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To cite this article: Darja Vrščaj , Sven Nyholm & Geert P. J. Verbong (2021) Smart mobility innovation policy as boundary work: identifying the challenges of user involvement, Transport Reviews, 41:2, 210-229, DOI: [10.1080/01441647.2020.1829743](https://doi.org/10.1080/01441647.2020.1829743)

To link to this article: <https://doi.org/10.1080/01441647.2020.1829743>



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Published online: 09 Oct 2020.



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# Smart mobility innovation policy as boundary work: identifying the challenges of user involvement

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## ABSTRACT

In 2013 the Dutch Minister for Infrastructure and Water Management initiated a policy programme that aimed to develop a transition towards smart mobility. A Roadmap was developed to support the policy innovation programme because previous initiatives have failed due to the lack of a strategic document. The Roadmap's first transition pathway (policy goal) called for a development of a user-centric smart mobility. We analysed how this policy goal has been enacted. We conducted 32 semi-structured interviews with relevant smart mobility practitioners, which we have analysed through our theoretical framework consisting of three boundary concepts: boundary work, boundary objects and boundary organisations. Additionally, we have drawn from the literature on user-involvement. The boundary concepts have led us to identifying two main challenges that led to an unsuccessful realisation of the policy goal. One, the responsibilities for involving users have been transferred to numerous actors, who renegotiated the goals assigned to them by the Ministry, resorting to their old techno-centric innovating ways. The dominance of the techno-centric perspective acted as a barrier and inhibited a successful implementation of a more user-centric approach. Two, a key criterion for successful realisation of the pathway – namely, the support of an organisation specifically held accountable for realising the pathway – was absent. In our conclusion we provide recommendations for a more successful user-inclusion, as well as reflections on the state of the smart mobility policy in The Netherlands.

## ARTICLE HISTORY



Received 30 August 2019  
Accepted 23 September 2020

## KEYWORDS

Dutch smart mobility policy; innovation policy; boundary work; user involvement; user-centered design; smart mobility transition; transition pathway

## 1. Introduction

Recent decades have seen a shift in traffic management policy in the Netherlands, particularly regarding how decision-makers deal with road users. In the past, public parties in

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local and national government provided information to travellers collectively, using the radio and road boards. By the 2000s, smart mobility technologies enabled real-time travel and traffic information to be delivered directly to individual users, via their personal devices. Consequently, users could manage their journey optimally, based on their individual travel needs and preferences. For the first time, users and their specific needs became visible to traffic management decision-makers. Moreover, user-centric design, as opposed to a technology-driven approach, now became a stated objective for Dutch transport policy, as a report compiled by external policy advisors reveals.<sup>1</sup>

This approach was formalised in 2013 when the Dutch Ministry of Infrastructure and Water Management RWS (the Ministry) developed a “Routekaart” (literally Roadmap) underpinning the Dutch transition towards a new smart mobility market: “Better informed on the road 2013–2023” (Interviews 8, 31, 32; de Mooij, 2013). The transition aimed to stimulate a more efficient and sustainable mobility system through innovations (de Mooij, 2013). These changes were needed because the traffic system was facing multiple challenges like noise and air pollution, natural resource depletion, inefficient infrastructure utilisation, congestion and safety concerns (Geels, 2012). The Ministry defines smart mobility innovations as ICTs, like personal mobile devices, providing real-time travel information. Its Roadmap describes emerging smart mobility opportunities and their intended societal benefits, thereby identifying goals and transition paths to guide the implementation process.

The Roadmap’s first transition path focuses on users:

Facilitating road users in a better way. Working on a new perspective: from supply-driven to demand-driven. Coming up with ideas based more on the needs of road users and less on the technology. (p. 8)

From a user perspective, a smart mobility transition implies that users would have to change their mobility behaviour (Mont, 2004; Schot & Geels, 2008; Sopjani, Stier, Ritzén, Hesselgren, & Georén, 2019), by following real-time traffic and travel advice to avoid traffic jams, or using car- and ride-sharing applications. This transition path reinforces that the challenge for smart mobility transition is not merely designing the innovations, but also implementing them in ways that stimulate users to change their travel behaviour (Sopjani et al., 2019). In other words, the challenge is about designing smart mobility innovations that match user needs, and knowing user needs also requires involving users in the design process (Hyysalo, 2016; Kujala, 2010).

The role of users has been a major theme in other “smart technology fields” like smart grids and smart cities. Users are not only assumed to benefit from the new options; they also are expected to play a more active role. In practice, however, it has proven difficult to engage users (Geelen, Reinders, & Keyson, 2013). Often, project and pilot developers revert to a technology-driven approach (Verbong, Beemsterboer, & Sengers, 2013).

In this paper, we focus on the Dutch Ministry and other actors’ struggles to adopt a more user-centric approach. In the Dutch consensus-type of democratic and neo-corporatist political regime, (Hoppe, 2009) a document like the Roadmap is not a regulatory instrument but a starting point for societal negotiations. In this context our overarching research question is: how has the Dutch innovation policy goal calling for “facilitating road users in a better way” been enacted? We find that actors translate the Roadmap path in different ways, with different objectives and mixed results. This is a common

phenomenon in the interaction between science, policy, and practice. Sociologists have introduced the *boundary* concept to understand these processes. We can generally define the *boundary* concept as a focus on the social functions of people's discourses, how they build symbolic boundaries, and how communication nevertheless works across them (Riesch, 2010). We will use the boundary concept as a theoretical lens to understand the process of implementing a user-centric innovation policy, as indicated in the Smart Mobility Roadmap.

## 2. Theory

In this section we will explain the theoretical concepts used. First, we will introduce the concept of user involvement, which will be followed by explanations of the boundary concepts: boundary objects, boundary work, and boundary organisations.

### 2.1. User involvement

The first transition pathway in the smart mobility Roadmap presents the challenge of involving road users in the innovation design process. This issue is addressed extensively in the literature, including, for example, on consumption, innovation and information systems, but also from Science and Technology Studies (STS) (Hyysalo, 2016). "User involvement" refers to participation in the development process by potential users or their representatives, with varying levels of control to shape a technological future (Barki & Hartwick, 1989; Vines, Clarke, Wright, McCarthy, & Olivier, 2013). Companies involve users in various ways to manage uncertainty about customer and market, or end-user, needs (Piller, Ihl, & Vossen, 2010).

The literature on innovation is divisive. There is an overwhelming consensus that innovations which do not meet user needs will fail. However, numerous empirical studies show that companies often fail to meet some of the below-mentioned criteria for a desirable level of involvement, e.g. enabling them with a high level of decision-making power, or involving unrepresented users (Oudshoorn, Rommes, & Stienstra, 2004; van den Hoven, 2013; Woolgar, 1990). Thus in practice, user involvement in the innovation process is hampered in several ways. A common reason is ignoring the diversity of users. Another is adopting (often unwittingly) the so called I-methodology, whereby designers consider themselves representatives of users, which leads to excluding the needs of users who are less technology-savvy (Akrich, 1994; Oudshoorn et al., 2004). Innovators have continually failed to consider the unintended impacts of innovation, like privacy and security concerns raised by users in the later stages of the innovation process (van den Hoven, 2013).

The concept of user involvement is typically understood through three dimensions. First, *the stage of the innovation process when users are involved*, e.g. whether in the early stages (idea generation and concept development) or whether in the back-end (product design and testing) (Kaulio, 1998; Piller et al., 2010). Second, *the degrees of power that users have in decision-making* can range from a product being designed for users, with users, or by users, the latter one being the most inclusive (Kaulio, 1998). This also relates to degrees of autonomy and freedom, e.g. whether it is a narrow and pre-defined task with only a few degrees of freedom or whether it is an open and creative task that might lead to unforeseeable outcomes (Piller et al., 2010). Third, *diversity of users*

relates to seeing inclusion as an agenda to empower groups of people whose views, opinions, and needs might sometimes or often be ignored by mainstream society. Here, user involvement means working with user groups who might normally be excluded (Vines et al., 2013).

In our case, users are those who are directly benefiting from the solutions, e.g. the end-users. Although most of the actors such as innovators, or the policy officers, can also be seen as users, we concluded that considering actors' multiple roles would not significantly contribute to our research objective. Instead, we wanted to analyse their role in the enactment of the transition path by comparing actors' actions to their envisioned primary roles.

## 2.2. Boundary concepts

Initially developed in the 1980s in the STS field, and later adopted by management and organisational studies (Cook & Brown, 1999), the *boundary concept* help us to understand the complexities of scientific production. The "boundary" concept was proposed by Gieryn (1983). He argues that the boundaries between science and "non-science" are sometimes ideological or arbitrary, as they are perceived differently by different groups of scientists and have varying meanings for different groups of actors (professional and non-professional) and are also evolving over time. A significant amount of boundary work concerns the relationship between science and policy outcomes. (Gieryn, 1999; Gregory, 2003; Riesch, 2010). Since the 1980s, the boundary concept has evolved. In their literature overview, Orsini, Louafi, and Morin (2017) identify three directions that explain the relationship between policy and knowledge production: boundary objects, boundary work and boundary organisations.

### 2.2.1. Boundary objects

Star and Griesemer (1989) pointed to the role *boundary objects*. These are "objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (Star & Griesemer, 1989, p. 393). These objects enable communication and translation among various actor groups, which despite having different aims, norms, values or beliefs, still need to work together. Typical objects are a scientific article or a policy document like a roadmap. Further seminal work on the concept was done by Löwy (1992), who defined a contemporary boundary object as being composed of a hard core – the zone of agreement among interacting professional groups – and a fuzzy periphery, which is different in each group. The main element of the concept is an interpretative flexibility, relating to the "fuzzy" part that enables heterogeneous groups to form alliances.

Boundary objects are typically science or policy documents and have thus been alternatively framed as forms of texts, and analysed through a discursive approach (Oswick & Robertson, 2009). Adopting such a framing led Oswick and Robertson (2009) to developing a critical perspective of seeing boundary objects not only acting as "bridges and anchors" promoting change, or promoting communication amongst actors to work towards a common goal. Instead, they found that boundary objects sometimes create "barricades and mazes, protecting and/or privileging different interests groups' frames and references or occupational positions, rather than creating new shared understandings and perspectives which can inhibit and constrain the possibilities for change"

(Oswick & Robertson, 2009, p. 181). Hoppe (2009) further contributed to the discursive approach by developing a typology of ideological discourse types amongst science and policy actors, which range on boundary arrangements in terms of which knowledge domain inherits more power. For example, the enlightenment and technocracy models emphasises the separation between politics and science and primacy of science (Hoppe, 2005).

### 2.2.2. *Boundary work*

Whereas boundary objects are the instruments to enable communication and collaboration among different actor groups, boundary work consists of the efforts of actors involved to make this happen. For example, the gathering of experts (e.g. economic, environmental, social scientific) at the Round Table on Sustainable Palm Oil, to discuss the potential to make sustainable palm oil the norm, has been analysed as boundary work (Offermans & Glasbergen, 2015). This example focuses on the differences in interpretations by scientific and non-scientific actors. Researchers studying boundary work not only focus on the role of objects like the Roadmap but also on the interpretations and social interactions related to the topic. Boundary work are the efforts by actors to successfully enlist other actors to accept envisaged objectives and accompanying roles (Riesch, 2010). It requires the translation of these objectives in a way that makes them acceptable and induces actions required. During this process, actors negotiate and establish their own goals, tasks, and margins of interaction (Callon, 1984).

Star and Griesemer (1989) argue that when it comes to the process of translation, “the important questions concern the flow of objects and concepts through the network of participating allies and social worlds” (p. 389). They see translations as a many-to-many mapping, where several actors negotiate with several kinds of allies and create an obligatory passage point (Callon, 1984). This passage point signifies the moment when a certain actor’s identity, expertise, and knowledge become indispensable. In other words, several groups of actors typically conduct boundary work simultaneously around the same issue, for example the attempt to develop a smart mobility market.

We analyse the boundary work by focusing on the translation efforts of the main actors involved. It emphasises how actors, during a process of translating the objectives to social practices, develop multiple meanings of a given boundary object. Boundary objects act as common information spaces that enable interaction and coordination without consensus or shared goals (Oswick & Robertson, 2009).

### 2.3. *Boundary organisations*

Similar to boundary objects, *boundary organisations* are found at the margins of two professional domains, or social worlds, such as politics and science (Guston, 2001; Miller, 2001). These institutions conduct boundary work or translate their knowledge and build joint knowledge with alliances (Cash et al., 2003; Guston, 2001). They add an additional criterion to the boundary concept, namely accountability, which they distribute across the margins. According to Guston (2001), boundary organisations are explicitly set up to manage or study the boundary between science and politics. For example, a technology transfer office conducts boundary work by encouraging collaboration between

scientists and technology transfer specialists, through invention disclosures (Orsini et al., 2017).

The concept of boundary organisations is overlapping with the concept of *intermediaries*, who are also engaged in a lot of boundary work, for example, when different types of actors need to cooperate or when different interests are at stake. Increasing attention has been given to the role of intermediation and intermediaries in systemic change (Kivimaa, Boon, Hyysalo, & Klerkx, 2019; Van Lente, Hekkert, Smits, & Van Waveren, 2003). Systemic change requires the collaboration of a large number of heterogeneous actors. Intermediaries are seen as important actors to make these complex social networks function. In the typology of Kivimaa, intermediaries are distinguished by the context of operation, goals, normative aspects (sustainability), interests and interrelations (Moss, 2009). This involves different types of activities.

The boundary work literature focuses on the content of part of intermediation (role of objects like the roadmap) and preventing differences in interpretations becoming an obstacle for the projects at stake. Systemic intermediaries are doing this type of work, but the scope of their activities is much larger. We used the boundary work framework because we focused on the interpretation of the role of users in a Smart Mobility policy programme and on programme's impacts.<sup>2</sup>

To summarise, we analyse the Ministry's efforts to establish a user-centric smart mobility market by utilising the boundary concepts in three steps: first, we analysed the Roadmap (and similar objects) as a boundary object. Next, approaching the pathway implementation process as boundary work, we focused on translation processes to analyse the resulting complex actor-world in relation to the (lack of) involvement and representation of users. Finally, we used the concept of boundary organisations to analyse the emergence of organisations trying to support the roadmap goal. The key issue here was determining who was responsible for achieving these goals.

### 3. Methods

We tracked the main actors' process of developing the Dutch Smart Mobility Roadmap. The initial step was analysing publicly available policy documents, such as an important letter written by Minister Melanie Schultz van Haegen stressing the need to develop a Roadmap, then the Roadmap itself, and the websites of influential Dutch smart mobility projects. We analysed the envisioned actor-network by considering which actors are mentioned and what their roles are expected to be. We focused on the envisioned role of users.

Subsequently, we conducted 32 h-long interviews with key stakeholders, including policymakers, public and private parties, NGOs, and researchers. We first interviewed actors involved in creating the Roadmap and its preceding programmes, followed by its catalysers, evaluators, and other developers of smart mobility solutions that were supposed to follow the Roadmap's pathways. Through these interviews, and using the snowball method, we were able to identify a broad network of actors enacting the vision for the Roadmap. The interviewees also shared non-publicly available documents, such as project specifications.

Our interviews were semi-structured and open-ended, as we were interested in how actors interpret and otherwise apply the Roadmap, our particular focus being whether



they included the users, and if so, in which innovation process stages, what types of users, and how much decision-making power were users given. The above-described theoretical framework informed our interview questions aimed at understanding actors' motivations and goals: how and whether actors use the Roadmap in their work; how and whether they include users in their project and innovation process; who they collaborate with; and additional aspects of their tasks, goals, or projects.

We analysed the interview transcriptions by creating codes for the three boundary concepts and clustering the transcription segments accordingly. From these, we extracted and compiled an overview of interviewee quotes describing actor enactments, and identified the factors contributing to translation successes and failures in the innovation process (see table in the [Appendix](#)).

## 4. Results

We have structured the results in three major clusters: the first addresses the Roadmap as a boundary object, the second is the boundary work to implement the Roadmap, and the third focuses on key boundary organisations involved. The results are presented in a chronological order, as much as possible.

### 4.1. Developing a boundary object

The process of developing the Dutch smart mobility market dates back to events from the 1990s up to 2013 (Interviews 1, 8, 31). Previously, traffic management and information were separate activities, both conducted by public parties. In the 1990s, the government decided to outsource the collection and delivery of traffic information. By the 2000s, with new technologies for delivering personalised traffic information and managing traffic via social media and personal devices, the two tasks were seen as inseparable and best handled by private parties. These ideas were discussed at mobility-related events (Interview 31); in 2009, the NGO Connekt (a smart, sustainable and social mobility network) encouraged the development of the SBVV group (strategic council for traffic information and traffic management) as a strategic discussion platform for Public-Private-Partnerships (PPP) in the traffic management transition. In 2011, the group sent the Ministry possible scenarios for the transition, which was the first instance where the Netherlands formally asserted the need to prioritise user needs rather than a technology-push approach in transport policy (Interviews 8, 31). However, these initial attempts had little impact, as they lacked the support of powerful representatives, a proper budget, and clear paths (Interviews 8, 31, 32).

In 2013, the Ministry took the initiative for a nation-wide transition in mobility. On February 7, Minister Schultz wrote to parliament, indicating that the Netherlands should develop a smart mobility market, involving solutions with real-time information. This would both promote policy goals regarding accessibility, quality of life and security, as well as give Dutch businesses a stronger competitive edge. Notably highlighting the significant societal benefits, Shultz van Haegen considered it her responsibility to create this smart mobility market by initiating the Roadmap. She expected this to be a 10-year coordination agreement, offering support and reassurance to all parties involved in the transition.



In order to disseminate these ideas, a further document was needed to attract a broad array of actor groups, who would in turn form alliances with the Ministry to develop user-centric smart mobility. In other words, the Ministry needed a boundary object. However, government policymakers did not write this document, but outsourced it to actors who could then represent the interests of various actors crucial for realising its vision. The Ministry called for collaboration among private parties (service developers, network providers), public parties (regions, municipalities), knowledge institutions (NGOs, Dutch universities) and end-users (Dutch travellers, the public).

Together with Connekt, the Ministry formalised a group of allies to consult and represent the interests of the private parties developing the Roadmap. They were called the 5 November group.<sup>3</sup> They consisted of carefully selected individuals with a personal interest in seeing the transition succeed (Interview 4). This was supposed to overcome the challenges of previous roadmap attempts, where no private parties were represented. However, despite users being central to the Roadmap and the only actors explicitly mentioned in the first Roadmap pathway, there were no users or user organisations in the 5 November group. All the actors except one were different from those in the SVBB group. Whereas the SVBB had representatives from radio stations, the 5 November group signified a smart mobility actor-network with new entrants and companies working on data collection and mapping.

Initially, the 5 November group invited Dutch traffic experts to take part in its workshops. Several interviewees attributed the failure of previous efforts to a lack of mapped-out transition paths (Interviews 7, 8, 31), so a “clearer” Roadmap or clearer guidelines were needed to attract more innovation. Connekt again facilitated, while a Ministry representative acted as note-taker and official Roadmap author. These actors joined forces to expand the Ministry’s 2013 letter into a vision describing the transition towards smart mobility. The key issues identified became the Roadmap pathways.

Later in 2013, the results were included in the Roadmap, which was then presented to the Ministry. This was the first time the Ministry directly adopted a document written by private parties and an NGO as a policy document. This can be seen as the first step through which the private parties started gaining power as one of the key Roadmap authors. The Roadmap was signed by its authors and additional private parties. Yet, Ministry representatives claimed that the Roadmap did not seek the commitment of participating parties through legislation. As there were no consequences for actors, this was the first ambiguity in the Roadmap’s status.

We noted additional ambiguities, especially the first pathway, which is the main topic of our study. Our interviewees revealed that the pathway on its own was too broadly and loosely defined to determine action:

Interviewer: when you talk about taking steps on the roadmap, how do you define your plan of action? Do you actually consult the Roadmap for information?

Interviewee: no, it’s our guideline, that’s for sure. But to reach another step on the roadmap, we need much more information ... information about what is happening now, what the stakeholders are aiming for and what they need, so per transition path there is a whole world to explore, and we determine our actions based on that. We don’t only use this document, it would be a bit strange if we only did that.

Interviewer: because it is rather broadly defined?

Interviewee: yes, so we further define the transition paths, in addition to what is in the Roadmap (Interview 25).

This quote illustrates that the policy goal for involving users was defined in a way that it was open to different interpretations by the actors involved. It was a typical boundary object. Although the Roadmap's status remained vague, it did provide the basis for the next step, the boundary work implementing the Roadmap. However, no end-users or user representatives (user organisations, like consumer organisations) were involved during this entire phase of developing the roadmap. Already during this initial stage, a clear power hierarchy between policy, science / engineers (private parties) and users became evident.

## ***4.2. Boundary work: developing user-centric smart mobility***

### ***4.2.1. The actor-network formation***

By the time of our research, which took place between 2016 and 2018, we observed that numerous new actor groups entered the translation process, such as public parties (regional), private parties, NGOs and researchers. They negotiated their positions. We saw the formation of a complex framework with several actors redefining the pathway, sometimes in ways that barely fulfilled the policy goal calling for user involvement, and instead pushing technological innovation. We describe this process below, detailing the boundary work done by the actor groups. We explain the roles the Ministry envisaged for the actor-network, followed by our assessment of whether the actors were enlisted and users represented.

The Ministry perceives its role as safeguarding public needs like safety, sustainability, and quality of life through its policymaking. It also considers itself the only actor with the expertise and tools for “monitoring” and “safeguarding” these public goals and therefore indispensable for enacting the Roadmap's goals. The Ministry underlines its proposed status as obligatory passage-point by presenting the socio-technical future as an opportunity for it and other public parties to support all actors by means of funding, networking and experimentation platforms, overall guidance and safeguarding collective goals. Nevertheless, we perceived a lack of accountability, already from the early project stages, as the Ministry did not ask other actors who signed up to the Roadmap for any serious commitment. Notably, the Ministry does not consider itself responsible for involving end-users (Interview 12, 31), and therefore prefers to enrol other actors for enacting its vision.

From the Roadmap and our interviews with its developers, we identified five major actor groups in the Roadmap, namely the Ministry, public parties, private parties, knowledge institutions, and users. Private parties are the companies required to develop smart mobility services, including mobile phone providers, navigation company representatives, mobility consultants, and application developers. Private parties are expected to carry out their work in close collaboration with public parties and have a bigger role in traffic management. They are expected to do this in a user-centric way. Notably, to achieve this goal, the roles of public and private parties would have to undergo a radical change between 2013 and 2023. Private parties would be assigned greater responsibility for providing travel information directly to individuals, as well as developing innovations, while

public parties would revert to more of a “monitoring role”, moving away from managing traffic and towards stimulating innovation (Interview 6). Private parties are responsible for involving users, firstly by representing their needs in smart mobility design and secondly, by creating a large market for smart mobility (Interview 12). Rather than being prescribed how to involve users for successful pathway implementation, private parties are expected to possess the necessary knowledge for involving and representing users. We interviewed a former employee of Rijkswaterstaat (RWS), the Ministry of Transport, Public Works and Water Management’s executive body, who said:

I cannot tell you what the user needs are because we don’t know what the user wants. It is the private parties that have the knowledge and the know-how about what the users want ... The private parties will structure the environment of users and provide that the smart mobility user needs get embedded in innovations and that the innovations get embedded in society. (Interview 10)

During the time of our research, the Netherlands had a large number of public actors in the mobility domain. This involves around 400 road authorities, including councils, provinces, regions, and RWS. These are expected to stimulate the smart mobility market by initiating and supporting smart mobility solutions through PPPs. However, little is said in the Roadmap about their exact role in relation to the user-centric perspective.

Both the letter and the Roadmap mention that knowledge institutions are expected to collaborate with public and private parties in the transition to smart mobility. The Roadmap claims to “articulate the combined expectations and goals not just of the Ministry but also the market parties, knowledge institutes and other public authorities/road operators” (p. 13).

The users here are all participants in Dutch traffic. User behaviour and choices will have a significant impact on the Roadmap’s success and therefore the transition to smart mobility. For example, to achieve the Ministry’s goal of increasing city accessibility, Dutch travellers must use the smart mobility technologies on offer and follow their real time advice. Interviewees stressed that often the quality of the smart mobility information relies on user feedback, increasingly enabled by ICTs. As the first Roadmap pathway is that on developing smart mobility-solutions aligned with user needs, users are envisioned to play both an important role and a changing role in the Dutch transition to smart mobility.

Finally, the Ministry sought alliances with key actors in the Dutch traffic system, like Connekt, the 5 November group, and Automotive NL (a Dutch automotive industry network organisation). At the same time, the Ministry’s self-ascribed role of safeguarding user needs, ensuring its place in smart mobility solutions, was partially outsourced to DICTM (an organisation supporting the advancement of new traffic standards) and Connecting Mobility (an innovation platform, also known as the Roadmap catalyser). We look at the role of these organisations in the section on boundary organisations.

#### **4.2.2. The actor-network enrolment**

We now move to explaining the process of enrolling the actors. Prominent actors in mobility, like the 5 November group, DICTM and Connekt, were collaborating with the Ministry, as well as with Connecting Mobility. These parties all claimed that they support the Roadmap. For example, in collaboration with Connecting mobility, Connekt, DICTM, and Automotive NL, the Ministry also established The Traffic Innovation Centre. It offers

a platform for testing and developing smart mobilities, stimulating PPP. However, between 2013 and 2018, these actors also negotiated their own interests and expectations. Notably, interviews with many of these organisations revealed that they do not even involve user needs in their project objectives. Instead, they created a barricade against the Roadmap goal, by focusing, on technological experimentation. This can be seen as what Hoppe (2009) described as a technocracy discursive type, characterised by a supremacy of engineering knowledge over the knowledge held by other types of actors.

After the Roadmap had been accepted as a policy document public parties planned new projects or tried to align the goals of existing projects, to stimulate smart mobility solutions through PPP. For example, a project in the southern province of Brabant planned a cooperative mobility system (Interview 16). This project was divided into three subsystems (data, hardware or network, and mobile application). After an open competition, finally the two best companies per subsystem were invited to develop a solution. Public parties prescribed project specifications for a wide variety of end-users. However, these specifications merely attracted many actors to collaborate on big innovation projects, but did not manage to involve end-users in the development process (Interviews 21, 25). A scoring system to evaluate the projects showed that the developers all scored very low, in 2015 max 5.8 on a scale from 1 to 10; furthermore, interviewees evaluating the process indicated that the project was, so far, unsuccessful in “starting from user needs” (Interviews 21, 25). Once more, the technology developers have interpreted the task differently, in a way that is closer to their occupational knowledge and have prioritised technological advancement was over user inclusion.

Nevertheless, during our interviews, the private parties reported some degrees of user involvement. Firstly, they invite users to share feedback on the reliability of the travel information provided via smart mobility applications. Secondly, private parties released their services to the market before they are fully developed, to attract users interested in co-developing them through their feedback. Notably, feedback on the overall functioning of services is often encouraged through surveys, but rarely through in-person meetings. Of the eight smart mobility solutions developers we interviewed, only one mentioned involving users early on in the problem-definition stage. Project coordinators and solution developers viewed the mere consultation (without giving users significant decision-power and without involving a diverse group of users) of private parties as proof that their approach is user-centred. A few were confident that their project is adequately focused on end users.

In an interview with private parties working on the above-mentioned Brabant project, we learned about one instance, which took place between 2016 through 2017, that even when users made their needs visible by sharing feedback, the service developers only partially accepted it. Developers are interested in feedback on the accuracy of traffic information, but less so in other aspects:

when you are listening to the radio or Spotify, our service will stop it, saying you need to slow down, which contrasts with the fact that you cannot use your phone in the car, because you have to concentrate on driving and so can't open the program again. I think this should be fixed because people won't use the app anymore because they want to listen to the radio which gets cut off on that bit of the road and then they will have to wait till they are in a

traffic jam or something. That is a small change and I heard today that it's not going to change (Interview 15).

The example above is a safety issue. By closing users' open apps to give traffic advice, this app forces them to interact with their phone, thus diverting their attention from the road. It suggests that the key traffic policy objective of safety was ignored by the private parties developing the app in question. The Ministry's monitoring role did not seem to be effective either.

Through our interviews with private parties, as well as with public parties interacting with them, we identified that the I-methodology, where service developers and other non-users "speak" for the user, rather than asking them for input, has been a popular innovation approach:

I think it would be nice to better integrate people's needs in the whole human behaviour ITS part and travel information services. Because now, how it is defined is that a government has a project, people from the government think about what the users need, they write it down, give it to the market. Which makes it more PPP, but the consumers are not involved yet, so there is a policy-push instead of a public pull ... (Interview 7)

Although we went to great lengths to find more examples of projects where users played a central role, only the one in the province of Brabant aimed to identify user needs and preferences through surveys and one-to-one interviews. One project in Amsterdam involved a specific user-group in the problem definition phase: it sought feedback from the parents of disabled children to identify their specific user needs. But these projects that communicated directly with users were exceptions, not the rule.

The actor group central in the story has barely been enrolled. Most services have only a few hundred users, which is not a lot compared to the Dutch population of 17 million.

Smart Mobility attracts specific actors, those who have specific interests in gadgets, are relatively young, male ... the early adopters. What you need is to get to the next step from early adopters to the bigger majority, also get other people to work on this, not so much the people interested in gadgets. (Interview 7, 23)

We identified a consensus in the discourse as many interviewees agree that user involvement is relevant, but still largely lacking in Dutch traffic systems:

We want to emphasize that the user is relevant because we are seeing, by being a catalyst, that the user perspective is often neglected or not taken into account in experiments. (Interview 7)

Numerous private parties we interviewed expressed a technology-push ethos: "the biggest challenge is always getting the end users to use the potential of the services that is already available" (Interview 1). We identified negative expectations about users among private parties – for example, that users do not understand the advantages of the innovations or how to use them. Several interviewees said that the way to change this is by raising awareness of these advantages. The example of the personal mobile phone was mentioned as an argument for not involving users in the decision-making process: users don't know what they will want in the future, just like they did not know the role mobile phones would come to play in their daily lives (Interviews 14, 20). We have identified another barricade against user-involvement. Private parties' occupational experiences and knowledge have led them to believe that users are best to be left out of

the innovation process, as they are seen to hamper the advancement of technological innovation.

Our findings indicate that by 2018, there has been a successful enrolment in the limited sense that the actor-network has grown; numerous public and private parties have been participating in PPP innovation processes (Interview 30). However, while new smart mobility solutions were being developed, they were not in line with the pathway. Although new knowledge emerged, actors resorted to their old technology-push approach, rather than to seeking new ways to develop smart mobility innovations based on user needs. Perhaps the roles for doing so were too loosely defined to begin with, which led to actors not wanting to accept responsibility for enrolling and representing users. Furthermore, this could also be explained by, on the one hand, a tension between the Ministry's expectations about the market parties' contribution to their vision, namely that they knew user needs and how to represent them in their smart mobility solutions. While, on the other hand, the market parties were themselves guided by a mixture of factors: disbelief in users' contribution capabilities; their limited perception of user needs (stressing their own rationale and financial motives); and their belief in the appeal of technological innovation, regardless of whether users find it appealing.

#### **4.3. Boundary organisations: lack of accountability**

We will now argue that an additional explanation for unsuccessful policy programmes is an unwillingness by the assigned boundary organisations to accept responsibility for ensuring that smart mobility innovations take account of users. We will focus on one of the boundary organisations set up to support the Roadmap implementation.

At the conception of the Roadmap, the Ministry appointed Connecting Mobility to help "connect" private and public parties, because its role, supporting policy programmes, was said to have been lacking in previous endeavours. Connecting Mobility was established as an independent body within and fully funded by the Ministry. We perceive its intended role as a boundary organisation, understanding and promoting the Ministry's goals, while also representing and enrolling public and private parties. Its aim would be to contribute, together with private parties, to new knowledge creation based on the policy pathway. It is an "innovation platform" helping smart mobility actors to realise the transition, assuring common guidance, and sees itself as a Roadmap catalyst, monitoring smart mobility solutions in transition pathways. In its director's words:

what Connecting Mobility does and wants is that all the parties like the public, the private parties, the NGOs work together and find their way. Our interest is speeding up the transition planned in the Roadmap. Nothing more, nothing less. (Interview 25)

However, other actors saw them as having a more prominent role in the translation process, namely an "execution body for the Roadmap project" (Interview 4).

Connecting Mobility has undertaken several actions to support the Roadmap. It published a report in 2016, encouraging private parties in the Dutch transport sector to develop service-oriented business models with clearly identified end-user needs. It also held "ITS roundtables", serving as platforms for key stakeholders to exchange knowledge and learn from each other, with an awareness-raising function. Additionally, in collaboration with knowledge institutions like TNO (the largest Dutch research institute) and

the Technical University of Delft, it has developed a simulation tool to be used by public parties for assessing and setting up their smart mobility solutions.

We were initially under the impression that these initiatives were well-known and well-attended within the actor-network. However, some of our interviewees have negatively evaluated their meetings with Connecting Mobility. The roundtable meetings, for example, were described as follows:

Connecting Mobility also try to inform you about how to interact with the user and what the user will want and what will make them change their behaviour. The thing is there are 100 people in some rooms, so you never learn anything about it. (Interview 13)

Furthermore, interviews with Connecting Mobility representatives revealed that the organisation has been reluctant to negotiate with developers about including user needs in its solutions, and that it has been primarily interested in enrolling public rather than private parties. The director said the organisation's main role has been to remain "in the background" or "low key" (Interview 25). In response to questions about its contribution to achieving the transition pathway, another Connecting Mobility employee replied:

I am just addressing the objective, but I don't think that we have actively done a lot of activities to reach that goal ... we hardly ever discuss with those companies, like asking what are the functionalities you are really seeking because your user wants it, and what are the ones for societal benefit? It is very often pushed the other way around. I think that is still something we could improve. (Interview 29)

This hampers the boundary organisation's main aim with respect to successful translation, namely to establish accountability within the network. It has evaded responsibility for urging innovators to follow the first transition path calling for user-involvement.

In an interview, one employee even tried to convince us that the purpose of the first Roadmap pathway is not to involve users, or put them centre stage. The response to our question how it is implementing the pathway was:

first you should get it clear that the roadmap does not, there is not one goal, there are four goals on the roadmap, which really address the user. It does not say to put the user in the centre, but it is more like improving the service quality for the user. (Interview 29)

After the interviewer explained the aim of the first pathway, the interviewee was still negative about its relevance in the broader policy programme. When the interviewer read out the pathway in the Roadmap document, the interviewee then softened his opinion, while remaining defensive about not perceiving the goal as significant:

no exactly, I agree with you in saying that the user and their needs should be addressed more primarily, as opposed to technology push, so yes sure. I was just mentioning before you address it as it's one of the four goals, it is not like it is in the title of the goals, it's like a derivative of the goals. Anyway, it was a side remark. (Interview 29)

In late 2017, the Roadmap programme was apparently "stopped", or was about to be "updated and rewritten", depending on who we interviewed. The role of the policy programme and Connecting Mobility remained ambiguous for a short while afterwards, and officially ended in 2018. The interviewees listed several reasons for ending the programme, e.g. the advancement of technologies not considered in the Roadmap such as



autonomous vehicles and changes in the Ministry's priorities brought about by a new parliamentary term. We suggest an additional reason was that no boundary organisation was made responsible, or accountable, for implementing the transition pathway. Organisations such as Connecting Mobility were meant to play such a role, however, we identified instances where they refused to accept responsibility. In the above example, the organisation transferred its responsibility for collaborating with private parties to public parties; what is more, it did not monitor private parties on their processes of involving users. Furthermore, Connecting Mobility adopted the role of a transition intermediary, and was as such operating in a complex dynamic context that was uncertain and lacked structure, where they had to respond to several actors (Manders, Wieczorek, & Verbong, 2020). Their role changed, it shifted from a role closely related to the Ministry to a more inclusive role trying to engage a wider range of actors. This is an example of how transition intermediaries adapt their activities and roles, due to the uncertainties.

## 5. Conclusions and policy recommendations

We analysed a Dutch innovation policy programme that aimed to develop a user-centric smart mobility market. The theoretical framework for our analysis consisted of three boundary concepts: boundary work (Gieryn, 1983), boundary objects (Star & Griesemer, 1989), and boundary organisations (Guston, 2001). A Roadmap supported the innovation programme because previous initiatives were said to have failed due to the lack of a clear strategic document. The Roadmap broadly defined the first specified transition pathway or policy goal. This is typically what a boundary object does to attract a wide range of actors from different disciplines to collaborate in enacting the policy goal. It worked well in attracting an actor-network of allies who created momentum in Dutch smart mobility innovation. We identified that the Roadmap pathway contained both the elements needed for successful boundary objects. It contained a "hard core" (Löwy, 1992), which our interviewees saw as "facilitating users in a better way" providing them with better information to self-manage; the rest of the pathway, calling for a development of smart mobility "based more on the needs of road users and less on the technology", was the very loosely defined "fuzzy bit" (Löwy, 1992). The responsibilities for enacting the goal were also very broadly defined. This led to a situation where several actor groups were working on smart mobility solutions to provide real-time travel and traffic information. However, the call for a user-centric perspective has been largely "lost in translation".<sup>4</sup> Despite the aim to have users play a central role in the implementation process, they were not involved in the Roadmap development.

Why did this happen? The main explanation is that the responsibilities for involving users has been transferred to actors such as the Ministry, local and regional government, the 5 November group, private companies, and knowledge institutions. Actors renegotiated the goals assigned to them by the Ministry, resorting to their old innovating ways, which the first Roadmap pathway was trying to avoid. Private parties were assigned great responsibility for representing and involving users in the implementation process. However, they were given a lot of leeway and the actor-network accepted their contribution without monitoring user involvement. The efforts to directly involve users were minimal. Often I-methodology (Akrich, 1994) was employed instead of directly asking

for user input. User involvement through market surveys was primarily considered for motivating the acceptance of a technological innovation. Although there are differences among these actors, they shared a technocratic or techno-centric discourse; this inhibited a successful implementation of a more user-centric approach.

The dominant technocratic discourse created a barrier. Our findings align with previous findings that show that smart mobility is largely techno-centric and focused on optimising consumers' mobility behaviour using ICTs, rather than on user needs (Benevolo, Dameri, & D'Auria, 2016; Noy & Givoni, 2018). Throughout our interviews, we have identified a widespread culture of disbelief in the value of user input in the innovation process. Private parties repeatedly stressed this, because in the past, market predictions such as future usability of mobile phones failed. We acknowledge this is a challenge. Nevertheless, studies identify numerous benefits of user involvement, for example enhancing user satisfaction and acceptance of the innovation (Hyysalo, 2016; Sopjani et al., 2019; von Hippel, 2005) as well offer numerous approaches involving users (see De Vries, Van Waes, Van Est, Van Der Meulen, & Brom, 2015, p. 65).

On a more specific level, we identified that a key criterion for successful translation – namely, the support of an organisation specifically held accountable for realising the pathway – was absent. Such an organisation would have served as “boundary organization”, supporting the translation process by seeking to collaborate and create more knowledge with the private parties and the users (Guston, 2001). The boundary organisation, appointed and funded by the Ministry to support the implementation of the Roadmap, Connecting Mobility, was reluctant to fully accept its role of encouraging private parties to help develop user-centric smart mobility solutions.

We argue that the policy programme could have achieved more success if one of the central actors (e.g. Connecting Mobility) had been made accountable for ensuring the policy pathway implementation (e.g. developing standards for successful user involvement). Being accountable means that the respective actor would have to develop mechanisms for educating and steering other actors throughout the implementation process (in our case, guiding private parties on how to successfully represent and involve users).

We propose a different approach consisting of two elements: increasing inclusiveness by involving actors with different perspectives and taking care of the issues of accountability. The literature on responsible innovation stresses the need for inclusiveness and anticipation (Stilgoe, Owen, & Macnaghten, 2013). Not only the vested interests and dominant perspectives should be taken into account. One option is to include “outsiders”, actors with a different perspective and mindset (Van De Poel, 2000). In this way, expectations about actors' roles and responsibilities are made explicit and accounted for, right from the start.

Regarding the issue of accountability, implicit assumptions of representing users in the process, proved to be a major reason for what happened with the Smart Mobility programme. To actively discourage the technology-push approach in smart mobility innovations, the Ministry should have put more emphasis on involving users, not merely outsource this task to private parties. Boundary organisations can take responsibility for this task, but user representation, and more general prevention of a technology-focus, should be sorted out.

From a broader perspective, we have focused on one aspect, the first pathway, of the Smart Mobility programme. However, our results fit in an overall assessment of the Smart

Mobility policy, which was, in The Netherlands, initiated with the Roadmap. It is not yet clear whether major steps have been set in the direction of a transition to a smarter mobility system. Partially, it is too early to assess this, as the transition might take decades. Nevertheless, there is still uncertainty about smart mobility's potential and possible directions of development and there is some disappointment on the lack of impact (Salas Gironés, van Est, & Verbong, 2019).

## Notes

1. <https://issuu.com/connekt/docs/eindadvies-sbv>.
2. Another PhD researcher, who was also a part of the research on the smart mobility programme, researched Connecting Mobility as an intermediary (Manders, Wieczorek, & Verbong, 2020).
3. Members: CEO Simens, TomTom Director, Director Management and Implementation North Holland Province, Director KPN, Director-General RWS, General-Manager Imtech Traffic and Infra, CEO Valis, General-Manager Technolotuion, Board Member SRE, Managing-Director Mobility TNO, Director Ministry I & E, Managing-Director Connekt, Director City Management, The Hague City Council.
4. This was also hampered by the Roadmap having five additional pathways.

## Acknowledgements

We thank the Dutch Ministry for Infrastructure and the Watermanagement and Rijkswaterstaat for co-funding this research project (10020513, from 01.09.2015 to 01.11.2019). We also thank all the interviewees for their participation. Finally, we thank the reviewers for their valuable input.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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## Appendix. Interviewee background

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Interviewee 1	Project manager I&M.
Interviewee 2	Project director, European ITS project.
Interviewee 3	Policy adviser, I&M.
Interviewee 4	Project manager, NGO on mobility.
Interviewee 5	Programme manager, I&M.
Interviewee 6	5 November group member.
Interviewee 7	Senior advisor on human factor, RWS.
Interviewee 8	Senior advisor, RWS.
Interviewee 9	Professor, TUE; Senior advisor, RWS.
Interviewee 10	Project director, Amsterdam project aimed at reducing congestion.
Interviewee 11	Advisor on public affairs, Dutch travellers association.
Interviewee 12	Policy advisor on smart Mobility, I&M.
Interviewee 13	Programme manager, smart mobility application for reducing congestion.
Interviewee 14	Project coordinator, Dutch automotive association.
Interviewee 15	PR, smart mobility application for reducing congestion.
Interviewee 16	Marketing, application for reducing congestion.
Interviewee 17	Director, Innovation Traffic Centre.
Interviewee 18	Co-founder, Traffic and travel navigation advice.
Interviewee 19	Researcher, Navigation Device Company.
Interviewee 20	Director, Mobility as a service project.
Interviewee 21	External advisor, RWS.
Interviewee 22	Roadmap user-workshop organiser.
Interviewee 23	Senior advisor, I&M.
Interviewee 24	Senior researcher, I&M.
Interviewee 25	Strategic advisor, RWS.
Interviewee 26	Senior advisor, RWS.
Interviewee 27	Programme organisation, RWS.
Interviewee 28	Project manager, RWS.
Interviewee 29	Senior advisor, RWS.
Interviewee 30	Programme director, RWS.
Interviewee 31	Programme director, RWS.
Interviewee 32	SVBB group chair, Dutch travellers association.

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