providers and social activities and living within a 15-minute ‘safe walk’ to designated parking spaces and docking stations. This way, it can also be related to **liveability** of a neighbourhood.

4 Constituting an important part of wellbeing, a **healthy** lifestyle can be indicated by how the individuals feel as a result of moving away from private car ownership toward active travel and higher levels of physical activity. More specifically on health, the increase in the level of physical activity (walking to the car can be included in the case of car-sharing) can be used. Finally, related to health, **safety** can be measured by the reduction in number of child and adult pedestrian casualties by social class and the levels of population exposure to traffic-related noise and air pollution (especially children and older people).

5 **Governance and political economic aspects** can have four main indicators. In terms of **employment impacts** of moving from production-led growth to a service economy, it is ensured that the job losses and gains (and its distribution amongst social groups) are also accounted for as a result of moving away from the focus on car manufacturing toward selling mobility services. **Equal access to decision-making** is also subjectively identified by how the citizens’ will to participate in local planning measures changes. **Accountability of transport governance** can be indicated by the transparency of pricing regimes and the deals between the service providers and local governments. Regarding **integration**, it is ensured that the cross-sector (dis)benefits (including impacts on education and health sectors) are also identified during the transitions toward car-sharing and bike-sharing.

**System definition and data collection stages**

- Identify the potential of adoption in the selected metropolitan regions/cities through desk-research and expert interviews
  - Construct country-specific ABM definition based on the insights from the expert interviews
- Identification of the country-specific social aspects/impacts and behavioural data collection
  - Conduct focus group discussions to understand country-specific policy and social dynamics
  - Change the SPREE mobility questionnaire according to the country-specific characteristic
  - Conduct survey (150-200 people)
- Economic and environmental data collection
  - Identify the key players (car clubs/bike-sharing providers)
  - Identify the types of vehicles that car clubs/bike-sharing providers use through desk research and business interviews (vehicle size and energy supply are particularly important)
o Identify the vehicle supply arrangements of the car clubs/bike-sharing providers in the city (i.e. whether trucking is used for transporting vehicles)
o Identify the maintenance arrangements of the car clubs/bike-sharing providers in the city (i.e. whether cars/bicycles are transported to cleaning facilities)
o Identify the legal requirements by the government through desk research and expert interviews (i.e. the minimum emission profiling of the sector given the accreditation system)
o Identify the arrangements between government-car club sector/bike-sharing provider with respect to infrastructure and road use charges
o Collect the LCA data identified above from the secondary sources (i.e. published papers)
o Collect the business data identified above from the annual reports/press/business interviews.

The below table summarises the indicators, data required in terms of ABM and the data collection methods.

**Table 9: Summary of the indicators, data requirements and data collection methods**

<table>
<thead>
<tr>
<th>Decoupling pathway</th>
<th>Indicators</th>
<th>Data required in terms of ABM ontology</th>
<th>Data collection methods/background research</th>
</tr>
</thead>
</table>
| Wellbeing from economic growth | **Direct social indicators:**
  1. Consumer groups according to age, income, household size and mobility assets and habits
  2. Affordability (cost of vehicle sharing relative to income)
  3. Accessibility (journey times to employment, education, primary health care providers and social activities)
  4. Health and safety (cycling casualties)
| 1. Questionnaire design – categorising the respondents
  2. Costs of the schemes under investigation (car sharing and bike-sharing or only car sharing)
  3. Not included in the ABM
  4. Based on the level of skills |
| 1. Explanatory case study research through expert interviews – surveys
  2. Desk-based research, business interviews and survey
  3. Explanatory case study research through expert interviews
  4. The relationship between level of skills and casualties can be identified from the existing studies and focus group discussions |
| Indirect indicators:
  5. Employment impacts of moving from production-led growth to service economy; equal access to decision-making; accountability of transport governance |
| 5. Not included in the ABM |
| 5. Focus group discussions and literature review |
| Economic growth from transport shift | Revenue and income (6. producing business groups + 7. household income + 8. government) |
| 6. Cost structure of car club operators and bike-sharing providers including the cost |
| 6. Business interviews, press review
  7. Business interviews, press |

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Data collection tools

Overall, there are three main data collection tools including focus group discussions, surveys and expert/business interviews in addition to literature review.

**Focus group discussions (FGDs) and expert interviews**

Expert interviews are used here to serve two purposes: i) illustrating what our conceptualisation stresses, and ii) complementing the key elements of our methodological framework for further empirical analysis. The interviewees should include policy, industry and academic experts. The industry interviews will be used to obtain the economic data identified above (see Annex A).

The FGDs serve the following research objectives.

- To illustrate the social/political aspects of vehicle sharing in the selected cities and regions, which should inform perceived acceptability and effectiveness of potential policy measures in the later stages of the project.

- To measure the potential social impacts of vehicle sharing that cannot be measured by surveys.

- To identify the potential behavioural thresholds of consumer categorisation (if necessary for the country-specific questionnaire).

To reflect the crucial consumer groups identified in the review and the country-specific fieldwork, the group should include mix of males and females, ethnicity, age groups, different family sizes and household incomes, and owners & non-owners of cars, mix of those with one car & those with multiple cars. The participants should use or be open to car- and bike-sharing schemes (see Annex B for FGD materials).

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11 Total shared trip/total mileage driven is the preferred transport growth indicator. If the data cannot be found, we propose to use total mileage driven. Number of bicycles and cars are still relevant.
Survey

The survey sample size should be at least 150-200 people. The questionnaires will be provided as part of the mobility-specific tools. However, the country teams are expected to change the questionnaire to reflect the system definition changes in their respective countries. The questionnaire consists of six sections including the background information, questions on local neighbourhood and travel habits as well as mobility assets, lifestyle and perception questions and consumption choices on car- and bike-sharing.
5. Conclusions

This deliverable provided conceptual and methodological frameworks of servicizing in the mobility sector. It also identified the specific mobility system to be investigated in the SPREE mobility research and presented the appropriate methodologies to employ in the SPREE countries (UK, Sweden, Finland and Israel).

First, a roadmap of the mobility research was presented guided by the generic conceptual framework provided for all sectors by WP2 of the SPREE project. The key message is that servicizing in mobility should be regarded as a continuum. The servicizing continuum in mobility moves along from transport goods to mobility services and covers reduction of the need to travel with changing levels of ownership, space/time, actors and products and services. These elements are in turn affected by ICT, eco-innovation and the EU’s sustainable development vision. The discussion of the social aspects and political issues (justice and equity issues with respect to social progress) reveals that mobility capitals and political economic institutions influenced by public, political and business discourses, respectively, identify the cultural and political/institutional constraints. Overall, the conceptual framework constructed in this chapter help identify what is actually happening without any normative assumptions about the uptake of servicizing systems in the mobility sector.

Second, the construction of the methodological framework addressed the physical and resource constraints. Economic and transport growth measures were altered to reflect the servicizing-specific changes in the system. The decoupling indicator for the mobility sector in this project is identified as the emissions/energy use/air pollutants per unit of revenue from car club sector growth (or vkm driven if bike-sharing is the focus depending on the country system definition). The total economic revenue and income changes are suggested to be a valid measure of economic progress as the often used measures like GDP is not applicable to the servicizing case and as discussed above, the use of GDP as an economic measure entails several social issues. The social impact assessment should bring two dimensions, i.e. whether the impacts are direct/indirect and whether they are subjective and objective.

Finally, the specific system definition was described through the illustrative examples from the UK case. The system chosen for study within the mobility sector is the potential to move along the servicizing continuum between vehicle ownership, through the currently available methods of sharing to passenger transport in particular city contexts. It is entitled From owning to sharing in car and bicycle use across European contexts. According to the definition, the empirical work should focus on moving away from private car ownership towards servicized vehicle use mainly concentrating on car sharing and bike-sharing.

In conclusion, this deliverable should be taken as the conceptual and empirical basis for researching servicizing in mobility in the SPREE countries. The system definition provided in this deliverable should be carefully examined considering the country-specific characteristics. This deliverable also provided methodologies for identifying the perceived effectiveness and acceptability of the servicizing systems, which should help the policy-packaging process.
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Appendices

A. Other servicizing practices in transport

1. Public transport services

With increasing populations living in cities, it is vital to make public transport easier and more comfortable as it is a safe and environmentally preferable alternative to car commuting. Moreover, public transport use can strengthen social capital by providing a safety net of transport options for disadvantaged groups (Curie and Stanley, 2008). Physical inaccessibility is likely to result in inaccessibility of goods, services, decision-making, life chances, social network and social capital, which then leads to social exclusion.

Most public transport can be considered servicizing in general. In fact, providing mobility a service can be best described as providing public transport. Moreover, bike-sharing schemes are also considered public transport. However, complementary actions that reduce the use of infrastructure and machines, such as the use of mobile phone applications for travel routing and reusable travel cards, would be the main focus of the analysis if considered from a servicizing perspective as they are likely to increase the service component in the consumption bundle.

As a best practice, Oyster card is an electronic ticketing system employed in public transport in London. Issued by TfL across different public transport modes including tube, buses and light railways, it provides discounts for registered users, students and seniors. TfL has several other mobile applications like journey planners, travel news and time tables and maps that can be accesses by short messaging service or any other applications on mobile phones.

As another example, Nokia Transport offers a unique service that makes available the most convenient directions to buses, suburban trains, underground and trams. The service is available as a mobile app and in 2012 it covered more than 500 cities in 46 countries. The app allows the traveller to plan the commute and navigate in the city in an environmentally friendly way. It displays where the nearest public transportation is located as well as how to get to the station and further the final destination (CSCP, 2012).

ICT has a significant role in enabling greater accessibility to public and private mobility solutions and intermodal integration. However, the complementary actions to increase demand for public transport are not limited to ICT-related activities. Comparing the demand for public transport in Germany and USA, Buehler and Pucher (2012) point to the role of complementary policy actions that render Germany more successful than USA in using public transport. They list provision of better service and multimodal integration, more attractive fares and convenient ticketing (where ICT plays a significant role), imposing high taxes and restrictions on car use and land-use policies as the complementary factors that determine the higher levels of public transport use in Germany than in USA.

In this project, public transport is only considered as part of a consumption bundle available to consumers, therefore the public transport fleet is not considered. However, social accessibility and equity issues and the abovementioned complementary policy actions should be carefully considered.
in conjunction with other servicizing opportunities. The conditions for active travel and health benefits of walking and cycling should be considered when planning public transit.

2. Mobility of goods

There are several freight transport activities that can be recognised under servicizing. Most servicizing practices in freight arise from the paradigm shifts in manufacturing and logistics. Kritzinger, et al., (2010) point out that provision of vertical local greenhouses, collaboration in supply chains, industrial symbiosis and selling & leasing trends tend to ‘servicise’ freight transport. These activities, particularly collaboration in supply chains, aim to reduce empty load trips and therefore render servicised freight transport more efficient. Because the intrinsic value of travel does not play a role in freight transport demand, the servicizing elements may potentially become more effective in freight transport.

Since the SPREE project does not examine freight transport, we do not go into details of different types of servicizing activities in freight, but the role of ICT in servicizing freight is worth noting to better understand the role of ICT in transport efficiency. There are two main roles of ICT in increasing servicizing in freight transport, namely avoiding empty load runs and logistics management.

Avoiding empty load runs is achievable by optimising vehicle loading factors, especially for commercial freight sub-sector. There is much role for ICT to play here by means of packaging and loading optimisation, improving the efficiency of logistics, distribution and re-loading. Lorry sharing is particularly important in the servicizing context. Lorry-sharing is where freight service providers come together to form a collective organisation with shared access to orders. Using ICT for online routing and scheduling, together with lorry-sharing, is a strategy to prevent empty running. From a sectoral point of view, route planning has become increasingly important in transport and storage and wood and furniture sectors, while online retailing is one of the recognized best practices in wholesale and retail (Bauer, et al., 2011).

Logistics is complex. One of the key elements for success is to get the flow of data right. One of the major issues concerning cargo planning is that the vehicles only carry 50% load currently due to for mentioned causes (3TU, 2012). ICT modifies existing logistics systems and supply chains, global positioning satellites and dynamic modelling of routes are used in intelligent transport systems to make long-distance transportation more efficient. In regards to the private sector, on-line order and delivery services can entail environmental gains if personal commuting to physical stores is replaced by deliveries that are centralised and efficiently organised. The efficiency of the delivery is also dependent on the type of vehicle used, type of fuel, fuel efficiency, routing and the size of the delivery area. Environmental benefits can however be lost if consumers require fast and more exact deliveries as retailers may be forced to deliver overnight which can entail a shift to air freight and/or obstruct an optimised transport route and time.

3. Other forms of servicizing

In addition to above forms of servicizing, the servicizing is entailed in different forms of policy innovations and use of ICT. Whether they can be conceptualised as a servicizing system in the mobility sector alone is not discussed here. But for the later stages of the project, these
considerations should be integrated into policy-packaging process. Although the servicizing elements of the below practices are multi-faceted, we limit our discussion to the role of ICT.

Telecommuting and telepresence

Telepresence depends on ICT technologies and advanced network equipment and offers a type of high-definition videoconferencing system. The UK Department of Transport study found that teleworking reduces the commuting car usage by teleworkers by 48-77 %, which after taking into account possible increase in domestic transport represents 11-19 % final decrease in total private car travel (DTLR 2002). A study conducted by BT in 2010, for example, calculated its carbon footprint and carbon benefits that a global telepresence solution could offer (GeSI and BCG 2012). In the study BT found that the use of telepresence offered a total of 9,850 tons CO2e of GHG abatement, this represents an 83 % reduction in comparison to business-as-usual (i.e., flying to meetings). Bell, for instance, has estimated that their telecommuting policy has reduced its corporate GHG emissions by 20,000 tons CO2e on an annual basis. In Canada’s Bell Telecom there have been a lot of efforts to shifting the companies more towards telecommuting as many of the employees have a 60 to 90 minute commute to work. Many employees have reported lifestyle improvements as one of the major satisfactions with telecommuting while managers state that the use of technology has led to a higher efficiency in interaction (GeSI, 2012).

There are a few factors that offer the best potential for ICT services to replace physical trips. These include, for instance, that the knowledge is codified (explicit), adequate length of tele-meetings is 2-4 hours and that the partners in tele-work share the same linguistic and cultural background. Alternatively that the partners have had prior physical meeting(s) in order to build sufficient common ground (Heiskanen, et al. 2001).

A videoconferencing system can range between very inexpensive to moderately expensive, on the low end there are solutions such as tablets, web-enabled PC or smartphones with webcams that can be utilised to connect people in a very cost-effective manner, it can even be free. On the high end of the spectrum there are systems like the HP’s Halo videoconferencing system, which can cost up to $350,000 per installation (CSCP 2012; GeSI and BCG 2012). A favourable trend is that there is a general tendency of rapid price decrease for both the hardware and the software parts of tele-work infrastructure. Today, more and more of free public access tools and communication means are appearing rapidly and becoming an everyday means of communication for ordinary people too.

It must be also be kept in mind that telework, ecommerce or other e-services could free up more time and financial resources to generate new travel opportunities. In other words, the environmental savings are not given but depend how ICT redistributes personal travel and goods transport in terms of time, location and who does it/what is transported. However, even though video conferences cannot replace all business travel it can decrease the number of less essential trips, video conferences can further yield large savings over time indicating that even
Eco-driving

Eco-driving is one of the solutions that offer the some large climate change abatement possibilities and provides opportunities for a number of ICT applications (GeSi 2012). ICT can be used to reduce emissions by encouraging a certain driving style (e.g. the Miljökörkortet initiative in Sweden), by using alerts and other technology, which can improve the overall efficiency of the vehicle. Specific examples include offering an optimised route where GPS technology can be used to combine the fastest and shortest routing options, lowest emissions calculations, creating an alert to indicate when driving in a non-environmental manner and adapting cruise control to speed limits, traffic jams and hills, etc. (see e.g. Eco-RouteTM solution by Garmin) It could also be possible to use apps on smartphones and tablet computers to offer these services to avoid theme being built into a vehicle.

Corporate Travel Management System

Companies can use a Corporate Travel Management System (CTMS) to implement travel reduction. CTMS is a vehicle that provides personnel with a number of options to reduce travelling; the options can consist of virtual meetings, better travel logistics or the choice to use the least environmentally harmful and costly means of transport (Fadeeva 2001). A vital component in a CTMS is the ability to measure and compare the environmental impact related to different travel services, theses is however still a lack of such a system (Essex County Council 2011). Only a few companies apply this sort of system today, travel reduction is more commonly incorporated into the corporate travel policy.

B. Sample interview questions

<table>
<thead>
<tr>
<th>Theme</th>
<th>Example questions</th>
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</table>
| Understanding of vehicle sharing systems | - How is car-sharing defined?  
- What are the existing/potential cars sharing/bike sharing services?  
- What makes it more convenient to choose car-sharing as opposed to public transport and cycling?  
- How many car/bike manufacturers and service providers in the selected country? Would you be able to categorize them as small/big companies?  
- Are there any patterns between ownership/sharing in different modes? Bike-sharing used by car-owners? Or Non-car owners likely to use car sharing or public transport?  
- How often do you change the business models? What influences your decision? How long is your strategic vision?  
- What are the existing manufacturing models?  
- What are the sales models?  
- What are the relevant products to produce cars and bikes?  
- What type of cars/bikes? (models, fuel types, size)  
- Do you know what materials/waste produced from manufacturing bikes/cars? |
| Market exploration             |                                                                                   |

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Barriers and potential for uptake
- What infrastructures does car/bike sharing service company and manufacturers need?
- What are the relationships between (central/local) governments, manufacturers, and service and infrastructure providers?
- Can you explain the relationships between market research and strategic changes?
- What is the cost of infrastructure (road, electricity, etc.)?
- How do you see the societal perception on vehicle sharing in London/Bristol? Does city size matter?
- What are the consumer groups? (Income, age, trip purpose, status)
- Any information on travel distance needed by different consumer groups?
- What are consumer preferences – green/trendy/technological?
- What is the perception of public transport users and cyclist on car and bike sharing?
- Further uptake on bike ownership and bike sharing?

'Imagined public' and ‘potential travel markets

C. Focus group discussion materials

SPREE mobility questionnaire is distributed in the beginning of the FGD to obtain the background information on the participants.

*Conceptual mapping exercise – understanding of vehicle sharing*

This exercise is to identify the differences between the understandings of vehicle sharing by users and nonusers (via questions with 2 separate groups)

Start with the nonusers’ group:
- What do you understand by ‘sharing transport’?
- Can you give any specific examples of transport sharing services?
- How many car clubs they can name and if they know of any bike-sharing schemes/docking stations in their respective residential/work/school locations.
- How do you think car sharing and bike-sharing work?
- Would you join? Why would you join?
- Would you give up your own bicycle/car?
- What information do you need about the schemes before you join?

For users’ group
- What are the options of sharing in transport? How do you think bike-sharing work? How are both schemes different to car rental/car and bicycle ownership?
- Have you ever taken part in a local car-pooling project?
- How did you find out about the schemes?
- Why did you join?
- Did you give up your own car?
- Have you ever used the London cycle Hire scheme?
- What types of car sharing models do you know of?
- Gather both groups to ask the users what aspects of their life when they joined the car sharing schemes.
- Perceived wellbeing: Allow non-users to ask questions to the users – anything they would like to learn about the schemes.
- Ask about their driving/cycling styles... How would you describe yourself as a driver?

**SPREE Travel Options Mapping Exercise**

The aim of this exercise is to understand the participants’ travel patterns and how and why they would change/changed to vehicle sharing and whether it would change their level of participation in social life. The participants should be given the opportunity to articulate their own views. With this exercise, the accessibility impacts of car- and bike-sharing (in terms of access to transport services and access to education/employment/key social services) will also be identified.

The participants are provided with

- a map that shows the locations of the available services
- a list of key players (car and bike-sharing in the selected city/region)
- information on availability of services (walking distance from their homes)
- information on locations of designated parking areas/docking stations
- a list of prices of services (car clubs/cycle hire)
- a list of prices of ICT services required

The exercise should be accompanied by short questions by the moderator to understand the behavioural thresholds for the lifestyles indicators identified in the ABM case definition.

**Inclusive governance and the uptake/social impacts of sharing**

This section is to understand the social justice implications of using car- and bike-sharing. First, the perceived fairness/effectiveness/acceptability is evaluated. The second part focuses on whether participation and transparency in governance increases as a result of both formal and informal schemes.

1. Focus on car- and bicycle-sharing and explore the participants’ understanding of the impacts of the schemes.

Questions to ask:

- Why do you think car clubs exist?
- Why do you think the London Cycle Hire scheme started?
- What do you think are the potential impacts? (Both on individuals and society from economic, social and environmental perspectives?)
- Does the system have an equal impact on everyone? Do you think car-sharing scheme use has a class/gender/age dimension? Who do you think are the main users? Why?
- What do you think is the role of technology in a car sharing scheme/bike-sharing scheme? Should there be more of it?
  a. The main aspects/impacts to understand are whether equal access to political participation improves or the governance becomes more accountable and its impacts on other sectors (integration). The discussion should be embedded within the context of the
relationships amongst CarPlus, Transport for London, London Councils, Mayor’s Office, Barclays and the UK Department for Transport. How the impacts change in different geographical regions is also included in the discussion.

b. Transparency of transport governance structure, i.e. level of knowledge required in the uptake of vehicle sharing and its implications

c. Access to decision-making process, i.e. willingness to participate in planning and reaching a consensus on planning and regulation issues

d. Integration with other sectors – any cross-sector impacts on education and industrial policy?

2. Story-telling exercise will be employed to understand the participants’ perceptions on the role of governance and how they are affected by it. The stories will be briefly told by two different moderators 1) BMW buying the online venture parkatmyhouse 2) Is London cycle hire a Tory project?

Before the stories:

- What do you know about the governance of sharing schemes in London/Bristol? Do you think all the information has been made publicly available?
- Who do you think are involved in the London cycle hire/car club?
- Do you know what you are being charged for public transport and sharing schemes?
- Do schemes improve the pricing understanding?

After the stories:

- What do you know about the parking policy in London?
- Do you trust the government/businesses? Should shared parking space be facilitated by governments/businesses in the context of car sharing? (in the context of BMW buying the app)
- What do you think are the main legal/institutional barriers behind car sharing and bike-sharing schemes or public transport, cycling and walking in general?
- After the Boris’ bicycle picture:
  - How do you feel about the phrase ‘Boris’ bicycles’?
  - Do you think it is a ‘Tory project’?
  - How do you feel about public transport and walking/cycling facilities in London?

**Further uptake**

The participants will be asked the following questions:

- Who, in your family/work colleagues/relatives/neighbours, would join a car club/cycle hire scheme? Why?
- Do you think there will be more uptake in London? Why?
- Will you be using more of these services? Or do you think there will be better alternatives?