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Governance and collectivity

MOBILITY GOVERNANCE IN SMART CITIES OF THE FUTURE

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Introduction

The transport sector is at the start of a period of major change: new technologies, products and services are fundamentally changing mobility users and providers' expectations and opportunities, causing significant changes to transport systems in cities. To refer to these changed conditions, a common term used is the "smart mobility", which has become something of a buzz phrase in the planning and transport fields in the last decade (Campbell, 2013; Hollands, 2014; Jennings, 2010; Murgante and Borruso, 2013). It can be defined in line with the following realities: rise of the sharing economy, access over ownership, mobility services on-demand, the convergence of modes and types of transport, the blurring of the boundaries between public and private transport, the arrival of new entrants challenging the market and regulators to respond to a new world (Allwinkle and Cruickshank, 2011).
These modifications are reflected on both the transport demand and supply sides reshaping transport systems and fundamentally changing customers' expectations. On the supply side a system of new actors are entering the mobility system, which is seen as a business. New actors include multinational firms in the information and communication technology (ICT) sector applied to the transport sector, such as IBM, Cisco, Siemens have engaged in urban mobility initiatives conducted under the banner of the smart city, usually with the active support of the state and local administrations, but also novel entrepreneurial communities and innovative start-up firms (Rossi, 2015). On the demand side, citizens require much greater flexibility in line with the wider social trends around part-time working, working from home and more flexible journey choices. Moreover, due to new ways of working, such as remote work and virtual meetings, work-related mobility and its reliance of the office hours decrease. From more fixed mobility patterns (e.g. car ownership or long-term season tickets), we now see a trend towards the provision of access to mobility opportunities and the emergence of the sharing economy bringing a new mind-set to mobility users' expectations. The increasing diversity among travel modes, modern lifestyle is featured by increasingly multifaceted mobility means that destinations travel hours and reasons for moving varies.

A specific impact regards the 'orgware' aspect of the mobility in cities: increasing number of new global and local actors is entering the transport system. These changing conditions necessitate reflection on governance issues and of the role of public authorities in the new framework. In details new approaches, methods and tools are needed to support the development of new solutions that reflect these trends, to unlock major opportunities for businesses and to ensure that social and environmental goals remain in the planning agenda.

Indeed, after a fervent first phase in which information technology and digital data were considered the answer for making mobility more efficient, more attractive and

for increasing the quality of travel, some questions are been growing around the risks and challenges of smart mobility systems. The distance between the visionary potential that smartness is providing is too far from the reality of urban mobility in cities and in some case far for societal goals of environmental and equitable transport system. With a specific view of governance aspects, we argue in particular that two main aspects of smart mobility should be eluded: the first refers to the merely application to technology on mobility system, what we called the techno-centric aspect; the second feature is the consumer-centric aspect of smart mobility, that consider transport users only as potential consumers of a service.
Starting from this, the study critics the smart mobility approach and argues on a the need of a different approach for smart mobility, in which technologies are only one aspects of a more complex system and mobility consumers are instead active citizens, participating in shaping mobility and their city. With a view on the urgency of looking beyond technology and beyond consumer-oriented solutions, the study arguments the need for an interdisciplinary approach that could supports transition towards a "smarter mobility" for enhancing the place making and the development of vibrant cities.
Main research questions are: what are the emerging "smart mobility" issues that the governance of mobility system should address? How to face the governance challenges related to smart mobility?

This contribution does not intend to produce a radical critique of the smart mobility concept, denying a priori its utility. Our perspective is that the smart mobility is sometimes used as an evocative slogan lacking some fundamental connections with other central aspect of mobility planning. Our focus is in particular on the smart governance solution for mobility.

The chapter is organized in the following sections: section 2 provides the rationale behind the study; section 3 explores the evolution on smart mobility paradigm in the last decades analyzing in details the "techno-centric" and the "consumer-centric" aspects and analyzing the new emerging issues related to the governance of smart mobility. Section 4 proposes an integrated smart mobility governance approach. Some conclusions are finally drawn in section 5.

Beyond the smart mobility paradigm

Different approaches to mobility systems and mobility planning have been developed and described within transport planning literature. The first one is defined "conventional mobility" planning and it focuses on the physical dimensions and on traffic (and in particular on the car) rather than on people: it is large in scale, rather than local, it is forecasting traffic and it is based on economic evaluation. In synthesis, the conventional approach is mostly aimed at shorting travel times, considering travel as a cost. In other words, traditional transport planning aims at improving traffic conditions; especially for motorized vehicles, and fail to adequately consider wider

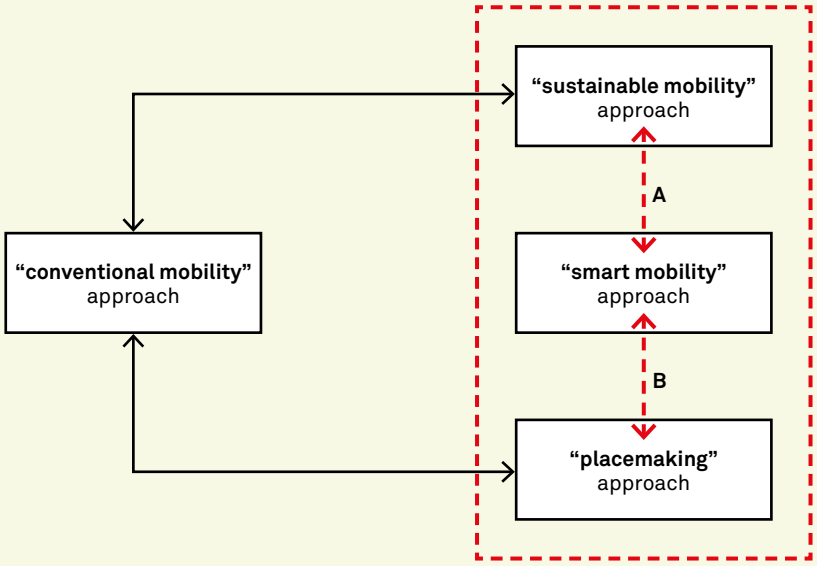
impacts. The "conventional mobility" paradigm could be seen as transport-based, as it maximizes travel distances by maximizing travel speed. Indeed, according to the "conventional approach", the performance of a transportation system was primarily evaluated on speed, convenience, and affordability. This approach was based on the "predict and provide" principle, meaning to predict future transport demand and provide the network for it, usually by building more roads. In other words, the lack of infrastructure capacity was countered by expanding road network that has strongly contributed to increase car use and to favor automobile-oriented improvements and had negative effect on the environment and safety.

In opposition to this, the sustainable mobility paradigm arose (Banister, 2008) which strengthens instead the links between land use and transport. It was clear that capacity of the transport system could not continue expanding. Indeed, the sustainable mobility refers to the broad subject of transport that is sustainable in the senses of social, environmental and climate aspects. The sustainable paradigm comprehends a broader range of modes, objectives, impacts, and improvement alternatives. Sustainable mobility is aimed at the ultimate goal of mobility, which is accessibility (Kennedy et al., 2005; Litman, 1998) and can be referred to as access-based, while it concentrates on creating access with the means of transport. This stems from the approach that creating access is the fundamental aim of most travel. In this sense it aims at reducing the need to travel and trip lengths and at encouraging modal shift and a greater efficiency in the transport system. In other words, the shift from conventional mobility to sustainable mobility involves moving from an idea of transport system performance, primarily evaluated based on speed, convenience, and affordability of motor vehicle travel to a more comprehensive, multimodal system of evaluation that considers a range of modes, objectives, impacts and improvement options (Litman, 2013).

Another approach to overcome the conventional mobility planning has been proposed and applied and it can be defined as the "place making" paradigm (Jones and Evans, 2012; Cervero, 2009; Gehl, 2013), born within the urban design literature and practice and applied also to the transport-planning sector. Density, diversity, design, distance to transit and destination accessibility become the key drivers in configuring the urban fabric and creating a place. According to this paradigm, the spatial and the transport systems have to be embedded first at the local scale, looking at the place making in local contexts. The attention here has been directed to the people and the places of the city and the emphasis is on the creation of quality of urban places.

Finally, a third approach has been proposed as an opposition to the "conventional" mobility planning: the smart mobility approach. With this term, academic research and industrial applications refer to the potential of optimizing existing city infrastructure, services, and urban behavior through the deployment and utilization of new technologies. The smart mobility approach, and its evolution, as described in the following section, is in fact mostly based on the application of new information

FIGURE 60
Mobility planning approaches and their missing links



technology for the innovation of transportation systems and it has been quite fashionable in urban and transport planning domains and in the policy arena in the last decade. According to some studies, the smart city and the consequent smart mobility concepts are no just limited to the diffusion of ICT, but it looks at people and community needs (Batty et al., 2014; Hemment and Townsend, 2013). Nevertheless, as explained in the following paragraphs, some important links with other aspects of mobility planning are still missing (Lauwers and Papa, 2014; Papa and Lauwers, 2015).

Starting from the distinction of the different approaches we want to provide insights on the weak or missing interrelations within them (Figure 60) and to analyze potential areas of cross borders both from in relation to specific planning goals, with have a direct impacts to governance aspects. Our main argument is that arrows A and B in Figure 60 that describe respectively the interrelations between smartness, sustainability and quality of places should be strengthen both in theory and in practice. In fact as stated by the executive director of the New Cities Foundation, the smart city (and in particular the smart mobility) seems to have lost its contact with humans: "if you type smart city on your image search engine, the first human being appears on the page number eight. The first hundred or so images are sci-fi renditions of cities that will probably never exist" (Lefevre, 2014). The same happens by searching "smart mobility" or "smart transport". In literature and in practice there is a gap between the smart approach, sustainability and place making approaches. We argue that in most case the paradigm shift is occurring directly from the "conventional mobility" approach, towards the smart mobility one, by applying new technology to transport system that instead would need better other solutions. In other words, the concept of smart transport as synonymous with innovative technological or consumer-centric solutions should go beyond this, in order to embrace citizen co-creation models for helping to drive the next generation

of smarter cities. There is still a huge need of supporting the growth of broadband digital infrastructure, wireless networks, e-gov and m-gov services and Internet of things sensor networks. However, all of that smart transport systems capability should be increasingly geared towards enabling citizen co-creation and urban transport entrepreneurship.

In this general framework, in the following paragraphs we examine the links between the goals and governance aspects of smart mobility and the others: the "conventional approach", the "sustainable mobility" approach, and the "place making" approach, stressing the missing crossovers in theory and practice of the three.

The evolution of the smart mobility concept

The term smart or intelligent mobility appeared at the beginning of the Nineties in order to point out at a city with a mobility system more and more dependent on technology and on innovation. Within the "smart city", studies have defined it in many different ways (for a complete and updated list see Albino et al., 2015). Intelligent Mobility is usually defined as a way of thinking about how to connect people, places and goods across all transport modes. It is about the utilization of a combination of systems thinking, technology and data across the transport network to inform decision-making and enable behavioral change. Despite the difficulty to account for the multiple meanings attributed to the concept and the many different approaches in current urban planning literature, we focus on two main aspects, described in the following paragraphs. The first is a "techno-centric" approach based on the application of information technology to transport infrastructure, and the second one is a "consumer-centric" approach, based on the idea of providing new mobility products for transport users, considered as consumers.

The techno-centric smart mobility

The techno-centric aspect of smart mobility is characterized by a strong emphasis on the "hardware" and, namely, on the idea that ICT infrastructure represents the keystone for building up the Smart Mobility. Accordingly, it refers to the implementation of information and communications technology (ICT) in the field of road transport, including infrastructure, vehicles and users, and in traffic management and mobility management, as well as for interfaces with other modes of transport. As transport infrastructures have evolved over the past decades, they have become more complex and now often have deeply interwoven interdependencies on other infrastructures. For example, most large-scale infrastructure assets are increasingly relying on flows of information and other communications technologies.
According to this approach, ICT represents the keystone for building up the Smart Mobility, relates the infrastructure of smart cities to their operational functioning and planning through management, control and optimization (domain of both large and small ICT companies). Indeed ICT has played an increasingly influential role in transport systems since the 1960s, mainly in improving efficiency of operations by

being embedded in business processes. Solutions to the mobility problem are seen in technological fixes and high tech solutions, such as alternative fuels, intelligent transport systems, integration of information and communication technologies and means of transportation etc. In the face of the outlined challenges of current mobility regimes, mobility scholars tend to see potential solutions in new technologies and their combination, e.g. smart motilities systems.
With recent advances in cloud computing, along with the increasing ubiquity of mobile devices and cheaper sensors, however, the role for ICT within the transport sector has expanded dramatically and is now a source of industrial disruption, creating new linkages between economic actors and providing entry points for smaller companies as well as players from adjacent markets.
ICT is being implemented into three main ways in the transport sector (Mulligan and Olsson, 2013):

- large-scale transport system, implemented across cities in order to streamline and improve efficiencies within existing systems;
- small-scale transport system, implemented at "app" level, based on open data from cities, in order to help transport users connect with existing transport solutions in a more convenient manner;
- industrial disruption implemented on either "app" or large-scale level and disrupts the established industrial structure, either through the introduction of new players or by completely redefining the transport system itself.

ICT exploits information and communications technology, thus improving traffic flow, enhancing safety, de-creasing environmental disadvantages, generating advantageous services for car drivers, and establishing increasingly convenient multimodal mobility service use. ICT strongly contributes to an increase in the efficiency of the system.
The techno-centric approach, largely widespread in the early 2000s and mainly focused on the technological aspects, provides a vision of smart mobility as capable of maximizing its efficiency thanks to a large and widespread use of ICT. Such a vision, which has been largely sustained by multinational companies, leaders in the sector of ICT manufacturing, focuses on infrastructural innovation. The techno-centric approach is still largely widespread, but even the vice-president of CISCO has recently pointed out that something should be changed. He stated indeed: "we are crossing the threshold to put internet-based tools to work in cities (….) technological devices are merely tools that can make our life better only if they are put in the hands of users who understand and can make the most of them" (Elfrink, 2012).

The consumer-centric smart mobility

The consumer-centered smart mobility is characterized by a strong emphasis on the human side and it has been largely widespread in the second half of the 2000s. According to such an approach, Intelligent Mobility combines a strong focus on putting the customer at the heart of the service offering with the requirement of integrating all transport opportunities into a whole system. Again, in this approach the user and their experience and requirements must be at the center of mobility provision.
Accordingly, the human component represents the crucial element for building

up a smart mobility system: more and more widely available technologies are intended as "enabling tools", but insufficient to make "smart" an urban context, only by themselves. In practice innovations (infrastructures, vehicle and services) look at people, seen as end-consumers of a service, reflecting their individual needs. Applications furthermore are aimed at again optimizing consumer's mobility behavior through the ITCs (behavioral aspects), but without considering other more comprehensive central goals.
In other terms, while the techno centric approach is mainly focusing on the supply side, the consumer centric focuses on the demand side of transport system, but with the limit of looking at transport users as consumers of a service, than as citizens. According to this approach, changes in the transport system are taking a user-centric approach to looking at mobility opportunities for customers as part of a wider, integrated system. Indeed recent decades have seen a proliferation of small scale consumer technology such as smartphones and tablets as well as an increasing availability of cheap computational capacity in the form of cloud computing. These technologies have now reached a point where they are able to reshape industrial structures as they permit the creation of new organizational forms.
Customers are now using new and multiple channels to communicate and to keep informed. Additionally, we see a growing requirement for personalization of services. Customers are looking for ways to make their journeys easier both in planning and in undertaking them. We only need to look at the uptake of new services such as online journey planning and ticket purchasing; the use of social media to communicate with operators; and the growth of apps like Citymapper, Moovit and Waze, to see that customers have an appetite for new ideas, it is now for the transport sector to respond.
Start-up companies who are creating innovative new products and services such as Bridj's 'pop up transit' or Uber's take on taxis and lift sharing are opening up transport sector.
Information and knowledge on the agents' action space are needed to better customize the mobility service in an increasingly difference-based and dynamic world, and adapt the mobility service to the evolutionary aspects of mobility. Key to this is the pervasive theme of innovating with a focus on putting the transport system users at the center of the mobility service (Atkins, 2014).

Emerging "smart mobility" governance issues

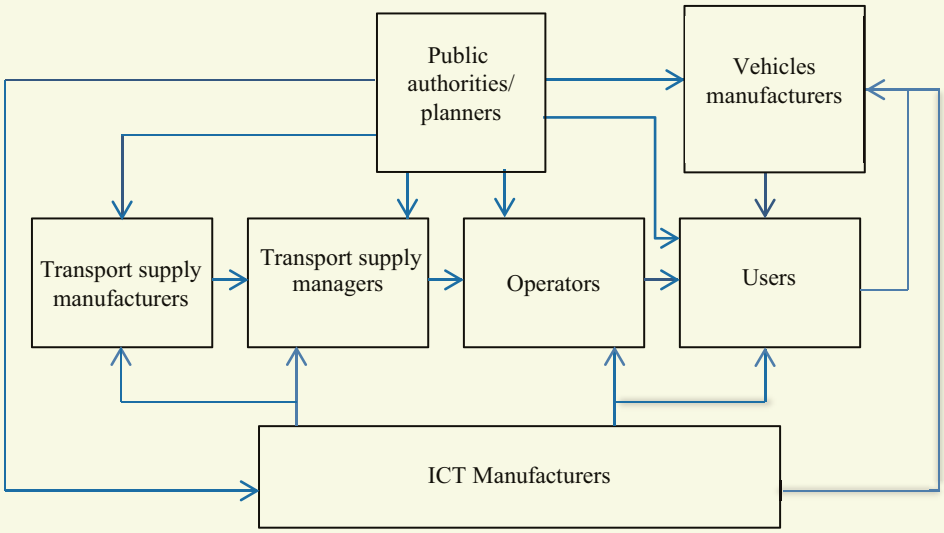
In the previous paragraphs, two different aspects of the smart mobility approach have been described and what emerge in both cases is the gap between the "smartness" and sustainability and place making aspects. The increasing part of ICT industry and the changed role of transport users into "consumers" bring a new set of issues in planning and in governance processes of mobility systems. Indeed, in both smart mobility approaches described previously, some crucial changing conditions are taking place, modifying the actual assets of decision rules (Nam and Pardo, 2011; Wachowicz and Portugali, 2012). Concerning the techno centric approach, new local and global ICT manufacturers are entering the mobility market, with the risk of losing contact with the public authorities and mobility planers. Concerning the consumer centric

approach, consumers are getting into the center of the system, with the risk of the prevailing of personal goals instead that mobility planning collective goals. In both cases, the public priorities and collective urgencies are putting in a second order.

The market is evolving because of several factors interacting with each other, including technological advance, policies that governed the interaction, and the activity of market participants. In the following scheme (Figure 61), the users and ICT manufactures are embedded into the transport value chain, showing the relationships between the different actors involved in this transition. The entrance of ICT and the centrality of mobility consumers let new organizational forms to emerge also outside of industrial boundaries, challenging the traditional organization. At the same time end users are now also more deeply embedded in the transport value chain: firstly, through the capturing of an end user's private data and secondly, through the capture and analysis of an end user's behaviors. From the governance viewpoint, ICT is already having a transformational impact on the transport industry, destroying existing relationships between actors in the value chain and creating space for new entrants. Market for Intelligent Mobility is rapidly developing as customers, transport authorities, businesses and governments understand the huge potential for unlocking major opportunities. Indeed, in the last 10 years we have seen technology introduced that has either directly delivered, or enabled, significant disruption across a number of sectors. This is hugely significant to the transport sector – as customers increasingly adopt new technology, it enables new services to be developed that are bringing real benefits to customers. We can now check live bus times or buy train tickets on our phones as well as plan our journeys and keep an eye out for any issues on the transport network, such as congestion, as it arises.

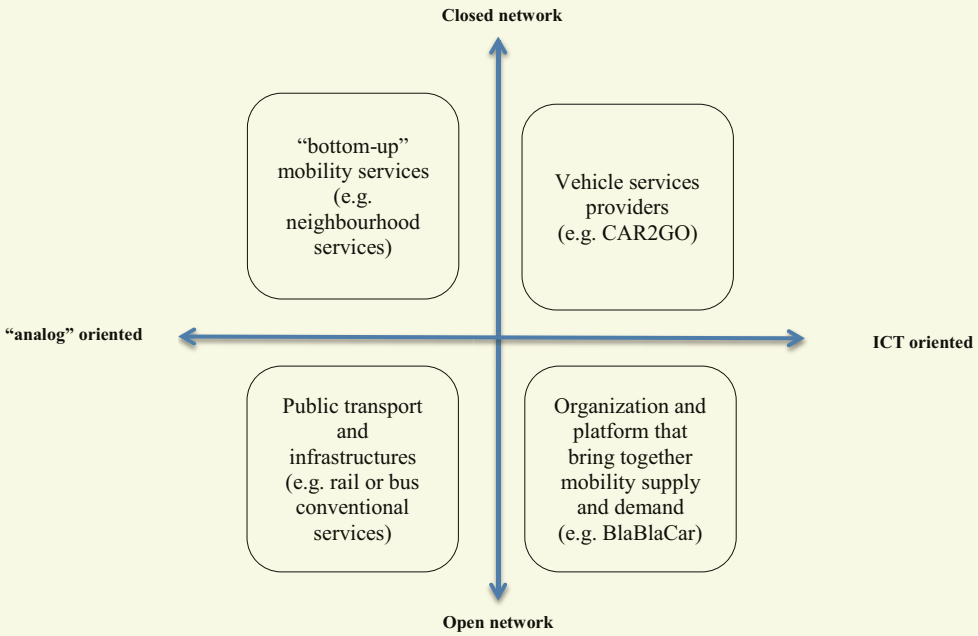
Looking again at the Figure 61, links between the actors are necessary to be stronger in order to achieve collective goals. In details, some direct links between

FIGURE 61
The system of Smart Mobility stakeholders (adapted from Mulligan, 2014)



public authorities and ICT manufacturers and from public authorities and users are necessary to assure a public regulation of some specific issue. The manner in which ICT is implemented is critical. For example, ICT can play a role in reducing congestion without building entirely new transport infrastructure, and ICT is helping provide end users more control over how they interact with transport systems. However, in both cases public authorities should have a clear role in this process. One example of these interactions is how a route planning application can be used to prevent for example the use of a specific road in a city, according to public authorities' goals, instead that only optimization of individual travel time.
The number of players is increasing as competition between transport modes. New products and services and new operators are been introduced (Figure 62). The transformed organization of mobility services could provide users a different travel behavior and lifestyles. The service supplies of emerged service operators could be extensive enough to provide creditable level of service. This of course has direct implication on form of organization and public authorities' governance approaches. As an example, a form of organization that it is already being tested in some cities is the so called Mobility as a Service (MaaS) (Heikkilä, 2014), based on integration of mobility modes and access to mobility rather than ownership of means of mobility: transport companies would produce services and sell them to the mobility operators in large amounts. Transport services include use of infrastructure, fleet, and data. In this framework, some questions remain open: what is the role of all the other stakeholders and how to face the new emerging challenges of smart mobility?

FIGURE 62
Clusters of Smart Mobility services (adapted from Bos, 2015)



Towards a smarter mobility governance

The need of a new integrated approach is necessary to govern the changing situation, which should be based on the place making that a Smart Mobility have to ensure through the integration between technological and social innovation and on the capacity of cities "to create the conditions of a continuous process of learning" (Campbell, 2013).
New mobility agents for innovative mobility solutions (supplementary services, personalized on-demand services, sharing motilities and application of ICT, mobility management and time planning) implies new governance models, in relation to different providers and local and global markets, virtual and physical infrastructure, technologies, and, again, socio-institutional organizations. In this perspective, one aspect is crucial: the centrality of "citizen" (including residents, visitors and city users), business and local authorities as participants in the co-creation of improved quality of travelling and living the city, which are not just users of services, but have a specific and active role in the transition.
This approach wants to combines the previous visions, looking at smart mobility as a system capable of using ICT in an extensive and intelligent way, in order to improve the overall urban performances and, above all, the quality of life of citizens.
Among the main elements that characterize the linked approach to the Smart Mobility, it is the awareness that enhancing through ICT the performance of individual sectors does not necessarily result in the building up of a smart mobility: "a smart mobility should be viewed", indeed, "as an organic whole – as a network, as a linked system. In a smarter mobility system, attention is paid to the connections and not just to the parts" (Neirotti et al., 2014). Furthermore, it is central to consider a smart mobility as the final goal of a virtuous path aimed at improving the quality of life of citizens and based on the involvement of settled communities.

As already stated, the transport sector will radically change – existing companies will have to adapt their services and new entrants will come into the sector using new business ideas to introduce new mobility products and services; citizen will have a more active role thanks to the increasing use of smartphones and data that will empower users to enjoy better services and a better user experience by providing much greater integration across the whole system. It is a historic opportunity to rethink and reinvent government on a more open, transparent and democratic and responsive model (Townsend, 2013). Public authorities are vital in modifying the regulatory framework: by unlocking public databases and building broadband infrastructure. At the same time, bottom up initiatives civic laboratories should be stimulated to test and design local innovations.

Final Thoughts

As described in the previous sections, new 'smart mobility' governance issues are emerging. The study demonstrates also the risks of considering smart mobility from

the narrow 'techno-centric' or 'consumer-centric' viewpoints. Our final thoughts want to emphasize that new smart mobility governance is necessary and it based on innovative combination of social aspects and technologies and involving cross-sectorial processes.

Concerning the vision and the governance goals, the new smarter approach should aim at place making that Smart Mobility has to ensure through the integration between technological and social innovation (Moss Kanter and Litow, 2009) and sustainability (Banister, 2008). The new approach should develop a holistic and system-level perspective on smart sustainable transport system that follows an integrative approach towards complex problems. For urban mobility are then necessary more integrated approaches that would make the best use of technology. Urban transportation requires more than technology and a new cross-disciplinary vision is necessary in order to support planning, transition and implementation of a 'smart mobility' for place making and sustainable urban mobility. The solution should extend beyond technology, but we should still value the indispensable role of it. The vision for the smart mobility of the future should integrate technologies, systems, infrastructures, and capabilities, where this innovation is a means, not an end. The transformation to smart transport system entails interactions of technological components with political, institutional and transitional components.

Concerning the governance aspects, one key element is the interactive and participatory process to commit "citizen" and not just "users" to a "smarter" mobility paradigm. The open and active involvement of people and stakeholders would be far more effective. Thus, broad coalitions should be formed to include specialists, researchers, academics, practitioners, policy makers entrepreneurs and activists in the related areas of technology, transport, land use, urban affairs, environment, public health, ecology, engineering, green modes and public transport. It is only when such coalitions form a real debate that smarter mobility can take place. The emphasis on human infrastructure highlights social learning and education. Accordingly, mobility system should start with people from the human capital side, and smart mobility governance it is about being able to function as an integral part of a larger system that also regards participation, urban and space quality, human capital, education and learning in urban environments (Siegele, 2012). The willingness to change and an acceptance of collective responsibility it is then crucial to create conditions for a continuous process of learning and innovation. Some new paths towards smarter mobility governance should aim at more cross-disciplinary, multi-actors and co-evolutionary approach (Boelens, 2009 and 2010) and at the integration between technological and social innovation. The central aspect of governance is a bottom up approach, with active involvement from every sector of the community: groups of end users, IT experts, policy/service domain experts, and public managers, coalition of business, education, government and individual citizens.

Main actions to make this approach concrete are achievable trough:

- creating the conditions of a continuous process of learning and innovation;
- broad coalitions: specialists, researchers, academics, practitioners, businesses, policy makers and activists in the related areas of technology, transport, land use, urban affairs, environment, public health, ecology, engineering, green modes and public transport;

- integrating smartness, local context, citizens, sustainability in real-life testing and experiential environments (Mobility Living Labs);
- prospective areas for Public-Private-People Partnership (PPPP) for innovative sustainable transport and mobility solutions in urban areas;
- interactive and participatory process to commit "citizen" and not just "users".

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