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Stakeholder involvement in decision-making process: a test assessment towards transition to autonomous vehicles

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Abstract

Diverse stakeholder participation in transport planning is beneficial but difficult to achieve, as it deals with various levels of government, operators, users, and other interested parties. Furthermore, such planning is confined by issues of geography, economics and human demand, and in the case of transport it must integrate with other territorial constraints.

The authors had an opportunity to carry out an accompanying research while municipalities or regional agencies establish a widened stakeholder involvement framework for municipalities including their surrounding ones, known as Functional Urban Area (FUA). In this process, aiming at optimizing commuter traffic, participating institutions are trying to set up a coordinating structure among various stakeholder in each FUA. To optimize the commuter traffic, a various new types of mobility services are considered as potential implementations such as ride sharing, car sharing, bike sharing, etc., as well as classical types of transport services such as public transport.

In this paper, we present what kind of role each stakeholder can play for different types of measures towards environment-friendly commuter traffic. Following this, we present an assessment about how it may change along with the penetration of higher-level autonomous vehicles (AVs). It will add some extra roles to public authorities compared to today, especially as regulators and financers. Stakeholder involvement to address questions arising with the penetration of AVs onto the street will have to be carried out in a step-wise manner, starting with those having with endogenous motivation for sustainable mobility, and then being extended to further stakeholders.

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Keywords: stakeholder involvement; commuter mobility; autonomous vehicle;

1. Introduction

For a successful implementation of policy instruments towards sustainable mobility, involvement of various stakeholders in the decision-making processes is essential. An appropriate stakeholder involvement in traditional types of transport-related projects ensures transparent decision-making and probable successful implementation. The same will apply to a wide range of questions that arises along with technological development of autonomous vehicles (AVs). Besides traditional types of questions, new ones will arise along with advanced technological levels of AVs, such as in which part of the city the fully automatic (driverless) vehicles should be allowed, how the "empty" driving should be regulated, how the shared use of AVs should be organized in the city, and so on.

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As discussed later, small and medium-sized cities are one of the vulnerable places when currently envisaged technological advancement in AVs will bring them on the road because of high levels of motorization, less regulation in parking, high levels of available infrastructural capacity which does not call for strict management of vehicular traffic, and so on. On the other hand, small and medium-sized cities are where the potential of autonomous vehicle can be well deployed if they are used to organize a small-scale public transport, which would not be affordable with human-operated vehicles.

The authors had an opportunity to carry out an accompanying research in an EU-funded real-world project aiming at establishing coordinating platform among various stakeholders towards sustainable commuter mobility in small and medium-sized cities in Central Europe. In this project, a common list of real-world measures that can be applied by project participants to make their commuter mobility sustainable are prepared with information about potential stakeholders that have to be involved in. Making use of this list of real-world measures, we carried out a first assessment about how the stakeholders themselves or the roles of the stakeholders will change when AVs are readily available. Based on this, we discuss how the stakeholder involvement should be organized along with transitions of vehicular traffic towards autonomous vehicle.

This paper is structured as follows. After an extensive literature review in Section 2, we will explain the context of the real-world project we accompanied in Section 3. In the same section, a short discussion about particularity of these small cities is presented. In Section 4, a summary of the 25 common measures listed for the real-world project, as well as potential roles of four types of stakeholders in the current circumstances are presented. In Section 5, we discuss which measures will be affected by AVs, and how the current potential roles of stakeholders will change when technological advancement will bring autonomous vehicles into the transport system. In Section 6, conclusions are presented.

2. Literature Review

The Oxford English Dictionary defines the term "*stakeholder*" as "*any person or group that has an interest or concern in something*" – in the context of transport planning, stakeholder participation is called for to design a transport system or infrastructure, including roads, public transport, bridges, cycle lanes, footpaths and so on in urban or suburban premises, and also to the organizations and rules that govern their use.

According to Freeman (1984), a stakeholder is by definition any individual (or group of individuals) that can influence (or are influenced) by the achievement of the organization's objectives. However, it is a very general definition, valid in any field or sector. A more specific definition referring to the transport field is the one provided by Banville et al. (1998): stakeholders are defined as those people who have a vested interest in a transport problem by affecting it or/and being affected by it.

Li et al. (2012) define stakeholders as groups formed by those people who can potentially affect the project process, who have positive and negative impacts on their living environment and have direct benefits and/or losses from the project implementation.

Recently, the decision-making process in the transport sector aims to identify the best solutions involving a collaborative planning approach. From this point of view, the stakeholders' involvement in the decision support process is necessary to consider all different aspects of the often-complex decision issues. The subjective judgment, the point of view and the needs of stakeholders have to be taken into consideration when an intervention must be carried out within the transport system. In fact, each intervention can bring advantages in some parts of the territory or for some stakeholders and disadvantages for others. Therefore, the solution must be the one that almost completely satisfies all the actors involved in the planning process and that causes less internal and external costs. It is true that a good transport policy must take into account the opinions of people who have interests, but it is also true that the success of politics depends on the acceptance of all the stakeholders. Any conflict, which arises among stakeholders, takes time and can cause a delay in the decision-making process. This makes the related negotiations and implementations very difficult.

In any case, it is always necessary to look for a comparison between the various stakeholders according to benchmarking. Benchmarking is a continuous process of comparison, review and search for best and better practice in decision-making. One of the main phases of the process is to understand who the stakeholders are. They can be different and have conflicting goals. They can be governments, planners, politicians, municipalities, private or public companies, citizens, transport operator, public and private organizations (authorities, universities, chambers, associations, enterprises, etc.), and so on. Stakeholders can be grouped into primary and key stakeholders. Primary stakeholders are often people with a high stake but a low influence, while key stakeholders are organizations or individuals with a strong power position and major influence due to their political responsibility, financial resources, authority, skills and/or expertise (Taschner and Matthias, 2009). Kelly et al. (2004) group stakeholders into three broad categories: government/authorities (ministry of transport, other national ministry, national parliament, politicians, local authorities, provinces, municipality), businesses/operators (transport operator, transport provider, private financier, national business associations, retailer, major employers) and communities/local neighborhoods (environment associations, transport users associations, media, transport users, citizens).

According to Walker (2002), if some stakeholders are not invited in the transport planning process and they have interests of any kind, the study or analysis will be ignored by policymakers or be attacked by the stakeholders. Therefore, it is necessary to pay attention to consider all the actors involved in order to reach the best solution.

In addition, the level of participation in the development process of transport policy depends on the resources and time devoted to the project, as it takes time and money to involve the stakeholders in the process. Also, not all stakeholders will be able or ready to participate in the policy analysis process and their participation might not even always be desired by the

analyst/planner. On the other hand, when the planner does not have the necessary knowledge about context or if the problem is inadequately deifned, the participation of the stakeholders is, however, necessary because the decision cannot be guaranteed by the analyst/planner alone (Macharis, 2005).

According to the literature on the subject, the diverse stakeholder participation in transport planning is beneficial but difficult to achieve, as it deals with various levels of government and stakeholders. Furthermore, issues of geography, economics and human demand confine such planning, and in the case of transport, it must integrate with other territorial constraints. Engineers and planners, and those they consult with, may have a considerable degree of choice as to how to solve a planning problem, and to verify that the planning taken is appropriate in terms of both technical and economic feasibility. Critics of stakeholder inclusion generally argue that enlarging the participation would make the planning process more expensive and potentially inconclusive (Ward, 2001).

The failure of many projects, due to lack of consensus building, led to include the stakeholders in the transportation strategy-making.

Several studies agree that stakeholder engagement is emerging as an essential element in the establishment of efficient transportation decisions. Kørnøv et al. (2000) claim that gathering of rich information from a variety of stakeholders characterized by different backgrounds, perspectives, and levels of experience results in a process characterized by rationality and intuition. They want to underline that, interacting, the decision-makers enter into decision situations with knowledge in order to determine the value of the possible consequences of an action and develop a set of alternative actions to select the optimal alternative that is expected to best achieve one's goals or objectives. Atkin et al. (2008) claim that it is inevitable to identify and analyze the concerns of stakeholders in projects during the participation process as to reach a consensus on project process and to avoid project disputes and failures. Tam et al. (2009) argue that when project stakeholders take part in different stages of projects, several benefits can be gained. The authors use a technique of conflict analysis to investigate the possible conflicts and alliance between interest groups in order to avoid opinion domination by those groups that generate the loudest noise in the process of urban planning. Their work demonstrates that the technique used helps collect public opinions more accurately that can represent the public interest in the selection of the best development and design scheme for the territory, which would not be corrupted by the "dominating opinions."

According to La Pira et al. (2013) the social interaction, between people that have a common interest, is a key of success in transport planning because it fosters the emergence of coalitions among stakeholders towards a shared solution. Also, it can help to understand how to make a good involvement process and can be helpful to make the planning process transparent, effective and cost-efficient.

The common idea among all the authors is that interaction among stakeholders is fundamental for the success of the participation process because it allows reaching more shared decisions and increases the degree of consensus of the collective decision. This interaction must be present at all stages/levels of transport decision-making process. In fact, different levels can be identified in the stakeholders' engagement process. Therefore, the decision-making process can be seen as a hierarchical process. According to the studies of Varvasovsky and Brugha (2000), the three steps of stakeholder analysis are: 1) identifying stakeholders and their interests, 2) analyzing their relationships, and 3) assessing their influences. Edelenbos and Monnikhof (2001) define five level of participation: "Informing" in which stakeholders are only informed about planned process by decision makers, but cannot influence it; "Consultation" in which decision makers seek discussion with stakeholders, the results, however, don't consist of any commitment from the official side; "Advise" in which stakeholders may develop solutions and report problems to decision makers. The decision makers will consider their input - however, they still are expected to hold the final decision; "Co-produce" in which decision makers and stakeholders jointly agree on issues to be solved and adequate solutions. The decision makers commit themselves to these solutions; "Co-decide" in which decision making bodies leave the policy planning to the citizens and only keep an advisory role. The results, however, need to be in line with certain preconditions (policy framework).

Kelly et al. (2005) identify five levels of stakeholder engagement: stakeholder identification; collecting information about stakeholder expectations, requests and concerns; obtaining general feedback on transport proposals; consultation in which decision-makers listen to the different points of view of the selected stakeholders on the proposed project; participation in which stakeholders become joint partners of the project choice and in the project implementation. Based on this study, Hail et al. (2017) suggest a transportation strategy developing process to help transportation managers in making the appropriate transportation strategy in a more participative way. The authors highlight the role of stakeholder engagement in achieving a successful and efficient transportation strategy at each level. They propose four stage. The identification of transportation strategy, the deliverables to achieve, and the stakeholder identification belong to the first phase. In the second stage, there is the generation of the transportation strategy options that can be evaluated through technical or statistical analysis in order to find the best alternative that satisfies all the stakeholders. In the third stage, the stakeholders have to use the necessary resources to determine the best solution. In the last stage, there is an evaluation of the outputs obtained from the implemented alternative in order to determine whether the objectives have been met. Also according to Erkul et al. (2016) the transport decision-making process, for mega transport infrastructure projects, is extremely difficult and it need to be divided into four phases. The authors claim that stakeholders and their interests have been identified, stakeholders' relationships have been analyzed, stakeholders' influence have been assessed, and stakeholder engagement have been practiced throughout the project lifecycle. They propose a model of framework to provide new perspectives to identifying the precise interrelationships between the stakeholder engagement and to

facilitate the complex processes and guide senior management in meeting project objectives. The first phase aims to determine who your project stakeholders are and their key groupings and sub-groupings. The second phase concerns the stakeholder analysis in which collective interests are looked into thoroughly, and it is analyzed how they will be influenced and to what extent they will influence your project. The basis of the transport strategy will be formed from the answers given to the questions. In this phase continuous consultation is necessary.

These studies agree in supporting that once stakeholders have been identified, it is then important to establish how and when they should become a part of the transport decision-making process.

According to Lowndes et al. (2001), the readiest form of public participation has been identified as public meetings. However, it is less common for the developer or its representatives to systematically canvass the locals' experiences, knowledge and suspicions of policies impact using less traditional techniques such as focus groups, issue forums, citizen panels and questionnaires (Bickerstaff and Walker, 2001). Public participation can also be ensured through written submission. Written submissions or comments as a response on transport policy rank as one of the most common forms of public participation. Antonson (2014) has compared 34 written submissions with road planning documents: the impact of the public views has been analyzed in a south Swedish case study. He found that Road Administration's regional office accepted most of the written submissions. This study has shown that, if properly managed by personnel directly in charge of policy-making at each stage, the use of written submissions may improve the road planning policies from a stakeholder perspective and also make the stakeholders feel they are being taken seriously. In this way, stakeholders have a role more interactive than only providing information. The aim of the consultation is to take into account the stakeholder views in making the decision on the issue being considered. The responsibility for the decision, however, still remains with the local authorities (Batheram et al., 2005). The idea is that participation can greatly assist local authorities in developing and delivering successful local transport plans but careful thought must be given to choosing the most appropriate technique. According to Macharis (2005), five commonly used evaluation methods can be identified: private investment analysis, cost-effectiveness analysis (CEA), economic-effects analysis (EEA), social cost-benefit analysis (SCBA) and multi-criteria decision analysis (MCDA).

Despite involving stakeholders is very important, in the transport decision-making there are several issues linked to stakeholder management. Yang et al. (2009) report some problems provided by different authors like the inadequate engagement of stakeholders, project managers having unclear objectives of stakeholder management, difficulty to identify the "invisible" stakeholder and inadequate communication with stakeholders. According to Cleland and Ireland (2002), in order to reduce and remove these problems, the project teams and decision makers have to know whether or not it is successfully "managing" the project stakeholders. To know it, they suggest using a "Critical Success Factors" approach that includes activities and practices that should be addressed in order to ensure effective management of stakeholders. Only a good stakeholder management can ensure an efficient transport infrastructure or transport policy.

3. Research context and particularity of small cities

3.1. Research context

As briefly mentioned before, we carried out accompanying research within an EU-funded project named Smart Commuting (hereafter referred to as the project). In this project, 4 municipalities and 3 regional development agencies covering 7 cities from central European countries (hereafter referred to as participating institutions) participate to set up some cooperation platforms in their functional urban areas. Table 1 shows the cities of the participating institutions involved in the project. The aim is, commonly among all participating institutions, to optimize the commuter traffic by shifting them towards environment-friendly modes of transport i.e. walking, cycling, public transport, ride-sharing, and so on.

A functional urban area (FUA) is defined as a city and its commuting zones. Several definition methodologies have been proposed: for example, OECD (2013) proposes a three-step statistical methodology starting with an identification of high-density population cluster by clustering contiguous grids with more than 1,500 inhabitants per square-kilometer (more than 1,000 for the US and Canada) to identify urban cores. If more than 15% of population in a cluster commutes to another non-contiguous high-density cluster, these are grouped into one cluster only. Finally adding worker catchment area where more 15% of working-age inhabitants commute to the urban core. European commission adopts the same methodology (Dijkstra and Poelman, 2017). Similarly, Roca and Moix (2005) proposes a usage of the interaction value between municipalities, calculated as the percentage of commuters from a municipality (Municipality A) to another (Municipality B) multiplied by the percentage of workers in Municipality B commuting from Municipality A, adding the same indicators to the reverse direction to this. In both cases, functional urban areas are defined as a set of an urban core and its surrounding worker catchment area.

Due to the limitation in availability of statistics from the participating institutions' territories, functional urban areas in the project was not defined in such a precise manner as proposed by OECD. Rather, the definition of functional urban areas was done in an empirical manner by each participating municipalities and regional developing agencies. This way is not as precise as the one proposed by OECD (2013) or by Roca and Moix (2005); however, from practical points of view, this is supposed to be a good substitution to identify commuter catchment areas.

In table 1, the populations of the core cities in each of participating functional urban area are summarized. As seen from the table, the participating institutions' core cities and functional urban areas are small, in a scale of a few hundred thousand

inhabitants at most. The participating institution with the largest number of inhabitants is Rimini (about 149,000 people) while the city with fewer inhabitants is Weiz (less than ten thousand people). As seen in the table, the project involved different types of small and medium-sized cities.

Table 1. Size of the participating cities

City	Country	Population
Rimini*	Italy	148,908
Koper**	Slovenia	51,794
Velenje**	Slovenia	32,802
Hranice na Morave***	Czech Republic	20,960
Zadar****	Croatia	75,062
Weiz*****	Austria	12,285
Szolnok******	Hungary	71,765

* Year 2016; Source: Istituto Nazionale di Statistica [Online: 05.08.2018] https://www.istat.it

** Year 2017; Source: Statistical Office of the Republic of Slovenia [Online: 05.08.2018] http://www.stat.si

*** Year 2017; Source: Czech Statistical Office [Online: 05.08.2018] https://www.czso.cz

**** Year 2011; Source: Croatian Bureau of Statistics [Online: 05.08.2018] https://www.dzs.hr

***** Year 2016; Source: City of Weiz [Online: 05.08.2018] http://www.weiz.at

****** Year 2017; Source: Hungarian Central Statistical Office [Online: 05.08.2018] https://www.ksh.hu

3.2. Particularity of participating small cities and their functional urban areas

The participating cities and their stakeholders were asked to complete a questionnaire to collect data and information about commuting in their FUA. Each questionnaire was tailor-made for the four institutional stakeholders as explained later in this paper: public authorities, employers and schools, infrastructure and service providers and interest groups (Nocera et. al., 2017). With contributions from the participating institutions, we collected various information about their territories, spatial structures, and available transport infrastructure and services. By analyzing them in a form of a workshop together with the participating institutions, the following common particularities among the 7 participating institutions are summarized.

- Information availability about mobility behavior is not often comprehensive. Survey data is often in lack on one hand, while there are not much financial and human resources available for regular surveys.
- Spatial structure:
    - The city center has a historic character, and it is within a walkable distance, within an approximately 500m radius;
    - Much of the suburban area within the core city is often within approximately 5km from the city center, thus having some potential for cycling.
    - Industrial areas are located in the outside of city center, and these attracts a large number of commuters;
    - The city center or industrial zones attracts many commuters from villages and settlements nearby within the FUA.
    - The city serves often as school centers, with a few secondary schools attracting pupils from each FUA.
    - In some particular case, a few similar-sized cities makes a small conurbation.
- Automobile traffic and infrastructure:
    - Modal share of car tend to be high (estimated up to c.a. 80%).
    - Motorization rate (car ownership per capita) is higher than large cities;
    - Parking is less regulated, or not regulated at all. Parking price is often set to a low level in the city centre, or the users are not charged for it.
- Public transport:
    - Railway usually serves the core city and a few municipalities along railway lines, but it is usually a part of national or regional network. The infrastructure is often managed by national-level Infrastructure Manager (IM), while the regional passenger service is planned by national or regional authorities. Other types of rail-based urban public transport do not exist.
    - In case the city is located along a main railway line that serves as a backbone of a national railway network, priorities are often set to long-distance trains, and regional trains that serve for travels within the FUA are an integral part of regional network covering areas beyond FUAs.
    - Urban bus network is often available, while frequency is often low (e.g. 1 or 2 services per hour).
    - Similarly to regional railway services, regional buses sometimes serve also as urban transport.

Of note, these common particularities are more or less common to many of European cities and functional urban areas in a similar size.

4. Identification of potential stakeholders and their roles in sustainable mobility

4.1. Types of potential stakeholders

As mentioned in the introduction and as seen in the literature review, the interaction with the stakeholders is an important success factor to implement any kind of measures in transport and mobility. It is important to ensure the involvement of stakeholders from the beginning, both in terms of building a common vision and for successful implementation of various measures that help cities shift the modal share for sustainable mobility.

Based on the general grouping by Kelly et. al. (2004), and with the aforementioned particularities of the participating institution's FUAs and the main focus of the project on commuter traffic taken into consideration, the following five types of institutional stakeholders are identified in the project. These are identified as ones that are potentially involved in vision-making process as well as in implementations of various measures, as well as the general public:

- Public authorities (Group PA);
- Infrastructure and service providers (Group ISP);
- Large employers and schools (Group ES);
- Interest groups, NGOs, business support organizations (Group IG);
- General public (Group GP).

4.1.1. Public authorities (Group PA)

This refers mostly to municipalities and agencies directly settled under them. Regional and national authorities and agencies are not excluded depending on competence of each government for particular administrative domains: for example, in some countries, urban trunk roads are managed by regional or national authorities. In many cases, regional railway is managed by regional-level or national-level authority rather than by the municipalities – this is another example of such cases. (e.g. Shibayama et. al. 2017)

4.1.2. Infrastructure and service providers (Group ISP)

This refers to companies, either private or government-owned, owning and maintaining infrastructures or providing transport services to the end users. This includes companies such as railway infrastructure managers and operators, bus operators, car-sharing operators, bike-sharing operators, taxi companies, app providers, and so on. (e.g. Shibayama et. al. 2017, Shibayama 2011)

4.1.3. Large employers and schools (Group ES)

These organizations are main generators of commuter traffics, and thus they have a particular influence in it. Their locations, industry types, working hours, shift operation, subsidies to commuters (e.g. overtaking costs of public transport tickets), facilities for employees and pupils (e.g. employee parking), employee structures (age, income level, migrants), etc. all impacts on their commuter traffic. In case of the employer having lots of individual customers such as a shopping mall, the range of them affects the customers' traffic, too. (Lemmerer et. al. 2015)

This group of the stakeholders can take their initiatives to enable or encourage their employees, pupils or students to use sustainable means of transport for commuting by slightly adjusting their working routines, shift hours, or implementing some facilities e.g. bicycle parking. Particularly in case of primary and secondary schools, they are a key stakeholder to encourage parents not to drop off their children by car at schools. It has to be noted, however, that the commuter traffic and their employees' mobility are often their secondary concerns on their daily businesses, and thus these organizations may be reluctant. (e.g. Lemmer et.al. 2015, Macoun et.al. 2015)

4.1.4. Interest groups, NGOs, business support organizations (Group IG)

Interest groups and NGOs are highly motivated stakeholders having strong interests in sustainable mobility. Such organizations sometimes can provide their expertise to the others in various forms such as advisory, planning, organization of advocating events, media relations, and so on. Business support organizations is meant for ones such as chambers of commerce and associations of certain industries. This group can play their role as advocator for various industries (thus to Group ES), as well as potential advisor to them.

4.1.5. General public (Group GP)

General public, including inhabitants and commuters, are important stakeholders in any of the publicly organized process. In the context of the project's aim to establish a cooperation platform among the institutional stakeholders, the roll of the general public is limited. Nevertheless, they need to be well informed and involved as taxpayers, commuters, electorate, and so on. Their knowledge of territorial/transport problems can lead to the identification of optimal intervention strategies.

4.2. Roles of institutional stakeholders in vision building and strategic spatial and transport planning

Among the 5 stakeholder groups listed above, four groups, namely public authorities, infrastructure and service providers, large employers and schools, and interest groups, NGOs, and business support organizations, are institutional stakeholders, while the last group, namely general public, is an individual stakeholder. The role between institutional and individual stakeholders are largely different in that the institutional stakeholders play practical roles to implement any kind of measures, while individual stakeholders play their role as taxpayers, electorates, inhabitants nearby, and potential users. In line with the context of the project, analyses and discussion below focus on the institutional stakeholders.

The involvement of institutional stakeholders takes place in two different ways: on one hand, as seen much from the literature review, they have to be involved in vision-building and decision-making process in planning, where they are financing bodies (Role F), implementing bodies (Role I), promoters (Role P), bodies supporting other stakeholders by offering technical advisory and/or assistance (Role T), or play other types of role as explained in the next section.

Roles in vision building and decision-making are often organized as joint processes among all of the stakeholders. Various methodologies can be employed, such as public discussions, conferences of mayors and stakeholders, study trips, making a common vision document, and so on (Bork et. al. 2017).

Characteristics of each group's interests and potential roles in vision building and in strategic spatial and transport planning is summarized in .

Table 2. Characteristics of each institutional stakeholder

Group Code	Interest in environment-friendly commuter traffic	Potential roles in vision building and strategic spatial and transport planning
PA	Endogenous	Initiator and promoter for vision building; principal institutions in charge of strategic spatial and transport planning; potential future implementing body;
ISP	Varies depending on circumstances	Potential future implementing body;
ES	Secondary interest at most	Potential future implementing body;
IG	Endogenous among some of them	Initiator and promoter for vision building; offering expertise in mobility;

Public authorities (Group PA) generally have endogenous motivations for environment-friendly commuter traffic. This group potentially can be an initiator and promoter during the phase of vision building. As for strategic spatial and transport planning, public authorities are the principal institution in charge of them, and thus they are expected to play proactive roles for this by preparing and regularly revising them. Adoption of them in municipal council is closely associated to the municipal administration. Moreover, as seen in the next subsection, for various measure this group will be an implementing body. Therefore, commitments from Group PA is very essential in these phases.

Interest of infrastructure and service providers (Group ISP) in environment-friendly commuter traffic depends much on their circumstances. Generally, this group, especially train and public transport operators, is assumed to have an interest in better energy efficiency or alike, leading lower operational cost. However, environment-friendliness in the context of the project is rather an issue among different transport modes such as walking, biking, public transport and automobiles. Modal shift to the public transport can be an interest of public transport and train operators if load factors are too low or additional passengers brings about more financial profit to them, provided that the service offered is of good quality and has costs comparable to the automobile (Nocera, 2010). In case of elasticity not having extreme values, there may be interest in reducing congestions or delays caused by congestions in case the load factor of their services in peak and off-peak hours are too uneven (Libardo and Nocera, 2008). At large, interests of this group are variable depending on the circumstances each of them has. Nevertheless, in the implementation, this group plays very important roles with transport infrastructures and services as their core business, and thus being main implementing bodies (Role I). Therefore, their involvement is essential to establish a common vision so that necessary measures can be implemented with less institutional barriers.

Environment-friendliness and sustainability in commuter mobility is in the domain of public interests rather than private company's typical interests. Commuter traffics take place in the outside of the employer's premises. It is also in the outside of working hours, when employers have to bear the personnel cost. Generally, employers do not have endogenous motivation to make commuter traffic sustainable, as they do not feel benefit out of it. Schools might be an exception, because they have clear peak hours for pupils coming there and going home, and teachers may have some public interests. In any case, the interest in environment-friendliness in commuter mobility is, for the Group ES, their secondary business at most. However, this is a very important group as this has a strong influence as the generator of commuter traffic. Some measures are potentially implemented by this type of stakeholder. Thus, involvement of this stakeholder group is essential even at an early phase to have a common vision in order to enable this stakeholder with strong impacts in commuter traffic to act proactively.

Interest groups and NGOs, by their nature, have endogenous interest in sustainable mobility, while their competence to implement measures is often limited. This type of stakeholder however tend to have a specialized expertise in sustainable mobility, and thus can provide their knowledge to the other stakeholder groups. During vision building and strategic spatial and

transport planning, this group can be an initiator and/or promoter of sustainable mobility. In addition to this, this group can be non-profit actor e.g. by undertaking promotional campaign. The last point is common to business support organizations (e.g. Chamber of Commerce).

4.3. Roles of institutional stakeholders in implementation of measures

In the phase of implementing any kind of measures, the role of each stakeholder varies from a measure to another, with stakeholders playing potentially different roles in the implementation of different measures. For example, a municipality is often an implementing body for road infrastructures for cyclists, while the same organization becomes a regulator for land use around public transport stops while developments of such lands are undertaken by other types of stakeholders such as land owners or real-estate developers.

The authors identified five different types of roles as summarized in the Table 3 below.

Table 3. Classification of roles

Role Code	Role	Description
F	Financer	A stakeholder subsidizes to another stakeholder, either by giving a financial subsidy as an incentive or by bearing the investment cost.
R	Regulator	A stakeholder regulate rules, land use plans, etc.
I	Implementing body	A stakeholder implements a measure as a part of its own business.
P	Promoter	A stakeholder serves itself as a promoter for other stakeholders or for the general public.
T	Technical assistance and advisory	A stakeholder offers its expertise to another in a form of advisory, or it provides any ready-made tool e.g. an online reservation tool.

Roles of each stakeholder type are different from one measure to another. To analyze potential roles, we make use a set of 25 different types of measures that were selected in the project, and assessed what types of role each stakeholder may play. The 25 measures are summarized in Table 4. (Franchini et. al. 2018).

Table 4. Measures used for assessment of roles of different stakeholders

ID	Measure	Description
1	Incentive apps for cycling	An app to record cycled track with smartphone's geolocation information and other sensors. A competition or awarding can be made as an incentive when data is gathered centrally.
2	Roof-covered bicycle parking (and subsidizing it)	Placement of roof above the bicycle parking, with proper bicycle racks, will increase the security of the bike parking. When this is at a public transport node e.g. at train stations, the people can use the bicycle as a feeder mode to the public transport, and thus increase the catchment area of the public transport.
3	Roof + bench at bus/tram stop	A combination of these increases the comfort of public transport in terms of weather protection, making public transport more attractive and thus chance of it being chosen higher.
4	Making access routes to public transport (PT) stops / stations pedestrian-friendly	Any trip with public transport is by its nature inter-modal, with access and egress often on foot. Thus making the access route to/from PT stops and stations will increase the chance of public transport being chosen.
5	Backside exit of railway station	An extra exit to the platform to increase catchment areas of a railway station.
6	New train station / bus / tram stop	An extra point to increase catchment areas of the public transport.
7	Car-sharing (Car Club), non-profit	While for-profit car-sharing works only in large cities, non-profit (cost-covering) car-sharing can work elsewhere.
8	Bike-sharing (fixed-station)	Shared bikes with unstaffed fixed-stations allowing one-way rental of a bicycles.
9	Ride-sharing (Car-pooling)	A digital or communal platform to match drivers and potential passengers to share a vehicle ride.
10	EV-charging spots	Placement of EV charging stations.
11	Regular exchange of information with outside	Mutual learning between municipalities, companies, regions, etc. about good practices and latest developments in transport technology and planning methodology.
12	Awareness raising in health and active mobility	Marketing of walking and cycling to make it visible as car companies do for driving.
13	Mobility education at School	For children it is important to make them understand the importance of sustainable transport in relation to what children learn in school. Such program can be embedded in "regular" teaching at the school for different ages.

ID	Measure	Description
14	Participatory process for strategy-building	Participation of citizens and stakeholder for long-term strategies will create the feeling of "ownership" of such document.
15	One-stop mobility service point	One-stop service point offering information and tickets for public transport, shared mobility, cycling and walking, etc.
16	Mobility information portal (web, app)	An online version of the one-stop mobility service point.
17	Bicycle parking and shower at companies/schools	A measure to enable cycling in hot summer when cyclists want to refresh after sweating.
18	Bicycle pump / repairing tools	A quick repair at work or in the public space is enabled.
19	Incentives for / Introduction of teleworking	Even one-day-a-week teleworking reduces commuter traffic of an employee by 20%. Cumulatively this will help reducing commuter traffic in FUA.
20	Introduction / regular revision of mobility management plan of company	Company's mobility management plan sets visions, prioritized activity areas and measures to realize sustainable commuter and customer mobility.
21	Coordinating shift-working-hours and PT timetable	Rail and bus timetables are adjusted so that the commuter can use PT.
22	Ride-sharing portal for employees	Company's or regional portal to match driver and passenger to share a ride to commute.
23	School bus / commuter bus	School or commuter bus can be organized jointly among companies or together with public transport.
24	Incentives for electric vehicles	This helps an energy resource transformation from fossil fuels to renewable energies.
25	Incentives for offices located in city center / factories near station	The most efficient way in a long-term to make mobility sustainable is by spatial planning to bring key facilities to the city center and close to public transport.

Source: Franchini et. al. (2018)

The assessment was carried out in a form of a workshop within the project, with its results summarized in the Table 5 below. The code in Table 3 above is used here i.e. F for financer, R for regulator, I for implementing body, P for promotor, T for technical assistance and expertise (Franchini et. al. 2018).

Table 5. Role(s) of each institutional stakeholder group in various measures for sustainable transport

ID	Measures	Role(s) of each stakeholder group				Description of Role of Stakeholders
		PA	ISP	ES	IG	
1	Incentive apps for cycling	F		P	T	Group PA: to finance app development / maintenance. Group ES: to encourage the employees to join in when team-competition function is embedded in the app. Group IG: preparation / maintenance of the app (often by subcontracting to IT company)
2	Roof/protection for bicycle parking	F, R, I		I		Group PA: to build roofs on public bike parking; to set rules / guidelines for bike parking; to finance it for the ones in public places / to subsidize it for the companies. Group ES: to build roofs on the private bicycle parking.
3	Roof and bench at bus/tram stop	F, R	I	F		Group PA: to subsidize it; to set rules/guidelines for this; Group ISP: to build and maintain it. Group ES: to build it; to provide a land surface for this in front of the company.
4	Making access routes to PT stops / stations pedestrian-friendly	F, R, I		P		Group PA: to finance, construct and maintain it; to set a guideline for it; Group ES: to liaise with the Group PA to plan the access routes from company to the PT stop.
5	Backside exit of railway station	F, I	I	P		Group PA: to liaise with Group ISP (infrastructure owner) to enable it; to finance it; to design and construct station square. Group ISP: to build and maintain it. Group ES located on the back side: to advocate the needs of it.
6	New train station / bus&tram stop	F, P, I	I	P		Group PA: to liaise with Group ISP (infrastructure owner) to enable it; to finance it; to design and construct station square. Group ISP: To build and maintain it; to adjust timetable for this. Group ES: to advocate the needs of it.
7	Car-sharing (Car Club),	F, I,		F, I	T, P	Group PA: to serve as the main stakeholder/organizer; to finance it; to

ID	Measures	Role(s) of each stakeholder group				Description of Role of Stakeholders
		PA	ISP	ES	IG	
	non-profit	P				communicate with citizens about it. Group ES: to serve as the main stakeholder/organizer; Group IG: to provide necessary system for this; to communicate with citizens about it.
8	Bike-sharing (fixed-station)	F, I, P	I	I		Group PA: to serve as the main stakeholder/organizer; to finance it; to communicate with citizens about it. Group ISP: to liaise the public transport services with this. Group ES: to provide spaces for station; to liaise with Group PA to locate a station.
9	Ride-sharing (Car-pooling)			I	T	Group ES: to provide ride-sharing portal for the employees. Group IG: to provide ride-sharing portal to the general public; to provide and maintain informal meeting point for this;
10	EV-charging spots	F, I	F, I			Group PA: to subsidize it; to place it in the public parking. Group ISP: to place it in the private parking.
11	Regular exchange of information with outside	I			I	Group PA: to organize stakeholder meeting; to serve as a knowledge-hub as a mobility issue; Group IG: to organize stakeholder meeting; to serve as a knowledge-hub as a mobility issue.
12	Awareness raising in health and active mobility	I	T		I	Group PA: to act as the main advocator; Group ISP: to forward the information to the employee; to include this as a health program of the company; Group IG: to act as the main advocator;
13	Mobility education at School	T, I		I	T, I	Group PA: to carry this out in schools; Group ES: to provide relevant materials for schoolkids; Group IG: to carry out this out in schools;
14	Participatory process for strategy-building	I	T		I	Group ISP: to join in the process; Group PA and D: to organize and monitor/report the process and discussion;
15	One-stop mobility service point		I		I	Group ISP: to provide mobility service point at the public transport nodes; Group IG: to provide it in the city center and at other important nodes;
16	Mobility information portal (web, app)		I		I	Group ISP: to provide and maintain it; Group IG, esp. Public transport association: to provide and maintain it;
17	Bicycle parking and shower at companies/schools			I		Group ES: to implement it;
18	Bicycle pump / repairing tools			I		Group ES: to implement it;
19	Incentives for / Introduction of teleworking	I		I	T	Group PA: to implement it; Group ES: to implement it; Group IG: to provide know-how to the Group ISP.
20	Introduction / regular revision of mobility management plan of company			I	T	Group ES: to prepare, monitor and revise it. Group IG: to provide know-how to the Group ISP.
21	Coordinating shift-working-hours and PT timetable		I	I		Group ISP: to provide time-table information to Group ES; to adjust timetable based on the information about the shift-working-hours; Group ES: to communicate with Group ISP;
22	Ride-sharing portal for employees			I	T	Group ES: to implement it for employees. Group IG: to provide technical platform, assistance.
23	School bus / commuter bus		I	F		Group ES: to finance and organize it; Group ISP: to run the bus;
24	Incentives for electric vehicles	F			P, T	Group PA: to subsidize it; Group IG: to advice the subsidy receiver;

ID	Measures	Role(s) of each stakeholder group				Description of Role of Stakeholders
		PA	ISP	ES	IG	
25	Incentives for offices located in city center / factories near station	F, R				Group PA: to implement incentives in various policy area e.g. land-use plan.

Source: Adapted based on Franchini et. al. (2018)

5. Autonomous vehicles and stakeholder involvement

5.1. Potential impacts of autonomous vehicles on traffic in small and mid-sized cities

Various recent research and studies show that autonomous vehicles (the ones corresponding to Levels 4 and 5) can contribute significantly to the reduction of certain types of problems that is caused by conventional automobiles, such as road accidents and congestion. However, in the next few years or perhaps decades, there will gradually be a change in the type of vehicle, which will be increasingly automated up to fully automatic vehicles in 2050 or after. Concurrently, older traditional vehicles will slowly disappear from the road space.

Until all vehicles are completely autonomous, autonomous and human-driven vehicles need to cohabitate in and share the road space. This situation may not be as positive for traffic flow and operational road capacity. According to Litman (2014), if parking is priced but roads are not, autonomous vehicles may drive in circles on urban streets to avoid paying for parking, exacerbating congestion and pollution problems. Litman (2014) also claims that reduced congestion and low pollution emissions require that autonomous vehicles have dedicated lanes. Calvert et al. (2017), claim that the interaction between traditional and autonomous vehicles will lead to higher average time headways and therefore to lower capacities. According to the authors, it should also be noted that improving technology may play a role to reduce the congestion problem.

Boultman and Houben (2016) identify six risks associated with the introduction of highly autonomous vehicles:

- The high number of road accidents is a consequence of a sudden introduction of a different type of vehicle on the road network because drivers lose soft safety countermeasures such as eye contact;
- More severe accidents due to the fact that as trust and comfort with autonomous cars grows so does complacency, which can lead to more serious accidents when autonomous cars can't intervene that would previously have been mitigated by cautious drivers;
- Slower speed of flow due to the aim of maximizing passenger comfort on board, highly autonomous vehicles will need to reduce the rate of acceleration and deceleration;
- Higher traffic flows because when autonomous cars become more mainstream, groups of people who don't currently rely on cars (such as the elderly and the young) will be empowered to travel more by cars. In parallel, occupancy rates may drop as more autonomous cars are used for one-way trips and then drive themselves back while empty.
- Larger cars because when the length of journey grows, people will seek greater comfort within their cars. This will lead to demand for larger cars growing, which will, in turn, reduce capacity on roads.
- More trips due to the fact that as journeys in cars become more comfortable, people may choose to move away from urban areas and commute longer distances to work. De-urbanization would, in turn, lead to busier roads.

From what has been said, it emerges that autonomous vehicles can be a "double-edged sword". Such discussions on potential impacts, both positive and negative, of autonomous vehicles apply generally to large, mid-sized, and small cities as well as rural areas. Considering the particularity of small and mid-sized cities as discussed in Section 3.2, the following points needs to be pointed out particularly for them.

- High motorization rate (car ownership per capita) and high modal share of cars nowadays implies that market penetration of autonomous vehicles and thus penetration of autonomous vehicles onto the road space will be faster into such area compared to large cities.
- Characteristics of road infrastructure and usage of them e.g. less interference with pedestrians and parked vehicles, etc., the road environment in such smaller and mid-sized cities have much affinity to the autonomous vehicles compared to that of larger cities.
- Driverless autonomous vehicle will potentially reduce the production cost of the public transport service, as personnel cost for drivers can be eliminated, enabling public transport that would otherwise financially impossible in such small cities. This will enable higher spatial coverage of inhabited and developed areas in small and mid-sized cities, and enabling higher frequency of public transport.
- Availability of "free" parking with little parking regulation makes it difficult to use such instrument to regulate autonomous vehicles.

As such, when autonomous vehicles at higher levels or driverless vehicles are readily available, small and mid-sized cities are particularly vulnerable to adverse effects that would be caused by autonomous vehicles on one hand on one hand. On the other hand, it can be benefited from it if public transport becomes more autonomously driven.

In this circumstances, small and mid-sized cities needs to be readily prepared for autonomous vehicles much earlier than the large cities so that the negative effects of it is minimized while the benefit is well used.

Commonly to the large cities, to be benefited from autonomous vehicles while to minimize the adverse effects of it for the sake of sustainable mobility, several general guidelines needs to be considered.

- Private use of autonomous or driverless vehicles has to be discouraged as much as possible.
- Empty driving (e.g. to parking after dropping of passengers) has to be discouraged, too.
- Autonomous vehicles need to be used in a form of small-scale public transport.

As for traditional vehicles, the main objective is to discourage the private use of vehicles and to favour public transport as a feasible alternative.

5.2. Measures affected when autonomous vehicles are readily available

When autonomous vehicles are readily available, certain types of measures are affected to some or a large extent in various manor. We carried out an assessment of the 25 measures listed in Table 4, and identified the ones listed in Table 6 as the ones affected by the autonomous vehicle so that we can make an assessment of impacts on stakeholders presented in the next subsection. We used following criteria as a "white list" i.e. the one matching with at least one of the criteria remains.

- Measures related to automobile remains.
- Measures targeting on non-automobile modes of transport with an infrastructural interface to vehicular traffic remains.
- Measures associated with urban space and parking, remain.

Table 6. Measures assessed as being affected by autonomous vehicles

ID*	Measure	How would this be affected by autonomous vehicle?
3	Roof + bench at bus/tram stop	Such places could be used as an easy place to get on/off when driverless vehicles are readily available. Adjusted regulation may be needed. More of such roofs/benches will be needed for small-scale public transport.
4	Making access routes to PT stops / stations pedestrian-friendly	In case the road infrastructure is fully adapted for autonomous vehicles, it may have some adverse effects for pedestrians.
6	New train station / bus / tram stop[#]	When autonomous or driverless vehicles are used as public transport, production cost of public transport is expected to decrease, and additional bus line will be put easily. This assumes greater value if the new line takes the place of the parking lots for private vehicles. In this way, the possibility of parking will decrease and citizens will be forced to use public transport. It is a circular dependency.
7	Car-sharing (Car Club), non-profit[#]	Autonomous vehicles can be shared within the same platform, while the use will be more like public transport. Thus, with autonomous vehicle, this is going to be more like a regular small-scale public transport or demand-responsive public transport
9	Ride-sharing (Car-pooling) [#]	This could be organized in a form of a regular small-scale public transport or demand-responsive public transport with autonomous vehicle.
16	Mobility information portal (web, app)	Public transport with autonomous vehicles, as well as demand-responsive public transport with autonomous vehicle, will have to be integrated on one platform. In this context, this kind of mobility information portal will have to work as a one-stop app (c.f. concept of MaaS – Mobility as a Service).
20	Introduction / regular revision of mobility management plan of company	Companies' mobility management plans have to be adapted for autonomous vehicles.
22	Ride-sharing portal for employees[#]	Similarly to No. 9, this could be organized in a form of a demand-responsive public transport with autonomous vehicle rather than company-specific ride-sharing portal for employees, and as is the case of No. 16, this can be integrated into one platform.
23	School bus / commuter bus[#]	This could be organized in a form of demand responsive transport or small-scale public transport with autonomous vehicle, and thus can be integrated as a part of public transport, as is the case of No. 16.

*ID as appears in Table 4. #c.f. discussion below.

5.3. Changes in roles of stakeholders

As discussed at the end of Section 5.1, in the interest of sustainable mobility even in the era of autonomous vehicles, a principle has to be sought that the private use of autonomous vehicles should be discouraged as much as possible, in favor of the

use of shared vehicles i.e. as a small-scale public transport. As discussed in Section 4.2, in vision-building process among various institutional stakeholders having influences and interests for mobility at a local scale, this principle is not necessarily taken for granted. Because such new technology can be "charming" for certain types of stakeholders, in the worst case, some activity of stakeholders can result mere in a negative effect against the principle.

In Table 7 below, an assessment about how additional role(s) of each stakeholder group will be needed to seek for the principle as discussed at the end of Section 5.1 is summarized for the measures affected by the autonomous vehicle as listed in Table 6. As discussed within Table 6, the measures that are marked with # there, such as shared services, will probably transform themselves more in a form either of a small-scale regular public transport or a demand-responsive transport with autonomous vehicle. This is in line with the aforementioned principle, but this is also where many changes in the roles of stakeholder will be needed. In the following assessment, these i.e. the measures No. 6, 7, 9, 22, and 23 are summarized as 51: small-scale regular public transport with autonomous vehicle, and 52: demand-responsive public transport with autonomous vehicle.

Of note, in Table 7, roles of each stakeholder group that some changes are expected are highlighted with the bold font and underline.

Table 7. Potential additional/changed roles of stakeholders, when autonomous vehicles are readily available.

ID*	Measures	Role(s) of each stakeholder group				Description of additional/changed role of stakeholders
		PA	ISP	ES	IG	
3	Roof and bench at bus/tram stop	F, **R**	I	F		Group PA: Particular, perhaps stricter, regulation needed for use of bus/tram stop will be needed.
4	Making access routes to PT stops / stations pedestrian-friendly	F, **R**, **I**		P		Group PA: Particular, perhaps stricter, regulation needed for use of bus/tram stop will be needed. Clear guidance not to adapt street space for automobiles will also be needed.
16	Mobility information portal (web, app)	**F, P**	**P**		I	To integrate shared autonomous vehicle (ride-sharing), initiative of public authority and/or by operator is essential. Group PA may have to subsidize.
20	Introduction / regular revision of mobility management plan of company			I	T	No particular change in roles.
51	Small-scale regular public transport service with autonomous vehicle	**F**, **R**	**I**	**P**		Group PA will need to set coordination framework where this type of service is to be implemented; some financing may be needed by Group PA. Group ISP will need to operate the service, as well as to provide necessary infrastructure e.g. depots. Group ES will need to encourage their employees/schoolchildren to make use of this.
52	Demand-responsive service with autonomous vehicle	**F**, **R**	**I**	**P**		

*ID as appears in Table 4.

5.4. Involvement of stakeholders for AV-associated issues in small and mid-sized cities

In the future circumstances, as seen in Table 7, for many of those measures that help sustainable commuter traffic, the roles of the public authorities (Group PA) will become more essential than it is nowadays. Many of the shared forms of commuter mobility that can be deployed nowadays will form a small-scale regular public transport or a demand-responsive transport with autonomous vehicle, and for these types the public authority will have to take more coordination roles. In particular, role as Regulator as well as Financer of the public authorities is expected to gain more importance. Albeit not included in our detailed assessment, the general public (Group PA) is one of the important stakeholder, not only because they are users/commuters but also because they are taxpayers.

As discussed in Section 2, after an identification of stakeholders, it is important to address the question how and when stakeholders should become a part of decision-making. In the context of AVs and its relevance, more difficult is to address when such stakeholder involvement process should take place.

It is probably too late if such stakeholder involvement process starts when some problematic situation arises with the market penetration of AVs. Such problem-driven involvement of stakeholders will end up with various conflicts among different interests among different interested parties. What is optimal is, thus, that such stakeholder involvement process starts in advance of market penetration of autonomous vehicle so that a future common vision among stakeholders is successfully built. It has to be noted, however, that, as pointed out in in Section 4.2, for sustainable (commuter) mobility, public authorities and some interest groups, NGOs, and business support organizations have endogenous incentives, while the other stakeholders' interests are conditional. Infrastructure and service providers are those who are much affected by AVs, and thus we can assume more endogenous incentives, as is the case of the public authority. Employers and schools can be assumed merely with conditional

interests. It is thus unrealistic to start with all of the stakeholders at the same time: stepwise involvement of stakeholders will probably make sense, which begins with those who have endogenous incentives. Over time some choices can be reviewed. In any case, the final decisions must be made considering all the stakeholders and all the interests, carefully evaluating the costs and benefits deriving from each choice.

Questions to address have to be also considered. As briefly mentioned in the introduction, main questions to address are: in which part of the city should fully automatic (driverless) vehicles be allowed? How should the "empty" AVs roaming around cities be regulated? How should the shared form of AVs be organized in the city in a form of small-scale public transport? From Table 7, questions arise such as: how should bus/tram stops be regulated as hop-on/-off points for AVs? How mobility information portal (app) should look like? Is such portal usable for everyone? These to-be-addressed-first questions have a good affinity with the stakeholders who have endogenous incentives for sustainable mobility. For these types of questions, any method that was discussed in Section 2 e.g. focus group, forum, citizen panels, questionnaires, written submission and so on can be deployed.

It is yet difficult to generalize in which timing such discussion should be started, because of different readiness for such discussions, available local experts, and experiences in such discussions. In the foreseeable future, as many different forecast states, there will be AVs running on the road. In addition, as pointed out earlier in this paper, small and mid-sized cities have much infrastructural affinity to AVs compared to large cities and thus market penetration might be faster than large cities.

Thus, at large, local working groups with stakeholders having endogenous incentives for sustainable mobility, namely public authorities, interest groups, and infrastructure and service providers in a near future will be optimal to address the above-mentioned questions so that the future issues associated with AVs can be addressed in advance, not in a problem-driven manner after the penetration of AVs onto the road. In addition, such working groups will have to have perspectives to expand themselves to a wider range of stakeholders.

6. Conclusions and outlook

In this paper, after an extensive literature review and an explanation of research context as accompanying research of an EU-funded real-world project, we presented an assessment of how the rolls of the five main stakeholder groups, namely public authorities, infrastructure and service providers, large employers and schools, interest groups, NGOs, and business support organizations, and general public will change when autonomous vehicles are readily available in the market, making use of a list of 25 measures that are used in a real-world project as potential measures designated for sustainable commuter traffic. Particular focus is set to small and mid-sized cities, where might be more vulnerable to market penetration of autonomous vehicles because of high levels of motorization, availability of parking at little cost of users, and existing road infrastructure with high affinity of automobiles compared to large cities.

The interest of each type of stakeholders in environment-friendly commuter traffic, as well as their potential roles in vision building and strategic spatial and transport planning are identified. Five roles of institutional stakeholders in implementation of measures are proposed: financer (giving a financial subsidy as an incentive or by bearing the costs); regulation (regulating rules, plans and programs, etc.); implementing body (implementing some measures as part of its own business); promoter (promoting general interests); technical and advisory (offering personal experience and/or competences). For the experimental context under examination, the roles of each stakeholder group in various measures for sustainable transport are analyzed.

From the assessment, several conclusions can be drawn, and some future research needs are identified. (1) Some transport/mobility measures of today thought for sustainable mobility – in our case, sustainable commuter mobility – will be much affected by the market penetration of autonomous vehicles in the future. In our example of the 25 measures, 9 are assessed as affected by autonomous vehicles. Among them, 5 are assessed as affected in a way that they will have to be transformed into small-scale public transport or demand-responsive service making use of low service production cost of the autonomous vehicle. (2) Such changes will add some more roles of public authorities compared to today, especially as regulators and financers. (3) In terms of stakeholder involvement to address questions arising along with future market penetration of autonomous vehicles in small and mid-sized cities, a realistic approach is to set up a local working group with stakeholders having endogenous incentives or motivations for sustainable mobility. In the later phase, involvement can be extended to a wider range of stakeholders. This approach will enable to avoid problem-oriented and post-market-penetration discussion with a higher risk of conflicts among different interests.

During the course of the research, a few questions have arisen: it is not fully clear in which timing the local discussion among stakeholders towards AV-associated issues should (or has to) start. The involvement of further stakeholders not involved in Smart-Commuting is also an open issue. Furthermore and obviously, the AV-associated questions listed in this paper also need to be further developed in the future.

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References

Antonson, H. (2014). Public participation and written submissions: A transport infrastructure planning case study. Transportation Research Part A: Policy and Practice 70, 59–66.

Batheram, M., Hardin, J., and Whitfield, S. (2005). Successful participation methods for local transport planning. Municipal Engineer 158, 9–16.

Banville, C., Landry, M., Martel, J., and Boulaire, C. (1998). A Stakeholder Approach to MCDA. Syst. Res. Behav. Sci 15, 15–32.

Bickerstaff, K., and Walker, G. (2001). Participatory local governance and transport planning. Environment and Planning A 33, 431–451.

Bork, H., Müllehner, S., Berger, M., Dorner, ., Emberger, G., Shibayama, T., Platzer, M., Groessel, S., and Selz, E. (2017). BahnRaum Schienenorientierte Siedlungsentwicklung und Erreichbarkeitsoptimierung – Planungshandbuch.

Bultmann M., and Houben, A. J. H. (2016). How autonomous vehicles could relieve or worsen traffic congestion. HERE Deutschland.

Calvert, S.C., Schakel, W.J., and van Lint, J.W.C. (2017). Will Automated Vehicles Negatively Impact Traffic Flow? Journal of Advanced Transportation 2017, 1–17.

Cleland, D. I., and Ireland, R. L. (2002). Project Management: Strategic Design and Implementation. New York: McGraw-Hill.

Dijkstra, L. and Poelman, H. (2017). Archive: European cities – the EU-OECD functional urban area definition, Available from http://ec.europa.eu/eurostat/statistics-explained/index.php/Archive:European_cities_%E2%80%93_the_EU-OECD_functional_urban_area_definition, Accessed on 19.06.2018

Edelenbos, J., and R. Monnikhof (2001). Lokale interactieve beleidsvorming. Een vergelijkend onderzoek naar de consequenties van interactieve beleidsvorming voor het functioneren van de locale democratie. Utrecht

Erkul, M., Yitmen, I., and Çelik, T. (2016). Stakeholder Engagement in Mega Transport Infrastructure Projects. In Procedia Engineering, (Elsevier Ltd), pp. 704–710.

Franchini, A., Lemmerer, H., Shibayama, T. (2018). Transnational Strategy to change commuting models in the FUAs, Deliverable D.T1.2.1 of SMART COMMUTING, Co-funded by Interreg Central Europe.

Freeman, R.E. (1984). Strategic Management: A Stakeholder Approach.

Haial A., Berrado A., Benabbou L. A. (2017). Transport strategy developing process based on stakeholder engagement. Proceedings of the International Conference on Industrial Engineering and Operations Management, 2408-2416.

Kelly,J., Jones,P., Barta,F., Hossinger,R., Witte,A., and Christian A. (2004). Successful transport decision-making: A project management and stakeholder engagement handbook. Guide maps consortium.

Kørnøv, L., and Thissen, W.A.H. (2000). Rationality in decision- and policy-making: Implications for strategic environmental assessment. Impact Assessment and Project Appraisal 18, 191–200.

Le Pira, M., Ignaccolo, M., Inturri, G., Garofalo, C., Pluchino, A., and Rapisarda, A. (2013). Agent-based modelling of Stakeholder Interaction in Transport Decisions. In Selected Proceedings of the 13th World Conference on Transport Research (WCTR), 15th-18th July, 2013.

Lemmerer, H., Shibayama, T., Macoun, T., Havelka, A., Soder, M., Németh, A., Virág Á. (2015) Study Eco-mobility. EMAH (Eco-mobility in the Austro-Hungarian border region), A report for European Regional Development Fund.

Li, T.H.Y., Ng, S.T., and Skitmore, M. (2012). Conflict or consensus: An investigation of stakeholder concerns during the participation process of major infrastructure and construction projects in Hong Kong. Habitat International 36, 333–342.

Libardo A. and Nocera S. (2008). Transportation Elasticity for the Analysis of Italian Transportation Demand on a Regional Scale. Traffic Engineering and Control 49-5, 187-192

Litman, T. (2014). Autonomous Vehicle Implementation Predictions: Implications for Transport Planning. Transportation Research Board Annual Meeting 36–42.

Lowndes, V., Pratchett, L., and Stoker, G. (2001). Trends in public participation: part 2 - citizens perspectives. Public Administration 79, 445–455.

Macharis, C. (2005). The importance of stakeholder analysis in freight transport. European Transport / Trasporti Europei 25–26, 114–126.

Macoun, T, Lemmerer, T, Shibayama, T (2015) Richtlinien zur Einrichtung von Ökomobilitätskonzepten. EMAH (Eco-mobility in the Austro-Hungarian border region),

Report for European Regional Development Fund.OECD, 2013. Definition of Functional Urban Areas (FUA) for the OECD metropolitan database. Available from https://www.oecd.org/cfe/regional-policy/Definition-of-Functional-Urban-Areas-for-the-OECD-metropolitan-database.pdf, accessed on 19.06.2018.

Nocera S. (2010). Un approccio operativo per la valutazione della qualità nei servizi di trasporto pubblico/An Operational Approach for Quality Evaluation in Public Transport Services. Ingegneria Ferroviaria 65-4, 363-383

Nocera, S., Dianin, A., Franchini, A. (2017). Guideline for SWOT Analysis, Deliverable D.T1.1.1 of SMART COMMUTING, Co-funded by Interreg Central Europe.

Shibayama, T. (2011) Organizational Structures of Urban Public Transport - A Diagrammatic Comparison and a Typology. Journal of the Eastern Asia Society for Transportation Studies, Vol. 9 (2011), pp126-141

Shibayama, T., Leth U., Emberger, G. (2-17) Methodology for diagrammatic comparison of transport planning competences over national borders. Transportation Research Procedia, Vol. 25, pp3656-3673.

Tam, C.M., Zeng, S.X., and Tong, T.K.L. (2009). Conflict Analysis in Public Engagement Program of Urban Planning in Hong Kong. Journal of Urban Planning & Development 135, 51–55.

Taschner, S., and Matthias F. (2009). Stakeholder Involvement Handbook, Deliverable D2.1 of the AENEAS project, 21 April 2009. http://www.aeneas-project.eu/docs/AENEAS_ StakeholderInvolvementHandbook.pdf

Varvasovszky, Z., and Brugha, R. (2000). How to do (or not to do) ... A stakeholder analysis. Health Policy and Planning 15, 338–345.

Walker, W.E. (2000). Policy analysis: A systematic approach to supporting policymaking in the public sector. Journal of Multi-Criteria Decision Analysis 9, 11–27.

Ward, D. (2001). Stakeholder involvement in transport planning: Participation and power. Impact Assessment and Project Appraisal 19, 119–130.

Yang, J., Shen, G.Q., Ho, M., Drew, D.S., and Chan, A.P.C. (2009). Exploring critical success factors for stakeholder management in construction projects. Journal of Civil Engineering and Management 15, 337–348.