Available online at www.sciencedirect.com

ScienceDirect

Transportation Research Procedia 48 (2020) 2385–2400

Transportation Research Procedia

www.elsevier.com/locate/procedia

World Conference on Transport Research - WCTR 2019 Mumbai 26-30 May 2019

Competence, interest and power in participatory transport planning: framing stakeholders in the "participation cube"

Michela Le Pira[a1], Giuseppe Inturri[b], Matteo Ignaccolo[a]

[a]*Department of Civil Engineering and Architecture, University of Catania, Via Santa Sofia 64, 95125 Catania, Italy*
[b]*Department of Electric, Electronic and Computer Engineering, University of Catania, Via Santa Sofia 64, 95125 Catania, Italy*

Abstract

This paper presents a new procedure for a simplified stakeholder analysis aimed at categorizing transport stakeholders according to their level of competence, interest, and power in decision-making in a three-dimensional space that we call "participation cube". Knowing in advance what role each stakeholder can play in the final decision and how she/he is related to the other stakeholders can be crucial for the success of any process aimed at consensus building. A preliminary stakeholder analysis is thus needed at an early stage of transport planning. A theoretical framework is here provided, built on literature, and a practical application is presented as an example to test it in a real-world case. The aim is to help policy-makers and practitioners to understand, in advance, how to deal with stakeholders in transport planning processes with the aim to foster consensus on shared decisions.

Keywords: stakeholder analysis; public participation; social network analysis; transport policy

1. Introduction

Citizen participation has been defined by Arnstein (1969) as "the strategy by which the have-nots join in determining how information is shared, goals and policies are set, tax resources are allocated, programs are operated, and benefits like contracts and patronage are parceled out". Arnstein's definition focuses on the involvement of citizens and, in particular, of disadvantaged citizens (the "have-nots") in planning processes as a mean by which they can induce "social reforms". However, we can broaden this concept by including all the other heterogeneous actors that should be involved in decision-making processes, i.e. the so-called "stakeholders". Any individuals or group that have

* Corresponding author. Tel.: +39-095-738-2220.
E-mail address: mlepira@dica.unict.it

2352-1465
10.1016/j.trpro.2020.08.281

an interest or hold a stake in a particular decision can be defined as *stakeholders* (Le Pira, 2018). Hearing different voices can be important at different levels. First, it can help to appropriately define the state of the art with critical issues and constraints; then, it can help to set the relevant objectives to pursue; moreover, it allows for the definition of alternatives in line with stakeholder objectives; finally, it assures transparency to the planning process with, at least in principle, less contested decisions. However, as pointed out by Walker and Bickerstaff (2005), one should be careful when setting the objective of participation, since more participation is clearly not the same thing as more democracy, and it can reproduce existing patterns of social exclusion and disadvantage, if particular and forceful interests dominate the process and not all the voices are heard.

In any case, public participation can be considered an important instrument that public administrations should use with the purpose of influencing the choice(s) being made, so to reach decisions that would likely be accepted, and could lead to behavioral change (Bickerstaff et al., 2002; Banister, 2008). This is a widely spread and well-established concept in some sectors, including land use planning (see Arnstein, 1969), while it has been only recently introduced as a fundamental element of a city's wide-ranging planning and design. Transport planning is a case in point, since it has undergone a continuous evolution over the years, from "planning" intended as a "plan document" to a "plan process", and from a "strongly rational" to a "cognitive rationality" approach, where the concept of choice optimization has been overcome with that of satisfying the community needs in an evolving process (Cascetta et al., 2015).

Literature conceptualizing the theory of public participation in transport planning – mostly from a governance model's point of view – is abundant (Legacy et al., 2012). In this respect, Legacy (2016) suggests that new urban governance settings that respond to the politics are needed, including debate and public deliberation, but that should not disavow this process of its politics. Besides, nowadays it is clear that the "best" solution is not necessarily the *best* one from a technical point of view, but the one that *best* meets the needs of stakeholders. In this respect, one could argue that the most difficult part would be to find a compromise between technical analyses and stakeholder-driven evaluations (Le Pira et al., 2018). The new Sustainable Urban Mobility Plans (SUMP) go in this direction with the concept of "Planning for people", in contrast to traditional transport planning approaches, by placing particular emphasis on the involvement of citizens and stakeholders, the coordination of policies between sectors, authority levels and neighboring authorities (Wefering et al., 2014).

Planning for people and with people means that policy-makers should deal with multiple heterogeneous actors with different roles in the decision-making process, but equally important for its success. "Consensus planning" processes should be "inclusive of different forms of knowledge including tacit and local knowledge of place" (Legacy and Stone, 2019). To simplify, on the one hand, one can recall experts, i.e. those that can help to analyze the problem from a technical/economic point of view, and propose solutions consistent with the plan objectives. On the other hand, there are stakeholders and citizens, or those who will bear the consequences of the choices made. The former, having specific interests, are fundamental to build the cognitive framework and evaluate, *ex ante*, the feasibility of the planned interventions. The latter, as users of transport services and, more generally, as vital elements of the city, must be continuously involved and informed, since the main objective of each plan should be the satisfaction of the needs of the community. All of them can have different roles and interests in the decision-making process, and should be involved accordingly. There are different levels of growing involvement, as suggested by Cascetta and Pagliara (2013), from stakeholder identification, to listening of their needs and communication with them, up to consultation and participation in the final decision. The first step of stakeholder identification, despite being a preliminary phase aimed at deeply understanding *who* are stakeholders, is one of the most important and, often, neglected. In this respect, recognizing and identifying all the relevant stakeholders and different interest groups within the urban area, and defining how to carry out the participation process can be a difficult task for local authorities, while strongly dependent on the planning context (Ballantyne et al., 2013). Besides, knowing in advance what role each stakeholder can play in the final decision, e.g. in terms of "power" or "influence", can be crucial for a successful participation process aimed at consensus building. It is worthy of notice that a full consensus is nearly impossible to obtain when different stakeholders with heterogeneous interests are involved. Sometimes, the search for consensus itself can be seen as a mechanism of silencing rather than of giving voice – where individuals held opinions that conflicted with the majority (Bickerstaff and Walker, 2005). However, deliberation can help smoothing diverging opinions and making stakeholders aware of the different points of view. This is important to find tradeoff solutions that are likely to be accepted by them. Besides, "a process which engages people in deliberation can produce a large group of readymade champions willing to advocate the solutions to their peers" (Walker, 2009).

A preliminary stakeholder analysis is thus useful at an early stage of the planning process.

Literature in the last years on methods to support consultation and participation is growing (see, e.g., Macharis et al., 2009; Gatta and Marcucci, 2016; Gatta et al., 2019; Giuffrida et al., 2019), also in terms of models and simulations for participatory decision-support (Le Pira et al., 2017a; 2018; Marcucci et al., 2017). However, less is known about structured procedures and methods for an initial stakeholder analysis in transport planning. From a simple web search in WoS database by the keywords "stakeholder identification" (183) or "stakeholder analysis" (1067), it emerged that there are very few publications (14) specifically related to these topics in the transport-planning sector, mainly dealing with analysis of stakeholder preferences and perspectives[2]. In general, there is a research gap in transport literature between theories and experiences of public participation and practical and easy methods than can be used to guide participation from the very first phase of stakeholder identification and analysis. In this respect, a good knowledge of stakeholders and understanding of their role in the decision-making process become important to tailor participation and choose the right methods.

Based on this premise, this paper presents a new simple procedure for a stakeholder analysis aimed at categorizing stakeholders according to their level of competence, interest, and power in decision-making that could help planning effective participation processes. A theoretical framework is provided, built on relevant literature, and a practical application is presented to test it in a real-world case. The aim is to present a simplified analysis for policy-makers and practitioners to understand, in advance, how to deal with stakeholders in transport planning processes to help reaching a consensus on shared decisions.

The remainder of the paper is organized as follows. Section 2 will contextualize stakeholder analysis in transport planning by introducing the main concepts related to stakeholder identification (2.1), classification (2.2), and social network analysis (2.3). Section 3 will present the "participation cube" and the rationale behind it, while section 4 will show an application of the proposed framework in a simple case study (4.1), together with an analysis of the social network of stakeholders (4.2). Section 5 will conclude the paper, highlighting the main limitations and future research endeavors.

2. Stakeholder identification and analysis

2.1. Stakeholder identification

Freeman has first defined stakeholders in the management environment in 1984, as "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman, 1984). Starting from this definition, Mitchell et al. (1997) proposed a theory of stakeholder salience based on their level of power, legitimacy, and urgency so to univocally identify them as "those entities to whom managers should pay attention".

A transposition of this paradigm to the public planning sector is needed. In this respect, managers engage firm stakeholders since they can have a positive or negative effect on company *private interests*, while, *mutatis mutandis*, public policy-makers engage transport stakeholders since they can help them taking decisions consistent with the general *public interests*.

For what concerns transport projects, typical stakeholder groups are: (1) government and authorities, (2) business and operators, (3) communities and local neighbourhoods, and (4) others (e.g. Universities) (Wefering et al., 2014).

Cascetta and Pagliara (2013) propose a broader classification for transport planning based on seven categories (institutions/authorities, users, transport operators, business and unions, local communities, media and financial institutions) (Table 1).

[2] The web search was performed in April 2019 by topic keywords "stakeholder analysis" OR "stakeholder identification", and selecting all the documents in the categories "Transportation" and "Transportation Science Technology".

Table 1. Stakeholder classification in transport planning (reproduced from Cascetta and Pagliara, 2013).

Institutions and Authorities	Users	Transport operators	Business and Unions	Local communities	Media	Financial Institutions
European Union	Direct users (pass)	Transport operators	National and local industry associations	Transport users associations	TV station	Banks
National government and authorities	Direct users (freight)	Transport operator associations	National and local trade unions	Local interest groups (e.g. borough associations)	Radio station	Funds
National parliament	Indirect users (pass)	Consultants	National and craft unions	Environmental associations	Newspapers	Insurances
Regional governments and Authorities	Indirect users (freight)		Retailers associations	Citizens		
Regional transport authority			Industry in public works	Visitors		
Local authorities (Provinces and Municipalities)			Industry in vehicles production			
Political parties and single members			Industry in technology production			

These categories are comprehensive and can be used as the starting point for stakeholder identification in any new participation process in the transport sector. Based on stakeholder category, they can be classified according to the main role they have in the specific plan/project.

2.2. Stakeholder classification: power, interest, and competence

Mitchell et al. (1997) identify three main attributes related to stakeholders, i.e.: *power*, in terms of ability to influence the others; *legitimacy*, referred to actions that are "desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions"; *urgency*, i.e. "the degree to which stakeholder claims call for immediate attention". These attributes are variable in time and contribute to stakeholder salience, i.e. the degree to which managers give priority to competing stakeholder claims. In the context of public policy, power has been put in relation with reality and rationality in the seminal work of Flyvbjerg (1998).

Some authors classified stakeholders in transport according to the interest they have in the plan/project in: *primary stakeholders*, i.e. those who have a direct interest in the decision (e.g., transport operators or transport users), and *secondary stakeholders*, i.e. the ones who have an indirect interest (e.g. local communities) (Cascetta and Pagliara, 2013). Similarly, the SUMP guidelines (Wefering et al., 2014) identify four types of actors to be involved in the decision-making process, i.e.:

i. *primary stakeholders*, defined as those "who will ultimately be affected – positively or negatively – by new transport measures";
ii. *key actors*, i.e. "who has political responsibility [...] who has the financial resources [...] who has the authority [...] who has the skills and expertise [...] – in transport and related domains";
iii. *intermediaries*, defined as those "who implements transport policy [...] who carries out major transport activities [...] who represents pertinent interest groups [...] who informs and reports on transport";
iv. *local champions*, as "key individuals who may play a significant role in mobilising resources, creating alliances, etc. because of their personal skills and the recognition they receive among local actors".

Besides, in the SUMP guidelines it is also suggested to analyse the "actor constellations" by developing an "Influence-Interest Matrix", which groups stakeholders by their level of influence (low/high) and interest (low/high

stake), being those with high influence and high stake the most critical stakeholders. This classification is similar to the one proposed by Gardner et al. (1986) with the "interest/power" matrix, identifying four categories of stakeholders, i.e.: *marginal stakeholders* (with low interest and weak power), *operational stakeholders* (with high interest and weak power), *institutional stakeholders* (with low interest and strong power), and *key stakeholders* (with high interest and strong power).

It is also important to take notice of the competences of each stakeholder in relation to the specific plan/project. In this respect, a simplified representation has been proposed, representing transport planning actors in a pyramid (Fig. 1), and classifying them according to the level of competence and the type of interest in: *experts* (key informants), with high competence but low stake, general *stakeholders* (e.g. transport companies), with competence and high stake, and *citizens*, with low competence with public interests (Le Pira et al., 2016). Of course, this intentional simplification opens the debate especially with respect to the role of the public, which should not be merely intended as (a) a rather homogenous block, (b) lacking competence, and (c) representing public interests. In relation to (a), one can argue that the public may consist of groups with quite diverse needs (e.g., disabled people, people with respiratory problems especially affected by transport pollution, families with young children, people in peripheral or central areas, those living along a transport corridors). It is plausible at least to assume that a major task for a participation exercise would be to seek to identify and include different sections of the public, trying to understand their specific interests and competence with respect to the specific problem. In this respect, for what concerns point (b), in general it can be argued that most members of the public may not be well aware of transport technical analysis or the theory behind transport planning, but this should not to be intended as a lack of knowledge, which can be very helpful to support the decision-making process. There are several examples in environmental planning of cost-effective solutions derived from public participation, able to break a deadlock and create conditions more conducive to implementation (see, e.g. Graversgaard et al., 2017 and Drazkiewicz et al., 2015). Finally, it is clear that, in general, considering the public as (c) representative of public interest, e.g. in terms of livability of their city or a better accessibility to all urban functions by different modes of transport, is a simplification, since they can have specific private interests that should be understood, adequately circumscribed and taken into account in the decision-making process.

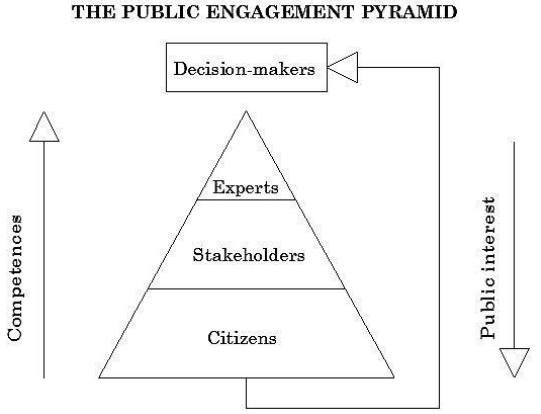


Fig. 1. The Public Engagement pyramid (Le Pira et al., 2016).

With these caveats into mind, one can purposely operate a simplification to conduct a plain yet interesting analysis. Competence, interest and power are all features that can help to have a clear insight of the actors involved and their role in the decision-making process, but one should also consider the relationships with the others. In this respect, "social dynamics" can appropriately be investigated via building a social network of stakeholders, as explained in the following.

2.3. Social network analysis

A social network (SN) of stakeholders is a graph consisting of nodes (i.e. the social agents) and links (i.e. the relationships among them). SNs are considered complex networks, whose structure is irregular, complex and dynamically evolving in time (Boccaletti et al., 2006). Social Network Analysis (SNA) is an approach to analyze SNs that allows to quantify the social importance of a given individual in a network via centrality indexes, and understand the potential problems due to topology (Scott, 2013).

The use of SNA in the field of stakeholder engagement can simply consists of stakeholder mapping or it can include centrality measures (Prell et al., 2009; Gonzalez-Urango and García Melón, 2018). According to Schonk et al. (2011), project managers of construction works can use SN visualization to identify the stakeholders to engage, while stakeholders have clear insights on their positions in relation to the others. SN re-creation can be performed using different methods, e.g. the "name generator" technique (Ryley and Zanni, 2013), which identifies SN through in-depth interviews, or the "snowballing" technique where a small number of people are asked to nominate others, the nominees are asked for further nominations and the network builds up like a snowball (Scott, 2013). There are also automatic tools able to create a network and extract information from it, such as UCINET (Borgatti et al., 2002), NodeXL (Smith et al., 2010), or StakeSource, a web-based tool that uses SN, and a "crowdsourcing" approach, to identify and prioritize stakeholders and their requirements (Lim et al., 2010). Besides, it can also be useful to study how the information flows in the SN, and how the relationships among stakeholders can influence the outcome of a participation process. In this respect, it is possible to simulate their dynamic interaction via agent-based models, investigating the role of topology and other variables for the emergence of collective patterns, e.g. consensus related to specific transport project/policy/plan (Le Pira et al., 2016a, 2017a, Marcucci et al., 2017).

Centrality can be measured in different ways, e.g. according to the number of links of a node (degree centrality), the average length of the shortest path between a node and all other nodes (closeness centrality), the number of times a node acts as a bridge along the shortest path between two other nodes (betweenness centrality) (Barabási and Pósfai, 2016). Fig. 2 reports an example of a stakeholder network with nodes colored according to in-degree centrality, i.e. the number of links directed to a node (Le Pira et al., 2018).

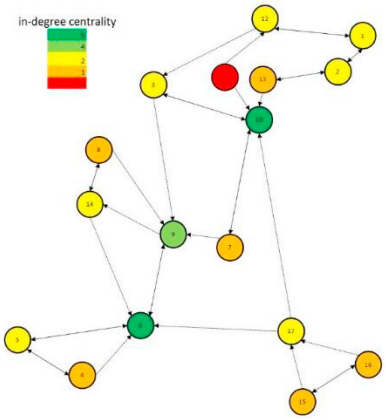


Fig. 2. Example of stakeholder network with in-degree centrality (Le Pira et al., 2018).

3. The participation cube

A new simplified framework based on Le Pira (2015) is here proposed to combine the interest/power matrix (Gardner et al., 1986) presented in section 2.2, the seven stakeholder categories in transport planning of Table 1, and the public engagement pyramid of Fig.1.

It is worthy of notice that the concepts of "competence", "interest" and "power" can have different definitions. Here, they are intended respectively as "power to influence the outcome of the decision-making process", "interest in the well-being of the community", and "knowledge and expertise related to the specific topic". Of course, these concepts can be interpreted in different ways according to the specific situation. Besides, the categorization of stakeholders according to competence/interest/power can be affected by different forms of aggregation to advocate specific interests, and their ability to influence the outcome of the decision-making process. In this respect, the proposed framework should be adapted to the context of analysis and planning process and intended as a preliminary exercise helpful to have an overall idea of the stakeholders involved.

It can be depicted as a three-dimensional space where the axes represent respectively public interest (x), power (y) and competence (z) and where it is possible to build a cube, representing different combinations of the three variables, from 0 (minimum) to 1 (maximum) (Fig. 3a). This cube can be considered as a "participation cube" where the different actors of the pyramid of Fig. 1 and the different stakeholders group of Table 1 can be placed according to their expected level of public interest, power and competence (Fig. 3b and Fig. 3c). Fig. 3b and 3c present some overlap, and they can be merged so that the vertexes of the cube represent the main typical stakeholder groups in transport planning (i.e. institutions and authorities, local communities, transport users, general stakeholders, transport operators, experts) (Fig. 3d). The vertex that remains bare, representing high level of competence, high public interest and low power, can be covered by what we call the "Public Participation Practitioner" (PPP), a professional figure that should help the decision-maker in coping with public interests (i.e. citizens), with expert competence, and no decision power. This is consistent with the vision that "as conveners of participatory design processes, transportation professionals must be responsive to other perspectives, help lay participants understand the technical aspects of the policies, be competent facilitators and cede some of their decision-making power" (Quick and Zhao, 2011).

To summarize, this simplified representation allows a generic but somewhat comprehensive classification of the main actors to involve in a transport decision-making process according to their level of competence, interest and power. Placing the main typical actors in the cube vertexes, even if unrealistic, is intentional to allow a separation and a clear visualization of each stakeholder group. In this respect, it should be considered just as a reference framework and a starting point for stakeholder analysis, useful to understand how to involve them, via appropriate techniques.

This cube representation can be used both to clearly classify the different actors and choose the most appropriate participation tools, and to appropriately deal with heterogeneous stakeholders. The rationale is to plan the participation process trying to maximize the probability of consensus building in the stakeholder group.

This implies acting on the three components (competence, interest and power) so to smooth the differences among the different actors. In this respect, information provision about the reference framework is important to make non-competent stakeholders aware of the problem under discussion, while fostering interaction and communication among powerful and interested stakeholders is important to make them conscious of the different points of view. Besides, competent stakeholders can be fundamental to understand the reference framework, create shared future visions and evaluate the proposed strategies.

Table 2 summarizes the main actors involved in transport planning processes, and suggests some tools to engage them according to the position in the cube. In this respect, many methods have been proposed to support stakeholder engagement in transport planning processes (see, e.g. Bickerstaff et al., 2002; Cascetta and Pagliara, 2013; Kelly et al., 2004). An overview can be found in Le Pira (2015), Franceschini and Marletto (2015), and Le Pira et al. (2017b).

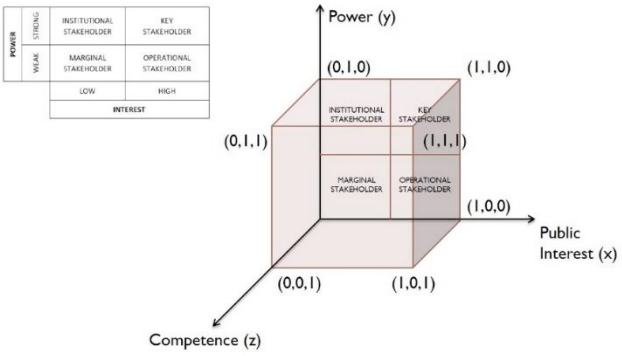
Among them, one could recall:

- *Focus groups*, to provide qualitative data and insight thanks to the participation in a discussion focused on a given subject (Bordagaray et al., 2015). Focus groups are suitable especially in the first phases of context setting with critical issues and constraints, and should foster the involvement of competent, powerful and interested stakeholders.
- *Citizens' juries*, i.e. a small group of people, selected to represent the general public rather than any interest group or sector, which meets to deliberate upon a policy question (Kenyon et al., 2001); in this respect, only members of local communities should be involved.
- *Consensus conferences*, involving diverse stakeholders in interactive, iterative processes in which networks of people with divergent interests in an issue work together to define the problem, create a vision, identify appropriate pathways, and evaluate the impact (Quick and Zhao, 2011); these are especially suitable to try to

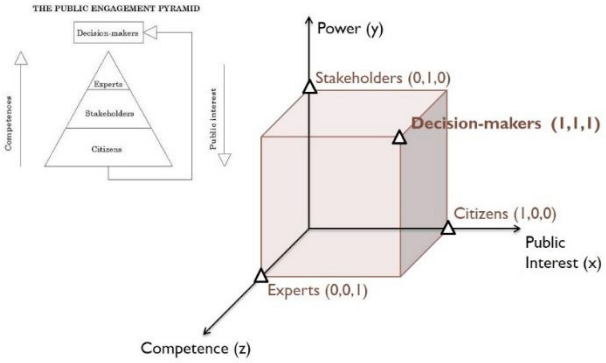
smooth diverging views of powerful stakeholders aimed at finding trade-off between their often conflicting interests.

- The *Delphi method*, an iterative procedure for the convergence of opinions, which is generally used to make experts converge on issues regarding future innovations (Dalkey and Helmer, 1963); it can be useful in the first phases of the planning process, when shared future visions should be defined.
- The *stakeholder dialogue*, a technique based on a facilitated discussion in which stakeholders perform a simplified multi-criteria analysis about the solutions proposed (Franceschini and Marletto, 2015). It should be used to involve interested, competent and powerful stakeholders both in the identification of the most important objectives to be reached and in the assessment of the impacts of different alternatives from a multi-stakeholder multi-criteria perspective.

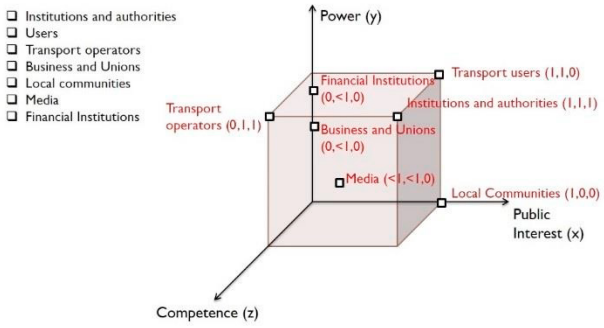
(a) The three-dimensional matrix of public interest/power/competence with the "participation cube" based on Gardner et al. (1986)



(b) The "participation cube" with the actors of the public engagement pyramid based on Le Pira et al. (2016)



(c) The "participation cube" with the seven stakeholder categories in transport planning



(d) The complete "participation cube" with the "Public Participation Practitioner"

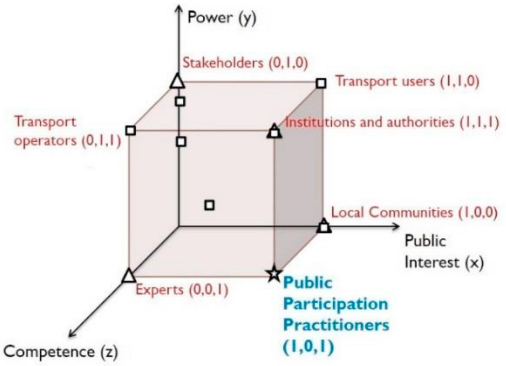


Fig. 3. The "participation cube" (own setup).

Table 2. Main actors involved in transport planning processes and suggested engagement tools.

Actor	Description	Public interest	Power	Competence	Some suggested engagement tools
Institutions and Authorities (i.e. decision-makers)	Decision-makers	✓	✓	✓	-
Transport users	Interested/powerful stakeholders	✓	✓		Focus groups, stakeholder dialogue
Transport operators	Powerful/Competent stakeholders		✓	✓	Focus groups, stakeholder dialogue
Local communities (i.e. citizens)	Interested stakeholders	✓			Citizens' juries, survey
(General) stakeholders	Powerful stakeholders		✓		Consensus meetings, stakeholder dialogue
Experts	Competent consultants			✓	Delphi method, stakeholder dialogue
Public Participation Practitioners	Facilitators	✓		✓	-

Next section will present a practical application to test this framework in a real-world case.

4. Case study

The case study is Acireale, a small city of approximately 50,000 inhabitants located in Southern Italy, with a high touristic vocation thanks to many cultural and historical attractions. It shows basic mobility problems, including lack of accessibility and efficiency of public transport, insufficient infrastructures dedicated to cycling and walking, high level of road congestion, also due to infrastructural inefficiencies of the road network, with consequent air pollution and low levels of livability even in the most prestigious areas of the historical center.

The Municipality has adopted an Urban Mobility Plan in the last years, through which the strategic choices related to the transport system have been defined, and it is currently carrying on the process of defining the Urban Traffic Plan, a short-term operational transport plan aimed at managing and improving the existing resources via appropriate strategies. A participatory procedure has been set up to build the plan together with citizens and stakeholders. The whole process is inspired by MUSA, an Italian project aimed at increasing the capacity of local authorities of southern Italy to design and implement effective policies for sustainable urban mobility (Franceschini and Marletto, 2015).

The participation process involved experts, stakeholders and citizens to define the general and specific plan objectives and the primary strategies that best respond to these objectives. Three main categories are involved in the process, i.e.:

- *experts* or *"key" stakeholders*, involved via in-depth interviews aimed at understanding the planning framework and creating a first draft of the plan scheme, consisting of the aim of the plan, general and specific objectives;
- *stakeholders*, via a stakeholder dialogue to discuss the plan scheme and provide a ranking of importance of the objectives and priority actions;
- *citizens*, involved via a survey to elicit their preferences for plan objectives, and through the creation of a citizens' jury to discuss and validate the final version of the plan scheme and the selection of objectives and priority actions.

For what concerns the stakeholder dialogue, twenty stakeholders have been involved, representative of different categories and chosen to cover all the potential interested parties, including transport companies, citizens associations, trade associations and institutional representatives. Although they can be generically identified as "stakeholders", they can show different competence, interest, and power. In this respect, they include the public via citizen associations, and typical transport stakeholders, i.e. transport companies. Therefore, it becomes useful to understand how these stakeholders can be placed in the "participation cube" to have an insight on the main differences and help dealing with them. In this respect, during the first meeting they were asked to answer a questionnaire with a section to investigate

social aspects, including relationships among them. In particular, they had to evaluate, for each of the stakeholders involved, on a 1-5 scale, if they agreed with the following statements regarding the topic of urban mobility, i.e.:

1) she/he has a significant role (in transport planning)
2) we have frequent exchanges of opinions (related to mobility)
3) we share interests and objectives on the future of mobility in the city
4) we have already started joint projects (related to mobility).

The answers to these questions can be useful to understand how each stakeholder can be placed in the "participation cube" according to the relationships with the others, giving some advice on how to conduct an effective participation process oriented toward consensus building. Of course, linking social aspects with concepts of competence, interest, and power might be misleading and give only a partial vision of the problem. In fact, a deeper behavioral analysis would be needed. However, it is useful to understand how to apply the framework in practice.

In particular, answers to question (1) can be interpreted as representative of the level of "competence" of each stakeholder, according to the "social reputation" they have from the other stakeholders. Question (2) can give an idea of the power of each stakeholder, intended as the "social influence" they have, and can also be used to recreate the SN of stakeholders. Answers to question (3) can help to understand the degree of "public interest" of stakeholders, according to the "sharing of interest" and objectives among them. Finally, question (4) can be used as a "control" question, to check their relationships in terms of degree of collaboration related to joint projects.

It is worthy of notice that the application of the "participation cube" to this specific context, although based on a real-world case, should be considered only as a preliminary test. In this respect, it should be intended as an example based on preliminary data. Results will be presented in the following section.

4.1. Framing stakeholders in the participation cube

Eight stakeholders answered to questions 1-4, expressing judgments (from 1 to 5) with respect to all the other stakeholders involved in the process (belonging to the stakeholder group $S=20$). Stakeholder quantitative evaluations (1-5) were normalized in order to have values between 0 and 1 for each stakeholder i as follows:

$$x_i(interest) = \frac{interest_i - \min interest(S)}{\max interest(S) - \min interest(S)} \tag{1}$$

$$y_i(power) = \frac{power_i - \min power(S)}{\max power(S) - \min power(S)} \tag{2}$$

$$z_i(competence) = \frac{competence_i - \min competence(S)}{\max competence(S) - \min competence(S)} \tag{3}$$

$$\forall i \in S$$

where x, y, and z are the normalized indicators.

Results of each indicator are reported in Table 3, allowing stakeholders to be framed in the "participation cube" (Fig. 4). Stakeholders are also typified according to the classification of Table 1 in: (1) local communities, (2) business and unions, (3) transport operators, and (4) institutions/authorities.

As can be noticed, results are variable in terms of competence, interest, and power, but some clear positions emerge. In this respect, stakeholder 6, belonging to "transport operators", is considered as the most competent actor, given her/his knowledge of the transport sector, while stakeholder 12, belonging to a retailer association, is considered as the most powerful, given her/his relationships with the others, which is quite realistic since, in general, retailers are among the most influential categories. Finally, stakeholder 15, belonging to the clergy, is considered as the one with the highest public interest, representing the objectives of the whole community.

There are some stakeholders with low power and variable interest/competence, e.g. stakeholders 11 and 16 belonging to the category "local communities". The most competent stakeholders are in general transport operators (stakeholders 6 and 20), even if also stakeholders 12 (retailer association), 14 (citizen association) and 17 (association of professionals) are considered competent. These stakeholders are also powerful and share interests with the others. Therefore, they can be considered as relevant stakeholders that can affect the outcome of the participation process. The stakeholders with less public interest are surprisingly belonging to "local communities" (10 and 11), and 3, 4 and 8 belonging to "business and unions". This result can be interpreted as the lack of relationships with the other actors. In fact, the question to investigate this issue regarded the sharing of interests and objectives on the future of urban mobility. Together with the stakeholder belonging to the clergy, other stakeholders sharing common interests belong to association of professionals (stakeholder 17), and to an environmental association (stakeholder 18).

Table 3. Stakeholder classification: interest, power and competence.

	Stakeholder	**Type**	**x (I)**	**y (P)**	**z (C)**
1	Cultural association	Local communities	0.51	0.72	0.34
2	Transport association	Transport operators	0.40	0.44	0.21
3	Business association	Business and Unions	0.17	0.36	0.18
4	Tourism association	Business and Unions	0.17	0.39	0.46
5	Association of professionals	Business and Unions	0.51	0.50	0.00
6	Transport operator	Transport operators	0.63	0.36	**1.00**
7	Trade Union	Business and Unions	0.51	0.50	0.26
8	Trade Union	Business and Unions	0.38	0.41	0.13
9	Citizen association	Local communities	0.63	0.44	0.43
10	Consumer association	Local communities	0.00	0.36	0.07
11	Citizen association	Local communities	0.17	0.00	0.18
12	Retailers association	Business and Unions	0.61	**1.00**	0.66
13	Retailers association	Business and Unions	0.65	0.44	0.26
14	Citizen association	Local communities	0.85	0.60	0.66
15	Clergy	Institutions/Authorities	**1.00**	0.90	0.26
16	Environmental association	Local communities	0.38	0.12	0.09
17	Association of professionals	Business and Unions	0.74	0.70	0.77
18	Environmental association	Local communities	0.74	0.44	0.21
19	Trade union	Business and Unions	0.51	0.48	0.34
20	Transport operator	Transport operators	0.65	0.36	0.92

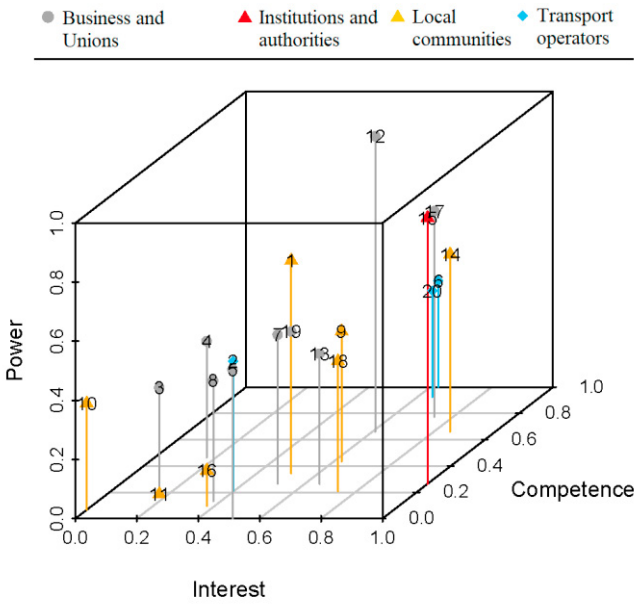


Fig. 4. The participation cube with the stakeholders involved (built using the software R).

Overall, stakeholders are quite scattered in the participation cube showing, on average, a medium value of public interest (0.51) and competence (0.48), and a lower value of power (0.37), but with a quite high standard deviation (respectively 0.25, 0,23, 0.29). PPP should carefully manage stakeholder relationships, trying to avoid coalitions of the most powerful ones (see e.g. transport operators and retailers), informing and engaging them in a continuous dialogue, in particular less competent/public interested stakeholders, so to increase the awareness of the public problems under consideration, and foster consensus building. Besides, it can be interesting to see how they are linked in a social network, by using answers to questions (2) and (4).

4.2. Stakeholder network analysis

A smaller network with the eight stakeholders that answered to the questionnaire was built up with the results of question (2). We decided to include only the stakeholders who participated in this survey so to have a fair mutual evaluation from both sides. In particular, links were created according to the quantitative evaluations provided for each stakeholders, i.e. 0 if no relationship exists, 1-5 according to the degree of exchange of opinions. The network emphasizing stronger relationships is presented in Fig. 5a showing a good graph density (0.70), in terms of proportion of direct ties with respect to the possible number of ties.

It is possible to evaluate two simple centrality measures, i.e. in-degree and out-degree centrality, consisting of the number of links directed to and from a given node. These indexes has been weighted according to the entity of the connections between any two nodes, by averaging the values obtained from individual evaluations (ranging from 1 to 5). Results are presented in Table 4. As can be noticed, stakeholder 12, belonging to a retailer association, is the most central, both in terms of in-degree and out-degree centrality, while stakeholder 11 (citizen association) is the less central one. These results of course confirm the ones obtained by framing stakeholders in the participation cube, but they can also help to have a deeper insight on the relative levels of power/influence. As an example, some asymmetries are visible by comparing in-degree and out-degree centralities for each stakeholder. In this respect, stakeholder 5 (association of professionals) shows a higher out-degree centrality with respect to in-degree, while the opposite occurs for stakeholder 14 (citizen association). Since in-degree centrality can be associated with “reputation”, while out-degree can be seen as a measure of “sociability”, it can be concluded that the former is more willing to cooperate with

the others, but he/she has not the same degree of social reputation, while the opposite occurs for the latter. The ability of the PPP should be to understand the main characteristics and differences among stakeholders and cope with them to try to find a convergence of opinions.

Table 4. Centrality measures in the stakeholder network.

	Stakeholder	Weighted in-degree centrality	Weighted out-degree centrality
1	Cultural association	1.63	1.88
5	Association of professionals	1.75	2.50
9	Citizen association	2.00	2.00
11	Citizen association	0.88	0.63
12	Retailers association	**2.88**	**3.00**
14	Citizen association	1.88	1.25
17	Association of professionals	2.00	2.13
20	Transport operator	1.25	0.88

We also compared these results with those obtained by using the answers to question 4, i.e. "we have already started joint projects (related to mobility)". In this respect, centrality values are lower than the ones obtained in the previous case, demonstrating that stakeholders often exchange opinions but do not share joint projects related to mobility. Overall, the networks are quite similar (see Fig. 5b), showing a bit lower graph density in the second case (0.66) and confirming the same most influential stakeholders, i.e. 12 and 5.

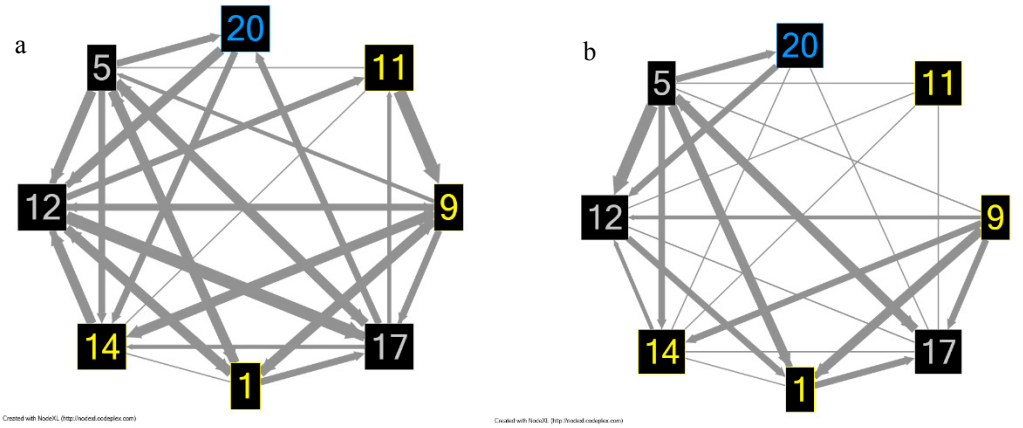


Fig. 5. Stakeholder social networks built using (a) answers to question 2 and (b) answers to question 4 (built using NodeXL).

5. Discussion and conclusion

The results presented refer to a small sample and to a specific case, built with the intention to prove the feasibility of the proposed framework for stakeholder analyses. As such, they cannot be generalized and they do not allow making any robust implications for policy-making. Nevertheless, some useful hints for discussion and further research emerge from the simple application presented, and will be briefly discussed in the following.

- Data acquisition. The results obtained strongly depend on the data acquired, i.e. the questions used to elicit stakeholder opinions about the other actors involved. In this respect, more questions, e.g. related to the frequency

or type of collaboration, would be useful to have a deeper insight on social issues, and a wider behavioral analysis, based on in-depth interviews with each stakeholders, would allow to appropriately understand their role with respect to transport issues.

- "Social capital" dynamics. Social capital has several definitions, and according to OECD it can be seen as "networks together with shared norms, values and understandings that facilitate cooperation within or among groups" (Keeley, 2007). Monitoring the creation (or destruction) of social capital, by repeating the questionnaire during the participation process, can be useful to understand the dynamics of interaction and participation, and to have an indicator of the success of participation (Franceschini and Marletto, 2017; Drazkiewicz et al., 2015).
- SNA metrics. In the example shown, indicators based on the number (and weight) of links were used. More sophisticated centrality indexes can be used to assess the importance of stakeholders in a network. As an example, "betweenness centrality" can give an idea of the stakeholders that can act as "bridge" between other stakeholders who are not connected between each other, while "eigenvector centrality" can undercover the most influential stakeholders being those connected with already well-connected ones (Barabási and Pósfai, 2016).
- Tool for stakeholder analysis. In the exercise presented in this paper, several tools have been used for stakeholder analysis, from a direct questionnaire, to the software R (R Core Team, 2013) and the social network analysis software NodeXL (Smith et al., 2010). A unique tool performing this type of stakeholder analysis is desirable, combining data acquisition and processing, and visualization of results, as already done e.g. by StakeSource cited in section 2.
- Role of PPP. Results of stakeholder analysis should be clear and easily interpretable by PPP and decision-makers. In this respect, PPP have a fundamental role in understanding how to deal with the different stakeholders, and how to tailor the participation process according to the different level of competence, interest and power in the stakeholder network.
- Limits of quantitative approaches. It is important to acknowledge the limits of quantitative approaches to assessing and determining participation processes and their outcomes. In this respect, the proposed participation cube is not exempted to some limitations in practice. First, the cube in itself is not able to capture the heterogeneity of competence, interest, and power that stakeholders can have, nor the underlying motivations of these differences (e.g. competence related to tacit knowledge of citizens or to specific expertise). According to the way indicators are determined (i.e. according to the data acquired), there is the risk of privileging or neglecting certain forms of knowledge and expertise. Second, while the cube can be useful to have an overview of the role of the different stakeholders involved, understanding how to interpret the obtained results cannot be easy, e.g. how to effectively take into account the heterogeneity of competence, interest, and power that can be present in the same stakeholder group. Finally, one should bear in mind the inherent political nature of transport planning, where decisions can be driven by stakeholders, but are inevitably affected by political interests (Legacy, 2016). In this respect, the cube does not allow to understand how political issues affect the distribution of competence, interest and power among the stakeholders.

In conclusion, the Authors are aware that the proposed framework is a simplification and, at present, more focused on theory with limited practical implications, and should be applied in different participatory decision-making contexts to confirm its usability and usefulness. Nevertheless, it represents an attempt to provide a simple procedure and a framework for stakeholder analysis in participatory transport planning processes. Categorizing stakeholders according to their level of competence, interest, and power can help planning effective participation processes. In this respect, literature generally focuses on methods and tools to support consultation and participation, most of the time neglecting procedures and methods for a preliminary stakeholder analysis. The aim is to carry out effective participation processes by knowing in advance what role each stakeholder can play in the final decision. This is consistent with the concept of "Planning for people" advocated by the EU with the SUMP, where participation of stakeholders and citizens is considered fundamental to design effective strategies to foster sustainable mobility in our cities.

Acknowledgements

This work has been partially financed by the University of Catania within the project "Piano della Ricerca Dipartimentale 2016-2018" of the Department of Civil Engineering and Architecture and the project "Piano per la Ricerca 2016-2018 - Linea di intervento 2" of the Department of Electric, Electronic and Computer Engineering.

References

Arnstein, S. R., 1969. A ladder of Citizen Participation. Journal of the American Planning Association, 35, 216-224.

Ballantyne, E. E., Lindholm, M., & Whiteing, A., 2013. A comparative study of urban freight transport planning: addressing stakeholder needs. Journal of transport geography, 32, 93-101.

Banister, D., 2008. The sustainable mobility paradigm. Transport policy, 15(2), 73-80.

Barabási, A. L., & Pósfai, M., 2016. Network science. Cambridge University press.

Bickerstaff, K., Tolley, R., & Walker, G. 2002. Transport planning and participation: the rhetoric and realities of public involvement. Journal of Transport Geography, 10(1), 61-73.

Bickerstaff, K., & Walker, G., 2005. Shared visions, unholy alliances: Power, governance and deliberative processes in local transport planning. Urban Studies, 42(12), 2123-2144.

Boccaletti, S., Latora, V., Moreno, Y., Chavez, M. & Hwang, D.-U. 2006. Complex networks: Structure and dynamics. Physics Reports 424, 175 – 308.

Bordagaray, M., Dell'Olio, L., Ibeas, Á., Barreda, R., & Alonso, B. 2015. Modeling the service quality of public bicycle schemes considering user heterogeneity. International Journal of Sustainable Transportation, 9(8), 580-591.

Borgatti, S., Everett, M., & Freeman, L. 2002. Ucinet for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies.

Cascetta, E., Cartenì, A., Pagliara, F. & Montanino, M. 2015. A new look at planning and designing transportation systems: A decision-making model based on cognitive rationality, stakeholder engagement and quantitative methods. Transport Policy 38, 27-39.

Cascetta, E. & Pagliara, F. 2013. Public engagement for planning and designing transportation systems. Procedia - Social and Behavioral Sciences 87, 103 – 116.

Dalkey, N., & Helmer, O., 1963. An experimental application of the Delphi method to the use of experts. Management science, 9(3), 458-467.

Flyvbjerg, B., 1998. Rationality and Power: Democracy in Practice. Chicago: University of Chicago Press.

Franceschini, S., & Marletto, G. 2015. Assessing the benefits and the shortcomings of participation–findings from a test in Bari (Italy). Journal of Transport Geography, 44, 33-42.

Franceschini, S., & Marletto, G. 2017. The dynamics of social capital during public participation: new knowledge from an on-going monitoring. CRENOS Working Paper 2017/06. Available at: https://www.researchgate.net/publication/318835120_THE_DYNAMICS_OF_SOCIAL_CAPITAL_DURING_PUBLIC_PARTICIPATION_NEW_KNOWLEDGE_FROM_AN_ON-GOING_MONITORING

Gardner, J., Rachlin, R., & Sweeny, A. 1986. Handbook of strategic planning. New York: Wiley.

Gatta, V., & Marcucci, E., 2016. Stakeholder-specific data acquisition and urban freight policy evaluation: evidence, implications and new suggestions. Transport Reviews, 36(5), 585-609.

Gatta, V., Marcucci, E., Delle Site, P., Le Pira, M., & Carrocci, C. S., 2019. Planning with stakeholders: Analysing alternative off-hour delivery solutions via an interactive multi-criteria approach. Research in Transportation Economics, 73, 53-62.

Giuffrida, N., Le Pira, M., Inturri, G., & Ignaccolo, M., 2019. Mapping with Stakeholders: An Overview of Public Participatory GIS and VGI in Transport Decision-Making. ISPRS International Journal of Geo-Information, 8(4), 198.

Gonzalez-Urango, H., & García-Melón, M. 2018. Stakeholder engagement to evaluate tourist development plans with a sustainable approach. Sustainable Development 1-12.

Jackson, M. O. 2008. Social and Economic Networks. Princeton: Princeton University Press.

Keeley, B., 2007. Human Capital: How what you know shapes your life. OECD Publishing

Kelly, J., Jones, P., Barta, F., Hossinger, R., Witte, A., Wolf, A.C., 2004. Successful Transport Decision-making: a project management and stakeholder engagement handbook. Volume 1: Concepts and tools; Volume 2: fact sheets. European Commission

Kenyon, W., Hanley, N., & Nevin, C. 2001. Citizens' juries: an aid to environmental valuation?. Environment and Planning C: Government and Policy, 19(4), 557-566.

Le Pira, M., 2018. Transport planning with stakeholders: an agent-based modelling approach. International Journal of Transport Economics 45, 1, 15-32.

Le Pira, M., 2015. Towards participatory decision-making processes in transport planning: an agent-based approach. PhD Thesis. University of Catania. Available at: http://dspace.unict.it/handle/10761/3934

Le Pira, M., Ignaccolo, M., Inturri, G., Pluchino, A., & Rapisarda, A. 2016. Modelling stakeholder participation in transport planning. Case Studies on Transport Policy, 4(3), 230-238.

Le Pira, M., Inturri, G., Ignaccolo, M., Pluchino, A., & Rapisarda, A. 2017a. Finding shared decisions in stakeholder networks: an agent-based approach. Physica A: Statistical Mechanics and its Applications, 466, 277-287.

Le Pira, M., Inturri, G., Ignaccolo, M., & Pluchino, A. 2018. Dealing with the Complexity of Stakeholder Interaction in Participatory Transport Planning. In Advanced Concepts, Methodologies and Technologies for Transportation and Logistics (pp. 54-72). Springer, Cham.

Le Pira, M., Marcucci, E., Gatta, V., Ignaccolo, M., Inturri, G., & Pluchino, A. 2017b. Towards a decision-support procedure to foster stakeholder involvement and acceptability of urban freight transport policies. European Transport Research Review, 9(4), 54.

Legacy, C., 2016. Transforming transport planning in the postpolitical era. Urban studies, 53(14), 3108-3124.

Legacy, C., Curtis, C., & Sturup, S., 2012. Is there a good governance model for the delivery of contemporary transport policy and practice? An examination of Melbourne and Perth. Transport Policy, 19(1), 8-16.

Legacy, C., & Stone, J., 2019. Consensus planning in transport: The case of Vancouver's transportation plebiscite. Transportation Research Part A: Policy and Practice, 120, 295-305.

Lim, S.L., Quercia, D., Finkelstein, A. 2010. StakeSource: harnessing the power of crowdsourcing and social networks in stakeholder analysis. In Proceedings of the 32nd ACM/IEEE International Conference on Software Engineering-Volume 2 (pp. 239-242)

Macharis, C., De Witte, A., & Ampe, J., 2009. The multi-actor, multi-criteria analysis methodology (MAMCA) for the evaluation of transport projects: Theory and practice. Journal of Advanced transportation, 43(2), 183-202.

Marcucci, E., Le Pira, M., Gatta, V., Inturri, G., Ignaccolo, M., & Pluchino, A. 2017. Simulating participatory urban freight transport policy-making: Accounting for heterogeneous stakeholders' preferences and interaction effects. Transportation Research Part E: Logistics and Transportation Review, 103, 69-86.

Mitchell, R. K., Agle, B. R., & Wood, D. J. 1997. Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. Academy of management review, 22(4), 853-886.

Prell, C., Hubacek, K. & Reed, M. 2009. Stakeholder Analysis and Social Network Analysis in Natural Resource Management. Society & Natural Resources: An International Journal, 22, 501-518.

Quick, K. & Zhao, Z. J. 2011. Suggested Design and Management Techniques for Enhancing Public Engagement in Transportation Policymaking. Report No. CTS 11-24, Center for Transportation Studies, University of Minnesota, Minneapolis, Minnesota.

R Core Team, 2013. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

Ryley, T.J., Zanni, A.M., 2013. An examination of the relationship between social interactions and travel uncertainty. Journal of Transport Geography 31, 249-257

Schonk, T., Hartmann, T. & Zerjav, V. 2011. Visualizations of Social Networks as support for stakeholder management within construction projects. Management and Innovation for a Sustainable Built Environment. Amsterdam.

Scott, J. 2013. Social network analysis. SAGE Publications Ltd

Smith, M., Ceni A., Milic-Frayling, N., Shneiderman, B., Mendes Rodrigues, E., Leskovec, J., Dunne, C., 2010. NodeXL: a free and open network overview, discovery and exploration add-in for Excel 2007/2010/2013/2016, from the Social Media Research Foundation: https://www.smrfoundation.org

Walker, P., 2009. Dinosaur DAD and Enlightened EDD–engaging people earlier is better. The environmentalist, 71, 12-13.

Wefering, F., Rupprecht, S., Bührmann, S. & Böhler-Baedeker, S. 2014. Guidelines. Developing and Implementing a Sustainable Urban Mobility Plan. Rupprecht Consult – Forschung und Beratung GmbH.