

Social sustainability and smart mobility : exploring the relationship

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Social Sustainability and Smart Mobility : Exploring the relationship

Hans Jeekel*

Prof. Dr.J.F.Jeekel

Chair Societal Aspects of Smart Mobility
School of Innovation Sciences
Eindhoven University of Technology
P.O.Box 513 5600 MB Eindhoven Netherlands

Abstract

In this article the relationship between two broad concepts will be explored. The first concept is social sustainability, a concept still in discussion. The second concept is smart mobility, a new concept, related to IT- related mobility options and solutions. How social sustainable is smart mobility ? This article offers a clarification of both concepts and of the relationships between the concepts. The conclusion is that whether smart mobility will be social sustainable depends on the route smart mobility will take ; only related to cars, and to higher segments of the fleet, or broader in scope and more related to mobility services.

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* Corresponding author. Tel.:0031651551561.
E-mail address: J.F.Jeekel@tue.nl

1. Introduction

This paper is explorative by nature. The focus is on the relationship between two broader concepts. The first concept is social sustainability. In the Brundtland Report (1987) social issues were considered important in reaching sustainable development. However, 1987 onwards attention for these social issues lagged in the professional and in the academic world behind environmental or ecological issues and behind economic issues. In recent years, more attention is given to social sustainability. The second concept, smart mobility, is newer. Smart mobility, often used in conjunction with smart cities, is still a rather undefined concept. The concept presents the connotation of a more active orientation to mobility problems and solutions than its “elder brother”, sustainable mobility, thus yielding enthusiasm in business circles and with governments.

2. Methodology

How social sustainable is smart mobility? The aim of this paper is to explore some first answers on this question. The existing literature on social sustainability will be assessed in 3. The focus is on concepts being used. In 4. I will elaborate on the ways social sustainability is operationalised in studying the built environment and mobility. Part 5 presents the domains of smart mobility, a concept still in need of a scope. A first scope will be presented related to an article of Papa and Lauwers (2015), but mostly related to the study of websites of 14 organisations active in the field of smart mobility. In 6. the relationships between the themes of social sustainable mobility and the dimensions of smart mobility will be explored. This exploration is a first exercise in this field, and can be considered intuitive in character.

3. Social Sustainability

3.1 The Brundtland Report

Four main dimensions of sustainable development can be derived from the *Brundtland Report* (1987). Sustainable development as explained in this report is about safeguarding long-term ecological sustainability, is about satisfying basic human needs, and is about promoting intra-generational and intergenerational equity [3]. In these four dimensions the social element is clearly represented, via satisfying basic human needs, and via promoting intra-generational equity. The core of argument in the Brundtland report is that without satisfying the basic human needs there can be no sustainability of earth resources. This argument has a rather strong human development and developing countries- bias, as in most developed countries most basic human needs (e.g. food, housing, employment, human rights) are generally met.

Not all basic needs are met for all households in western societies, and the Brundtland Report of the World Commission on Environment and Development WCED also presents an equity perspective. Intra-generational equity should be promoted, at a world level, but also at lower geographical scales. The Brundtland report offers a social agenda, with good communities, human rights, and equity as cornerstones.

As Magis and Shinn (2009) write , within the sustainability community is now commonly accepted that inequity is a main cause of environmental damage [4]. Sustainability requires a concerted focus on the eradication of inequalities. To quote the Brundtland Report : “Physical sustainability cannot be secured unless development policies pay attention to such considerations as changes in access to resources and in the distribution of costs and benefits.” [5] This leads to a further notion ; democracy, as the form of government delivering these circumstances, is needed, and even invaluable to sustainable development. This broadens the social agenda to governance and participation.

3.2 Three pillars or one pillar ?

Operationalising the social agenda from the Brundtland Report has proven to be difficult. In a comprehensive study Littig and Giessler (2005) try to clarify this difficulty. They introduce the concepts “one pillar model” and “ three pillar model”. [6]

The “ one pillar model” gives priority to the ecological dimension. Social aspects, but also economic aspects are helpful, in so far as they help reaching sustainable ecological circumstances worldwide. In the social domain, to reach this objective, more equity worldwide is needed, provision of human rights is needed over the globe, and a more environmentally friendly way of life should be supported. This “one pillar – model”, with important tasks for the social (and also for the economic) domain, seemed dominant in the earlier years of sustainable development.

However, since 2000, at an international level the sustainability discourse started to concentrate on a “three pillar model”. In this model sustainable development should equally try to reach ecological, economic and social goals. As Littig and Giessler write ; “...although the metaphor of the three pillar model is certainly a welcome contribution to a purely ecological definition of sustainability, it can also be criticised in some points” [7] .

The first criticism to this “three pillar model”, also noted by other authors [8] could be that a complete social agenda is being introduced with this pillarization, with a broad focus on creating human rights, good governance worldwide, employment, health, equity within and between generations, an agenda no longer related to ecological objectives. As an example, Mc Kenzie (2004) presents such a broad definition of social sustainability : “social sustainability occurs when the formal and informal processes and structures support the capacity of current and future generations to create healthy, liveable communities” [9] that it becomes difficult to understand where the relation with ecology and environment should be situated, and whether the concept of social sustainability is not moving into the field of desirability instead of the field of sustainability [10].

The second criticism extends this. To quote Littig and Giessler when they address the issue of priorities in the equilibrium between the pillars ; “in fact, the much hailed “win-win” constellations of sustainable development often just provide for ecological and economic objectives , but hardly ever for social gains. The main reasons for this unequal treatment of the three pillars are ...the fact that such equality does not exist in the real world, that economic arguments often tend to be more convincing, and that the equal ranking of priorities is rarely an issue in the political context.” [11]

The third criticism is that in conceptualising social sustainability the difference between an analytical concept and a normative concept should be taken into account. Are we still talking about an analytical concept, related to reaching sustainability, or are we moving into the worlds of ethics and politics?

Bostrom brings in another perspective [12]. He notes that the social sector and the environmental sector have very distinct and separate traditions and are only in recent years starting to learn to know each other. As these different sectors exist, with different traditions and different policy styles, bringing the social aspects into the environmental sector and the environmental aspects into the social sector is not very easy.

3.3 Is sustainability a useful vehicle for researching social aspects related to environment ?

Is sustainable development a useful concept for social scientists, a useful concept for better understanding of the relationships between society and nature? Bostrom (2012) brings this question up and concludes that social sustainability is not the best concept for studying all the complexities in the social – environment relationship, but accepts that the concept has a potential as a frame to assist and to improve sustainability projects [13].

The other way around, much of the work done in the social pillar does not place very much focus on environmental links (Murphy 2012,20) Rather broad definitions are used, for example by McKenzie (2004). Most important issues from such broad definitions seem to be poverty, capacity building and equitable wealth generation. All three themes could be related to ecology and environment but also, and probably more appropriate, to social welfare, health and education policies.

3.4 Four orientations on social sustainability

Vallance, Perkins and Dixon presented in 2011 a broader perspective under the title *What is social sustainability ? A clarification of concepts*. Three different social sustainability orientations were presented. I would like to add a fourth one.

The first orientation is “*development social sustainability*”. This form of sustainability relates directly to the Brundtland Report. The definition most quoted from this report was : “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs ”[14] . Behind this definition, as we have seen in 3.1, a social agenda was sketched, related to emancipating households and families especially in the developing countries. The WCED was in this respect a frontrunner for the modern development paradigm, that reached form and shape in the Millennium objectives. Social sustainability is in this orientation about social development, better distribution of power, better housing, better education, more freedom, more equity worldwide. As Vallance et.al state (2011,343), however, “this raises questions about the extent to which sustainability might be considered relevant to those living in the so- called “First World”.

The second orientation is “*bridge social sustainability*”. In this form of social sustainability the focus is on creating lifestyles and circumstances that make it possible for sustainability to flourish and to blossom. The focus is on eco- friendly behaviour, on environmental ethics, on transforming the relations of

modern households with the environment. There is a non- transformative part in this orientation, with a focus on technology and IT- solutions, as well as a more transformative part, focussing on low- energy lifestyles, without a car – lifestyles, or zero – emission neighbourhoods.

The third orientation is “*maintenance social sustainability*”. Here the focus is on practices that people would like to see maintained. It goes from indigenous rights for the aboriginals, to maintaining existing lifestyles that most households in the developed world would like to continue. Remaining and maintaining existing experienced high qualities of life is the orientation. A central concept in this orientation is “social acceptance”; lots of new visions and insights can be proposed, but acceptance is needed. In this orientation also fits the idea to bring environmental objectives, social objectives and economic objectives on the same level, in balance in three pillars, thus restructuring the original debate on sustainable development from the Brundlandt report.

Looking at the literature, I note a fourth orientation: the “*social sustainability sensu stricto*”. In this orientation the emancipation of the social domain is the core issue, without much connection to other forms of sustainability. Social sustainability in this orientation is seen as creating circumstances of social justice, fairness, equity and cohesion, facilitating that working and thriving communities can be created and sustained. As Cuthill (2009) claims ; “social sustainability is about social justice and equity (on the ethical level), on social infrastructure (on the operational level) and on social capital (on the theoretical level) [15]. With such a description the whole social domain of modern policies in the developed world is included, but we moved rather far away from environment and ecology.

3.5 State of the art on social sustainability.

Where does this leave us ? Social sustainability is still a contested concept, at least at the generic level as discussed here. As Vallance et. al write ; “the many and varied contributions have led to a degree of conceptual chaos” [16] which, in their eyes , did compromise the utility of the concept. Colantonio (2007) on this theme ; “an overview of the main interpretations of social sustainability illustrate how different world views amongst social scientists have thus far prevented an unequivocal and widespread acceptance of the themes at the heart of this notion.” [17]. And Littig and Giessler conclude that a clear theoretical concept of social sustainability is still missing [18].

Probably a platform for dialogue would help, at least on this generic level. The most important issues to solve in such a dialogue, and, hence, most important themes to raise seem to be ;

- Should the concept of social sustainability be supportive to the core objective of reaching environmental or ecological sustainability, or is social sustainability something to strive for in its own right ?
- Should the concept of social sustainability primarily be used in the original developmental context, eventually broadened to the bridge orientation, or is a further moving towards the maintenance orientation acceptable ?

My orientation would be ; social sustainability should be supportive to reaching environmental and ecological sustainability, and the term should primarily be used in the developmental context, and in the bridge orientation. This means that I would not frame the concept in the maintenance orientation, and that I do not support the idea of full balance of the three pillars, and thus not the social sustainability

sensu stricto – orientation. Organising an open dialogue on the concept seems rather urgent, otherwise the concept of social sustainability remains blurred and ambivalent on a generic level.

4. Social sustainability in built environment and mobility

On a generic level the concept of social sustainability seems difficult to define, let alone to quantify. But, as Bostrom assessed : “the concept has potential as a frame to assist and to improve sustainability projects.” [19] On a more sectoral level the concept can easier be operationalized than at the generic level. In this paragraph the use of social sustainability in two sectors will be explored. The first is the use of social sustainability in the built environment, and more specific, in cities and urban areas (4.1). Using social sustainability here creates an appropriate bridge for the use of social sustainability related to mobility and transport (4.2).

4.1 Social sustainability and the built environment.

In the years after the Brundtland Report (1987) the role of cities and urban areas in sustainable development has become more prominent. Megacities did develop, and now the majority of these cities, containing more than 10 million inhabitants, can be found in the developing world. In 2008, for the first time, more than 50 % of the world population were urban dwellers, and this will lead to a projection of almost 70 % urban dwellers in 2030. Especially in the developing world, there is a great challenge to reach sustainability in cities. However, Dempsey et. Al (2009) note that “despite the anthropocentric focus of the definition of sustainability (Hopwood et.al, 2005) surprisingly little attention has been given to the definition of sustainability in built environment disciplines” [20]

Dempsey et.al (2009) tried in two articles (also Bramley et.al, 2006) to define what constitutes urban social sustainability. Their focus was more on the developed world, than on a developmental context. However, with their somewhat smaller focus, not looking at reaching sustainable development in its broadest sense, but more sectoral, their research creates an important bridge towards operationalising social sustainability in transport and mobility.

The authors start with a list of “factors” to be considered in understanding urban social sustainability, built op from a literature research [21].

Table 1 List of factors to be considered in urban social sustainability

| Non-physical factors | Predominantly physical factors |
|---|--|
| <ul style="list-style-type: none"> • Education and training • Social justice: inter- and intra-generational • Participation and local democracy • Health, quality of life and well-being • Social inclusion (and eradication of social exclusion) • Social capital • Community • Safety • Mixed tenure • Fair distribution of income • Social order • Social cohesion • Community cohesion (i.e. cohesion between and among different groups) • Social networks • Social interaction • Sense of community and belonging • Employment • Residential stability (vs turnover) • Active community organizations • Cultural traditions | <ul style="list-style-type: none"> • Urbanity • Attractive public realm • Decent housing • Local environmental quality and amenity • Accessibility (e.g. to local services and facilities/employment/green space) • Sustainable urban design • Neighbourhood • Walkable neighbourhood: pedestrian friendly |

This list of factors is still rather broad, but the authors see two underlying concepts, social equity, and sustainability of community.

Social equity goes back to the Brundtland Report, and relates to intra-generational equity, and partly to basic needs. Bringing the geographical dimension in, social inequity leads to areas of deprivation in cities, with poorer living environments and reduced access to a range of services (of which the authors define key local services [22].

Sustainability of community is a concept based on social inclusion and on social capital. This concept is in their view the umbrella for five dimensions ; social interaction, participation, community stability, pride and sense of place, and safety and security. Sustainability of community is basically about functioning city networks on all geographical levels.

With these two concepts; “social equity” and “sustainability of communities” the relation with the overall objective of sustainable development can be made, and indicators could be found. We seem to leave the rather nebulous world of social sustainability at the generic level !

4.2 Social sustainability in mobility and transport

In the academic world sustainable mobility is a core concept among transport researchers. However, there is, as Holden, Linnerud and Banister (2013) write: “...as of yet no political or scientific agreement on the definition of sustainable passenger transport “ [23]. Holden, Linnerud and Banister see sustainable transport “to include every aspect of transport, which is socially desirable, but it also therefore risks becoming meaningless” [24]. They propose to return to the Brundtland Report, and to start by using the Brundtland - objectives. Out of these objectives they develop the concept of the “sustainable transport space”. That space can be defined in four dimensions;

- Impacts of transport activities must not threaten long-term ecological sustainability

- Basic transport needs should be satisfied
- Intra-generational transport equity should be promoted
- Intergenerational transport equity should be promoted

Social sustainability is mostly related to the second and third dimension. In the second dimension affordability of mobility is a core issue. In the third dimension transport equity means that access to transport should not vary systematically across population groups. Accessibility is here the essential issue.

Whereas Holden, Linnerud and Banister (2013) focus on sustainable mobility on a world scale, Berger et.al (2014) focus in *Sustainable Mobility – Challenges for a Complex Transition* on a somewhat smaller scale. They note that the now existing mobility system in the developed world is unsustainable, as mobility leads to pollution, creates safety problems and takes a big share of the world's energy resources. The current mobility system in Western countries is dominated by the car and by the socio-technological "regime of automobility" [25]. This system now expands over the globe. It will be difficult to change the mobility system as (Berger et. al, 2014) : " the technical aspects of the transport system (vehicles, infrastructures, etc.), the organizational models (e.g. individual car ownership, car and bike sharing, and ticketing schemes), the regulatory framework, the user habits, etc. are all co-evolving. These interactive dynamics create path dependencies which make it difficult to alter the overall direction of the development. Making the mobility system sustainable would require a long-term transition where technical and non-technical developments align in mutually reinforcing processes." [26]

The transition they propose contains three lines ; people can travel more efficiently, they can travel differently, and they can travel less [27]. All three lines could present innovations, however; "travel, in particular everyday travel, is embedded in broader routines and that help people organise their daily lives " [28]. This means that reaching social sustainability in mobility needs to break with these routines and habits.

Smith, Axon and Darton (2013) developed a methodology for measuring the sustainability of car systems. Using the " three pillar – scheme" they present six main themes [29] provision of mobility, access to mobility, mobility service quality, health, safety, and workforce conditions. As the former three are already familiar, the latter three ask for some clarification. Health and safety can be seen as themes related to basic needs, and fit in the social domain. Specific attention to the workforce in the mobility sector can also be related (with some distance) to these basic needs, in terms of realising and maintaining employment and appropriate working conditions.

The European Commission commissioned the SUMMA (Sustainable Mobility, policy Measures and Assessment) -project, as part of its Programme on Competitive and Sustainable Growth. One of the objectives of this project was to operationalize the concept of sustainable mobility. Walker et. al (2006) presented the results of this SUMMA project [30] . Working from the three pillars – scheme, for social outcomes seven outcomes of interest are defined ; accessibility and affordability (here seen as one outcome), safety and security, health, liveability and amenity, equity, social cohesion and working conditions.

From these core articles on structuring sustainability mobility a greater convergence on relevant themes of social sustainability arises than from the generic perspective. Also a convergence with the built environment sector can be noticed.

To conclude seven themes to operationalize social sustainability in mobility arise ;

- affordability of mobility (share of household net income),
- accessibility of key services,
- social equity ,meaning equal entrance to mobility,
- health conditions for households (air quality, noise, amenities),
- safety and security,
- social cohesion (related to the “sustainability of communities”- theme in the built environment sector)
- working conditions in the mobility sector

These seven themes [†] will be central in paragraph 5, where a first assessment on the social sustainability of smart mobility will be presented.

5. Smart Mobility

Smart mobility is a newer concept in mobility that did attract attention in the last decade, especially from enterprises and governments. However, as yet this concept has not completely reached the academic world, as there are only very few hits on Scopus and Google Scholar [‡] relating to smart mobility. The academic world still concentrates its research under the heading of sustainable mobility, whereas at the Internet the former focus on sustainable mobility is being replaced rather fast by the more active looking concept of smart mobility.

But what can be considered the scope of smart mobility ? A web search visiting 14 sites [§] gives a basic orientation on the content of this concept. From the websites of the Technical University Eindhoven,

[†] I left “liveability and amenity” out of this list. This concept is not focussed enough. The concept is for its social aspects included in social cohesion, and is further a more spatial oriented concept.

[‡] In the academic search engines Scopus and Google Scholar (accessed 5-8-2015) I searched for “Smart Mobility”, resulting in only a few hits in Google Scholar (mostly related to ITS themes) and somewhat more in Scopus (mostly related to Smart Cities).

[§] I searched on Internet for the ways different organisations and platforms introduced smart mobility. I accessed all websites on 5-8-2015. The references ;
Eindhoven University of Technology, *InterTraffic Amsterdam*, <http://www.intertraffic.com/intertraffic-amsterdam/smart-mobility/pages/default.aspx> , *The Automotive Platform of the Netherlands*, <http://www.automotivenl.com/nl/topics/smart-mobility> , *City of Amsterdam*, <http://amsterdamsmartcity.com/projects/theme/label/smart-mobility?lang=nl> *Ford* ,<https://media.ford.com/content/fordmedia/fna/us/en/news/2015/01/06/ford-at-ces-announces-smart-mobility-plan.html>, *Toyota* http://www.toyota-global.com/innovation/intelligent_transport_systems/mobility/, *TASS International* <https://www.tassinternational.com/safe-green-smart>, *the World Bank* <http://blogs.worldbank.org/transport/smart-mobility-it-time-re-think-urban-mobility>

Inter Traffic Amsterdam, The Automotive Platform of the Netherlands, the City of Amsterdam, Ford, Toyota, TASS International, the World Bank, Civitas, Fraunhofer Institute, DAS, KTH University Sweden, and TRB (Transport Research Board USA) the following content for smart mobility arises.

- Smart mobility is about vehicle technology. Work is being done on new types of vehicles powered by alternative fuels, on electric mobility, on optimising powertrains, on reaching new levels in car safety, on vehicle fuel efficiency, on autonomous driving, on vehicle dynamics control, and broader on in car systems helping drivers.
- Smart mobility is about ITS, Intelligent Transport Systems. Work is being done on connected cars, on cooperative adaptive cruise control, on intelligent traffic management, on platooning of trucks.
- Smart mobility is about data. Work is being done on real – time passengers and travellers information, on personalized travel assistance, on logistics planning, on IT- systems matching supply and demand for mobility, on big data solutions, often in relation to smart city developments, on security architectures for generated traffic data.
- Smart mobility is about new mobility services. Work is being done on optimal utilisation of existing vehicle and truck capacity, on ridesharing, on car sharing, on new biking systems, on integration of mobility modes, on using smartphones for facilitating mobility demand and ticketing, on on- demand ride services, on the use of individual cars as public transport and broader ; on individual solutions integrated in dynamic transport control systems.

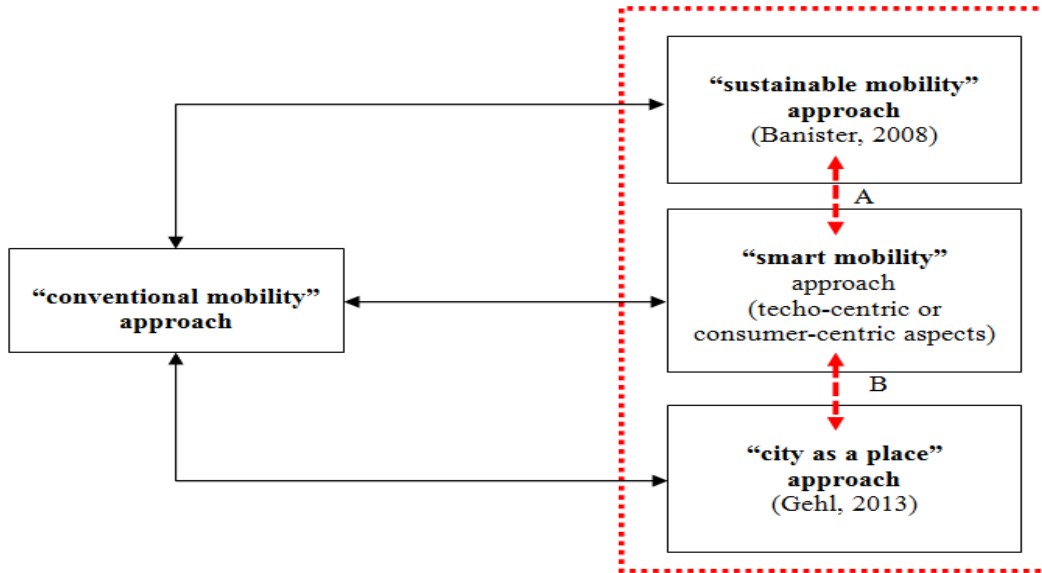
These four dimensions – vehicle technology, ITS, data, new mobility services – define the scope of smart mobility. Smart mobility is user- oriented, technology oriented, mostly car- oriented, IT- oriented, developed world- oriented. And, quite important, smart mobility is action - oriented. Probably here the attraction of smart mobility for governments and enterprises should be situated. Whereas sustainable mobility is related to transition management, to research, to reaching progress in coordinating efforts between three pillars, all with a connotation of long term strategies, with not easy to reach results, smart mobility comes in with smaller, trial and error related, new activities. Sustainable mobility looks fundamental, smart mobility looks pragmatic. Smart mobility could be considered the clever and active small brother of sustainable mobility.

In one of the few academic articles directly related to smart mobility ; *Smart Mobility: Opportunity or Threat to Innovate Places and Cities* (2015), Papa and Lauwers also try to position smart mobility. Their perspective is that ; “smart mobility is sometimes used as an evocative slogan, lacking some

Civitas <http://www.civitas-initiative.eu/content/smart-mobility-city-award>
Fraunhofer Institute https://www.fokus.fraunhofer.de/en/fokus/smart_mobility,
DAS <https://das.fbk.eu/smart-mobility> *KTH University Sweden*
<https://www.kth.se/en/ees/forskning/strategiska-forskningsomraden/intelligentatransportsystem/smart-mobility-lab-1.415239>
TRB (Transport Research Board USA) <http://trid.trb.org/view.aspx?id=1324148>

fundamental connection with other central aspects of mobility planning and governance. “ They note the other forms of mobility planning ; conventional mobility, with essentially a focus on speed, convenience and affordability, and with a “predict and provide”- attitude, sustainable mobility, with a broad and multimodal system , and the “city as a place”- approach where mobility should fit in the creation of attractive, liveable and efficient communities. In a scheme:

Scheme 1 Connections between different mobility approaches [31]



Papa and Lauwers are searching for the relations between smart mobility and these three other forms of mobility planning, and have to conclude that smart mobility is in many cases not related to the more comprehensive objectives of sustainable mobility and quality of city life. They also note a split in smart mobility, with a techno- centric part, related to the supply of mobility, with its core in vehicle technology and ITS, and consumer- centric part, related to the demand for mobility, with its in core in data and new mobility services. The state of art, my conclusion, is that smart mobility, needs to broaden its approaches towards sustainable mobility and towards smart city and city as a place- approaches, to become an active and comprehensive strategy helping to reach sustainable development.

6. Exploring the relationship between social sustainability and smart mobility

In this paragraph a first answer on the question “is smart mobility socially sustainable ? “ will be presented. We will confront the four dimensions of smart mobility, introduced in 5. with the seven themes of socially sustainability related to mobility introduced in 4. This is done in a rather intuitive way, based on experience and professional judgments.

Vehicle technology in smart mobility is helpful in reaching greater fuel efficiency, in reaching greater safety in cars, and thus can be considered positive on health and safety. With a strong focus of this vehicle technology on IT, there is a potential problem with security; cars working as “ Ipads on wheels” can be hacked. Most work in vehicle technology is directed to cars belonging to the highest segments, as

new technologies are still rather expensive. Poorer households cannot afford these newest technologies, so a temporary split can arise between smart cars and non- smart cars, along income dividing lines. Poorer households will not reach an early entrance to the most advanced cars.

Advancing on ITS brings other issues. Connected cars and truck platoons create a possibility to make traffic more cohesive and more coordinated. It will no longer be a complete “free for all”.. Connected cars are supposed to be safer. Security is probably a greater problem than in the Vehicle Technology dimension. First complaints on working conditions for truck drivers in platoons can be heard (less alertness, no appropriate tasks anymore). Also here problems with affordability and social equity could be noted, as the actual situation with driving assistance systems, with adaptive cruise control, and certainly with cooperative cruise control is that only the highest car segments have these technologies, with a rather slow “trickling down”- effect (Planing, 2014) [32]

The data dimension is on real – time passengers and travellers information, on personalized travel assistance, on logistics planning, on IT- systems matching supply and demand for mobility, on big data - solutions, often in relation to smart city developments, on security architectures for generated traffic data. From a viewpoint of social sustainability the central question is whether this work will remain car-based or will be broadened to other forms of mobility. When it remains car -based, car drivers get an advantage with respect to accessibility of key services. They know how to travel, they know when capacities are available. Potentially real time information and personalized travel assistance could be of great help for everybody that needs to be mobile to get access to services.

At this moment the focus of the research is on car- related information; how to utilise capacities *on roads* more optimal? This could lead to higher car densities, and thus to the possibility of more car traffic. Certainly in urban areas this could create health and safety problems. However; real – time information could also lead to better utilization of existing capacities *in cars*, but certainly also in trucks. Social cohesion could win with real-time information. On affordability and social equity the pricing of information services is important ; can these services be bought also with lower incomes. When difficult, personalized travel information is an extra help for the richer part of the (car driving ?) population.

New mobility services like ridesharing, car sharing, new biking systems, integration of mobility modes, using smartphones for facilitating mobility demand and ticketing, and on- demand ride services (for an overview, Deloitte (2015)) are potentially disruptive for now existing arrangements in the taxi world, or for rental and lease companies. Working conditions in these organisations could diminish, debates have started on this issue. However ; there is also the perspective of far less individual car traffic, of far better use of existing car capacities, of an impetus to social cohesion. Accessibility of key services for non – car drivers could grow, however, this seems dependent on the process of ridesharing and on- demand ride services. And on the attractiveness for car drivers to open up their vehicles. Less car traffic, and better used cars, could lead to better scores on health and safety.

Table 2 Relationship between social sustainability and smart mobility, first insights

| Smart mobility dimensions | Vehicle technology | Intelligent Transport Systems | Data and travel information | New mobility services |
|-------------------------------|--|--|-----------------------------|------------------------------------|
| Social sustainability themes | | | | |
| Affordability of mobility | negative | negative | unclear | Depends on price |
| Accessibility of key services | | | | positive |
| Social equity | negative | negative | unclear | positive |
| Health conditions | positive | | | positive |
| Safety , security | Positive on safety, negative on security | Positive on safety, negative on security | | positive |
| Social cohesion | | positive | positive | positive |
| Working conditions | | Negative for part of truck drivers | | Negative for existing arrangements |

From this first assessment a mixed picture on the relationship between social sustainability and smart mobility arises. The smart mobility options could be used for optimising the actual regime on car mobility – more comfortable cars, better coordinated traffic, greater densities possible on our roads. But the smart mobility solutions could also lead to a substantial contribution to sustainable mobility – environmental cleaner and safer cars, more drive-sharing via real time travel information and apps.

In this respect, the most important questions seem to be ;

- 1. Will the focus on creating technology for basically the highest car segments remain ? When yes, smart mobility will be - certainly temporarily- “toys for the richer boys”, and the divide in the car fleet will be broadened, with disadvantages on social equity
- 2. Will personalized travel information be offered and made available for all types of “mobilists”, or will it remain a service for car drivers only ? In this last situation the buyers of this personalized information will get an “accessibility profit”, with disadvantages on social equity
- 3. On new mobility services ; will the possibility to reach far greater mobility capacity in existing trucks and cars, via ridesharing, via on demand ride services, be picked up, or even made obligatory ? When not, this remains a nice narrative to sell new car technologies. When yes ; we will reach a new paradigm, with cars as public transport, with less trucks on the road, and with advantages on safety, health and social cohesion.

Especially this last question opens an interesting debate ; when society does get the possibility, via IT applications, to use trucks and cars to their full capacities, with great advantages on health, safety, space in urban areas and social cohesion, should this possibility just be left to individual decisions of car drivers and truck companies, or should it be made obligatory?

7. Some preliminary conclusions

From a perspective of social sustainability, smart mobility could develop along two basically different scenarios.

The first scenario is that cars will become so attractive , with easier use, and with more advantages for car drivers via personalized information, that more cars will be bought, and that sprawl will be encouraged. This scenario scores negative on social cohesion, on equity, and on accessibility of key services. Non car drivers will get disadvantages, and problems with scarcities in space (parking, driving in urban areas) will grow.

The second scenario is that with new technologies, it will become easier to share cars, to utilise their full capacity with ride sharing and on demand rides, meaning that cars can become part of the full spectrum of mobility options, with far less cars needed. This scenario scores negative on those working in the transport sector, but positive on social cohesion, equity and accessibility.

It could be expected that health and safety conditions will be better than nowadays in both scenarios, while affordability will be at least a temporarily problem for the next decade, with poorer households initially not being able to buy the smarter cars.

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