Technological Forecasting & Social Change 161 (2020) 120243

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

journal homepage: www.elsevier.com/locate/techfore

The role of policy entrepreneurs in defining directions of innovation policy: A case study of automated driving in the Netherlands

Edgar Salas Gironés[a,b,*], Rinie van Est[a], Geert Verbong[a]

[a] Eindhoven University of Technology. Atlas 5.402, P.O. Box 513, 5600 MB Eindhoven, Netherlands
[b] Fraunhofer Institute for Systems and Innovation Research. Breslauer Str. 48, 76139 Karlsruhe, Germany

ARTICLE INFO

Keywords:
Policy entrepreneurship
Directionality
Innovation policy
Policy process
Transformative innovation
Automated driving

ABSTRACT

As directionality is acknowledged as an essential component of contemporary innovation policies, questions have been raised about how and by whom the directions of innovation policy are set. Despite considerable attention on this matter, contributions have not explored the policy process of directionality, nor examined empirical cases to study directionality in practice. Considering these gaps, this paper presents an in-depth case study of the Dutch Automated Driving initiative that was developed under a smart mobility agenda with transformative aims (2013–2018). This initiative was rapidly championed by policymakers, and the agenda geared almost exclusively to its development. To study the policy processes therein, we used an adapted version of the Multiple Streams Framework (MS) (Kingdon, 1984). MS suggests that directions of policy change are determined by institutional entrepreneurs who have access to policy venues. We found that these entrepreneurs used political strategies (e.g. framing, problem-solution coupling) to champion automated vehicles as a transformative technology. However, eventually the transformative potential promises were not kept, leading to policy failure. In contrast, entrepreneurs' self-interests dominated the policy implementation phase. This paper suggests that more attention should be given in how directions set in the early policy phases can be kept throughout the policy process.

1. Introduction

In recent years, 'grand challenges' have become major factors for designing innovation policies. The societal-challenge orientation of innovation, labeled as 'transformative innovation', has exposed the limitations of current governance to deal with such challenges, resulting in proposals for new policy approaches (Weber and Rohracher 2012; Schot and Steinmueller 2018; Mazzucato 2016). Unlike contemporary innovation governance, these approaches acknowledge the need to give innovation processes a societally desirable strategic orientation. This orientation, labeled as *directionality*, refers to favoring directions of change at the expense of others (Edler and Boon 2018; Mazzucato 2016; Weber and Rohracher 2012). In other words, it is about making choices. Directionality allows to purposely design policies to achieve certain desirable societal outcomes (Mazzucato 2018; Markard et al., 2012).

Up till now, research on directionality has mostly focused on innovation policy instruments (Edler and Boon 2018), policy practices (Schot and Steinmueller 2018), and modes of governance (Lindner et al., 2016; Daimer et al., 2012), and less on the policy processes of transformative innovation. Moreover, this focus has been on how directions *should be* set rather than how they *are actually* set. Theoretically driven approaches, primarily drawn from sustainability transitions, suggest that societal engagement should be a major source for direction-setting (Lindner et al., 2016; Schot and Steinmueller 2018). This view, despite being desirable, neglects that transformative innovation is political in nature, with contestation, conflict, winners, and losers (Schot and Steinmueller 2018; Stirling 2008). Under these circumstances, other explanations need to be considered. Alternative explanations should acknowledge that other factors influence the directions of innovation, e.g. access to policy venues, ideologies, and power games.

We believe that a fruitful avenue to study directionality in innovation policies is by following the actors that have an interest in policy change. Such actors, known as institutional entrepreneurs, are considered central agents in the policy process (Bakir and Jarvis 2018; N. Cohen 2016), but they have been scarcely featured in the

Declarations of interests:
This project is part of a research project supported by the Dutch Ministry of Infrastructure and Environment

* Corresponding author.
E-mail addresses: e.salas.girones@tue.nl (E. Salas Gironés), q.c.v.est@tue.nl (R. van Est), g.p.j.verbong@tue.nl (G. Verbong).

https://doi.org/10.1016/j.techfore.2020.120243
Received 13 September 2019; Received in revised form 24 June 2020; Accepted 5 August 2020

transformative change literature (Kuhlmann and Rip 2018). This research studies how these actors may influence the directionality of innovation policy. To do so, we mobilize policy studies insights and apply them to a contemporary case study. In this way, this research intends to offer both a theoretically-sound explanation of how these entrepreneurs may influence policy change, as well as an empirical study of an actual policy field.

From policy studies, we use the concept of policy entrepreneurs (a specific type of institutional entrepreneurs). We mobilize a framework that has extensively theorized about their role in policymaking, the Multiple Streams framework (MS) (Herweg et al., 2017). In this framework, policy entrepreneurs incorporate their preferred issues and solutions in government agendas, to later translate them into government actions. They do it because they expect future returns from influencing policy developments (e.g. material interests, preferential treatment, etc.) (Zahariadis 2007). We have selected MS because it aims to understand how these actors influence the policy process, e.g. by mechanisms and strategies (Kingdon 1984) and because the MS assumptions (e.g. ambiguity, time constraints, uncertainty, vested interests, and fluid participation) are in accordance with the conditions of contemporary transformative innovation policies (cf. sections 3 and 4, Köhler et al., 2019).

We selected the Dutch automated driving initiative as a case study. Automated driving is interesting as its transformative innovation potential remains open to debate (cf. Wanzenböck et al., 2019). While automated driving –and particularly automated vehicles (AVs)– may transform the mobility system in a positive way, it could also reinforce the negative aspects of the current mobility system centered around the automobile (Marsden and Reardon 2018; Tillema et al., 2015). This has resulted in a call for capturing the public value of AVs and direct their development towards societally desirable outcomes (Docherty et al., 2017; T. Cohen and Cavoli 2018). The Dutch AVs initiative had a similar intention, namely to maximize their societal potential. It was developed under a smart mobility agenda, aiming to achieve a transition in the mobility field and contribute to three societal goals: quality of life, reachability, and safety (de Mooij 2013). This case is also suitable for our inquiry is that AVs were not considered in the first version of the smart mobility agenda. However, they were included soon after its announcement and rapidly 'championed' by policymakers, becoming a central priority (Tillema et al., 2017; IandW 2014; 2016b). For this reason, we believe that this initiative illustrates how innovation policy directions are changed throughout the process. The guiding questions in this research are: what role did policy entrepreneurs play in the adoption of AVs in the Dutch smart mobility agenda, how did policy entrepreneurs facilitate their adoption, and what returns did they get from it?

We start by outlining in Section 2 the theoretical background, including the concept of directionality for transformative change. In Section 3, we present the Multiple Streams (MS) framework, which, to the best of our knowledge, has only been applied to a limited extent in the innovation domain (see Jones et al., 2016; Edler and James 2015). We proceed with methods in Section 4 and findings in Section 5. We finalize with discussion and conclusions sections.

2. Theoretical background

The transformative innovation approach emerged as a consequence of the need for orientating innovation policies to societal benefits (Schot and Steinmueller 2018; Weber and Rohracher 2012). This societal-challenge orientation has led to a call for a new generation of innovation policy designs, e.g. inspired by market creation/mission orientation frameworks (Edler and Boon 2018; Mazzucato 2016; 2018) and socio-technical transitions (Weber and Rohracher 2012; Schot and Steinmueller 2018).

Researchers have agreed that transformative change policies need a 'direction-setting' function, which Weber and Rohracher (2012, 1042) labeled as *directionality,* suggesting that such policies should set collective priorities and identify societal demands to design innovation policies. This direction-setting will favor "certain types of changes [rather] than others" (Mazzucato 2016, 141), enabling societally desirable systemic changes. A directionality function offers numerous benefits: it allows mapping the social desirability and potential of emerging technologies (Mazzucato 2018), provides conditions for market creation (Mazzucato 2016; Edler and Boon 2018); enables coherent policy implementation (Coenen et al., 2017; Weber and Rohracher 2012); aligns innovation processes with societal and environmental values (Daimer et al., 2012), and fosters the development of complementary innovations required for the transformative change (Schot and Steinmueller 2018; Steward 2012).

Despite an increasing amount of literature on directionality in the past decade, limited attention has been given to how and by whom these directions are set in policymaking. Transformative innovation scholars suggest that direction-setting should be the result of societal participation and deliberative processes (Schot and Steinmueller 2018; Weber and Rohracher 2012). It is expected to include a wide array of stakeholders, who debate, negotiate, and ultimately incorporate different ideas and interests for societal transformations (Mazzucato 2018; Rogge et al., 2018). We believe, however, that this approach may neglect other relevant aspects of the policy and politics of transformative innovation. For instance, policy processes are not necessarily fully democratic, as they favor unrepresentative expertise and rational decision-making at the expense of participatory approaches (deLeon 1995; Ingram et al., 2016). Moreover, transformative innovation is prone to political conflict and contestation (Rogge et al., 2018; Schot and Steinmueller 2018), and access to policy venues is crucial for determining the content of policy choices. Thus, explanations should also consider factors such as confrontation, power, interests, access to decision-making arenas, and capacity of mobilization (Sabatier 2007).

For this reason, we require better approaches to how and by whom directions of change in transformative innovation are set. Potential answers to this inquiry can be drawn from the discipline of policy studies. Particular attention has been given in understanding directions of policy change through agents, by looking into (groups of) actors influencing decision-making (Zahariadis 2007; Sabatier 2007; Mintrom and Norman 2009). In this paper, we bring in the concept of 'policy entrepreneurship' to explain such directions. Policy entrepreneurs seek to influence policy change, by bringing ideas to policy arenas, convincing policymakers about their adoption, and translating these ideas into policy decisions and implementation (Herweg et al., 2017; Mintrom and Norman 2009). They do it with the expectation of getting future returns (Bakir and Jarvis 2017).

There are three main reasons why we have selected the policy entrepreneurship perspective. First, even though policy entrepreneurs have been central in conceptualizing change in innovation studies (Battilana et al., 2009), they have received limited attention in transformative innovation contexts (Grillitsch et al., 2019; Weber and Truffer 2017; Rogge et al., 2018). For instance, Kuhlmann and Rip (2018) have acknowledged their central role in defining *de facto* directions of transformative innovation. Secondly, policy entrepreneurship literature prioritizes agency, going beyond structural explanations. Thus, it allows us to evaluate how these actors mobilize strategies to influence policy circles. Finally, policy entrepreneurship is well-rooted in policy studies literature (Peters 2016; Bakir and Jarvis 2018). In this paper, we focus on one framework that has extensively dealt with policy entrepreneurs: Multiple Streams (MS) (Kingdon 1984).

3. The multiple streams framework

The MS framework was originally developed by Kingdon (1984) to explain policy change under conditions of ambiguity. According to Feldman (1989), ambiguity is "a state of having many ways of thinking about the same circumstances or phenomena". It leads to unclear problem and goal definitions (Zahariadis 2007). For this reason, how policymakers frame policy issues are crucial for understanding different policy responses (Herweg et al., 2017). MS is based on Cohen et al. (1972) garbage can model, suggesting that decision making is a chaotic and not fully rational process. MS has been used to study policy change in messy environments and for unstructured problems (Herweg et al., 2015; Jones et al., 2016). These conditions make policymakers operate under significant time constraints, unclear jurisdictions, and fluid political participation (Herweg et al., 2017; Jones et al., 2016). In such circumstances, policymakers are highly vulnerable to political manipulation from institutional entrepreneurs who invest their resources in shaping policy in return for anticipated gains (Zahariadis 2007).

In short, MS suggests that decision-making occurs under difficult conditions, in which policymakers are likely to be influenced by actors 'selling' their alternatives. This framework operationalizes this understanding by suggesting that policymaking is composed of three streams: problems (*problem stream*), solutions (*policy stream*), and choice (*political stream)* stream. Policy change (and the direction it takes) occurs when these streams come together: Problems emerge into the policy agenda, solutions are available, and the political stream enables their adoption. These episodes are called *policy windows*. However, these streams do not come together automatically but are rather coupled by *policy entrepreneurs.* These entrepreneurs encompass think-tanks, NGOs, industry representatives, businessmen, policymakers/public officials themselves, or lobbyists, among others.

Originally, the MS framework was developed to study agenda-setting. However, authors such as Herweg et al. (2015) and Howlett (2017) have extended this framework, to use it in later policy stages. In this paper, we analyze three stages: agenda-setting, decision-making, and implementation. Agenda-setting is the stage in which a policy problem is recognized (Wegrich and Jann 2006). During agenda-setting, policy windows emerge when "*attention lurches to a policy problem* […] *a solution to the problem is available* […] [and] *policymakers have the motive and opportunity to turn a solution into policy*" (Cairney and Jones 2016, 40, italics in original). Decision-making follows immediately after and refers to the phase in which the solutions for an issue are designed, e.g. government programs and legislation. Finally, implementation encompasses the execution of a policy. In this phase, policy instruments are set-up to achieve policy goals (Howlett et al., 2017).

While going through the various stages, the entrepreneurs' strategies differ. In agenda-setting, entrepreneurs frame problems in ways that allow their intended solutions to be adopted. During decision-making, entrepreneurs bargain details of how a policy should be designed (e.g. instruments, programs, etc.) (Herweg et al., 2017, 2015). In this way, they ensure that policy implementation will be aligned with their own views and interests. Finally, entrepreneurs play a less prominent in policy implementation, as the content of policy choices is defined in the first two stages. Fig. 1 presents an overview of the MS framework, which is composed of three (policy, political, and problem) streams, policy entrepreneurs, and policy windows.

- *Problem stream.* This stream contains the potential issues requiring policymakers' attention. Due to policymakers' limited time and resources, only a few issues make it to the top of the policy agenda (Cairney and Jones 2016). Issues become policy problems when policymakers are willing to do something about it (Knaggard 2015). Three elements attract the attention of policymakers to these problems: indicators (e.g. CO2 emissions per year), focusing events (e.g. accidents), and feedback (or previous policies addressing similar policy problems) (Herweg et al., 2017).
- *Policy stream.* The policy stream entails the ideas and solutions developed by expert communities like technocrats, engineers, think tanks, etc., still to be implemented (Nowlin 2011). Whether a policy solution is adopted depends on how fashionable it is in policy communities (Jones et al., 2016). Solutions likely to be adopted are considered easy to implement, have positive value acceptability (aligned with policymakers' values and beliefs), have public acceptance, and are financially viable (Herweg et al., 2017).
- *Political stream.* The political stream refers to the broader institutional and political contexts where policy decisions are made. It includes factors such as the national mood, broader societal views (e.g. of values, issue, and solutions to policy problems), partisan ideology, governmental political orientation affecting institutions, and the balance of interests (Jones et al., 2016; Howlett et al., 2017).
- *Policy window*. This is a window of opportunity where the three streams come together. It is created when changes occur in the political stream (in the legislature, the balance of interests, or elections), or in the problem stream (major instances of worsening indicators) (Herweg et al., 2017). Windows usually have a short time span (Zahariadis 2007). Thus, policymakers need to make decisions "against the clock", particularly if a problem seems to be getting worse.
- Finally, *policy entrepreneurs* are actors who invest resources in policy, expecting future returns (Herweg et al., 2017), such as organizations, interest groups, companies, and academics (Herweg et al., 2017). Their role in policy is to couple problems and solutions, convince policymakers to adopt their solutions, and guarantee their implementation (Zahariadis 2007; Mintrom and Norman 2009). To do so, they 'politically manipulate' policymakers: they use facts to modify policymakers' views and frame problems accordingly (Ackrill et al., 2013). Their success depends on their access to decision-making events, their political strategies and resources (Jones et al., 2016), and their ideological affinity with policymakers (Zahariadis 2007).

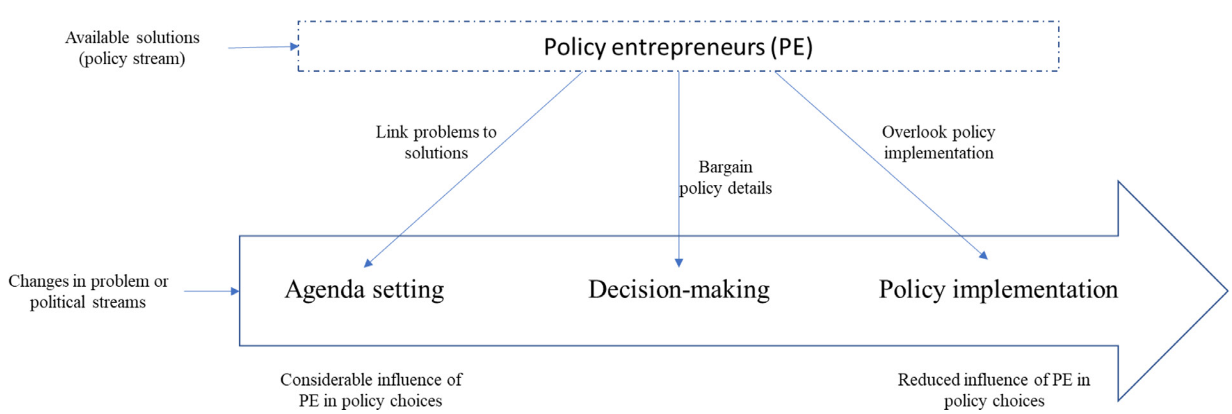

Fig. 1. The Multiple Streams Framework (adapted from literature review).

4. Methodology and case study

To explore *how* and *by whom* directions are determined in innovation policy, we carried out qualitative research using the MS framework. We opted for a single in-depth case study, common in innovation and transition studies. It allows researchers to unfold complex causation in particular geographical and institutional contexts (Köhler et al., 2019). Moreover, it is also used for theory building, to offer alternative explanations for preconceived approaches that may fit well with the phenomena they intend to explain (Flyvbjerg 2006).

We selected the automated driving initiative in the Netherlands as our case study. It was part of a 'smart mobility' agenda for implementing IT-based innovations in the mobility system, with the ultimate goal of achieving a socio-technical transition (de Mooij 2013). This agenda resembled an innovation policy with transformative aims as it had a strong focus on how smart mobility innovations can contribute to three societal goals: reachability, quality of life, and road safety (IandW 2013a).[1] Studies have argued that this agenda has a transformative potential (Manders et al., 2018; Salas Gironés and Vrščaj 2018), and that the Dutch smart mobility policy may resemble the transformative innovation approach (Salas Gironés, van Est, and Verbong, 2019).

Automated driving is an interesting subject of inquiry as even though it may have a transformative potential (Schreurs and Steuwer 2015; Wanzenböck et al., 2019), its contribution to societal challenges remains inconclusive. It can favor populations with limited mobility today (Fagnant and Kockelman 2015); offer cleaner freight transport (IandW 2015a); reduce car ownership (Docherty et al., 2017), and decrease human-related accidents (Fagnant and Kockelman 2015). However, automated driving may also reinforce the negative features of the current mobility system, such as inequity and exclusion (Docherty et al., 2017), natural resources depletion (Milakis et al., 2017), urban sprawl (Tillema et al., 2015), and reinforce the digital divide (Docherty 2018). Consequently, research on the governance of automated driving has been centered on how to capture its public value and provide a normative direction to its development (T. Cohen and Cavoli 2018; Milakis et al., 2017; Docherty 2018).

We gathered the data for our case study through desk research and interviews. Desk research consisted of the collection and analysis of primary documents from the initiative (such as policy briefs and communication between parliament and government), secondary sources aimed at the general public (brochures, public reports, promotional material, etc.), news articles, and consultancy reports. Documents gave us a chronological view of the activities and decisions for this initiative since the establishment of the smart mobility agenda. A general overview of the documents consulted per type can be found in table 1.

As the documents did not fully capture policy participants' motives and views, we also performed in-depth interviews. Following MS scholarship, we interviewed policy entrepreneurs and decision-makers. We found these entrepreneurs through (1) recommendations from public officials, and (2) via organizations working with automated vehicles. In total, we interviewed 11 entrepreneurs and 8 policymakers/public officials (hereafter we refer to entrepreneurs with the acronym entrepreneur_X, and PPO_X for policymakers & public officials, X being the interview number). Interviews took place between the years 2017 and 2018. A list of interviewees and their background is presented in table 2. The number of interviews is limited to nineteen for two reasons. First, we were reaching a saturation point, as respondents increasingly provided only limited new insights. Secondly, the smart mobility policymaking changed dramatically in 2018 (as explained in section 5.4.), resulting in reduced access to entrepreneurs. These interviews were semi-structured in four sections: Their view (and that of their company) on AVs, their role in their development, their participation in the smart mobility policy, their view on the role of policy in AVs development, and the last section open for them to discuss any other issues that they considered important.

Table 1
Consulted documents.

Document type	Number
Legislative documents	23
Consultancy reports	19
News articles	32
Documents aimed to the general public	13

Table 2
List of interviewees.

Interviewee	Number
Executive, high-tech company	Entrepreneur 1
Executive, public transport company	Entrepreneur 2
Business developer, mobility services	Entrepreneur 3
Executive, maps and location company	Entrepreneur 4
Executive, maps and location company	Entrepreneur 5
Business developer, infrastructure company	Entrepreneur 6
Consultant, mobility services	Entrepreneur 7
Consultant, mobility services	Entrepreneur 8
Executive, connected vehicle company	Entrepreneur 9
Executive, automotive embedded-software start-up	Entrepreneur 10
Executive, automated freight transport company	Entrepreneur 11
Director of Smart mobility research area, higher education institution	Public official 1
Policymaker, strategy, and innovation	Public official 2
Policymaker, Intelligent Transport Systems	Public official 3
Project leader, triple-helix collaboration	Public official 4
Project leader, automotive research facility	Public official 5
Program manager, higher education institution	Public official 6
Researcher, transport institute	Public official 7
Researcher, transport institute	Public official 8

For our data analysis, we took a 'directed qualitative content analysis' approach (Hsieh and Shannon 2005). It is a deductive approach whereby the coding process takes into account pre-defined categories, primarily drawn from theory (Assarroudi et al., 2018). This approach requires a researcher to examine a case study using pre-defined theoretical categories, to test the validity of a framework (Elo and Kyngäs 2008). In our case, the predefined categories were the three streams proposed by MS (problems, political, and policy streams). We identified elements of these streams in our empirical data, to place them in each policy window as shown in Fig. 1. Thus, by a coding exercise, we mapped the activities and decisions in the self-driving car initiative and link them with the MS framework.

5. Findings

This section views the AVs initiative's activities through the lens of the MS framework over a nine-year period (2010–2019). We structure the findings section in four parts: The agenda-setting, decision-making, and policy implementation phases of the automated driving initiative, as well as a section on recent developments (2018–2019).

We identified that the agenda-setting window occurred from 2010 to 2013. Social, environmental, and economic issues reached the top of the agenda, coupled with entrepreneurs with a technology-driven approach already developed in the policy stream ('smart mobility'). This coupling was possible thanks to entrepreneurs' and policymakers' strong political and ideological affinity. Afterward, a decision-making phase occurred between 2013 and mid-2014. The AVs initiative was incorporated in the agenda, and favorable legislation established to support their development. The implementation window ran from

[1] I&W stands for the Ministry of Infrastructure and Water Management (Ministerie van Infrastructuur en Waterstaat), formerly the Ministry of Infrastructure and Environment (I&M, 2010-2017).

Table 3
Findings over three stages of Smart Mobility policy.

Phase	Problem stream	Political stream	Policy stream	Policy entrepreneurs	Outcome and Impact on policy direction
Agenda-setting (2010–2012)	Potential accessibility and reachability problems in the Netherlands. Increased congestion, primarily in urban areas.	The emergence of a pro-business friendly, pro-innovation cabinet. Changes in innovation policy (top sectors). Interest in reducing I&W ministry's work and financial load in mobility.	Technologies in the fields of IT, electronics, and high-tech system materials labeled under 'smart mobility' ready for testing.	Coupled problems with solutions from policy streams. Reduced the scope for potential technologies by mapping those that could gain support as smart mobility. Translated societal issues into mobility problems that technology could solve.	A smart mobility agenda was established to solve societal issues through technological deployment. Proposed solutions were aligned with policymakers' interests in promoting innovation-led to economic growth.
Decision-making phase (2012–2015)	Similar to the agenda-setting stage, but new elements emerged such as the risk of lagging behind in vehicle automation technologies, based on developments, particularly in the U.S.	No significant changes.	Automation technologies proved technically feasible, particularly in other countries' experiments. The Netherlands seemed to have a strong research position in most technologies enabling vehicle automation.	Entrepreneurs used international developments as a focus for prioritizing autonomous driving within the smart mobility agenda. They mobilized indicators and a sense of urgency. They also framed the support for AVs in terms of economic benefits.	AVs incorporated as the ministry's top priority, led to I&W minister's political commitment to make the Netherlands a frontrunner. Many institutions were established, all with some form of entrepreneurs' input. Five knowledge domains created to gain public support.
Policy implementation (2015–2018)	No significant changes.	No major changes. I&W announces political commitment to make the Netherlands a frontrunner, followed by legislation changes.	Developments changing at a fast pace influence short-term application of AVs.	Entrepreneurs participated actively in experiments and decision-making events. Here we see the first gains from this policy, including entrepreneurs' capacity to influence policy under state sponsorship, proofs-of-concept, testing, and potential partnerships.	Knowledge gained in the experimentation phase and roundtables guaranteed entrepreneurs could shape indirectly the direction of AVs. The government aimed to set European & international standards. AVs deployment was thus tailored to entrepreneurs' input.
Recent developments (2018–2019)	After 8 years of promises, the smart mobility agenda did not seem to be solving problems. Similar issues as in agenda-setting phase re-emerged, but without smart mobility as a solution.	Major disruption due to elections and new cabinet. New priorities were set, promoting less technology-driven solutions. Less affinity between entrepreneurs and policymakers.	AVs never 'took off', causing a reorientation of the solutions. Shift from experimentation to more integration of existing technology, dismissing multiple projects on the smart mobility agenda.	Entrepreneurs were not able to maintain support (compared to 2012–2018) for automated driving in the Netherlands. AVs, albeit still of interest to the I&W, play a less central role in the smart mobility transition.	The inability to show actual results for AVs caused a switch in priorities (and thus direction) in innovation policy towards new priority areas. Support for AVs shifted from experiments to real applications.

2014/15 till October 2017, when entrepreneurs' gains materialized. Finally, since 2017 the AVs have greatly diminished interest in policy circles, unexpectedly disrupting the implementation stage. Table 3 shows a general overview of our findings for each of the three policy stages as well as 'recent developments' affecting the logical course of action for AVs initiatives.

5.1. Agenda-setting (2010–2013): smart mobility high on the policy agenda

The origin of the Dutch smart mobility agenda dates to 2010 and 2011, at a time when several issues were emerging from the *political* and *problem* streams in the mobility system. From the political stream, a pro-liberal, business-friendly minority right-wing cabinet 'Rutte I' was formed in October 2010 and ended in November 2012. This cabinet aimed to overcome the effects of the 2008–2009 recession, by positioning innovation as central for economic growth and productivity. This was part of the Dutch Ministry of Economic Affairs' objective to make the Netherlands one of the 'top 5′ knowledge economies by 2020 through a high-tech industrial approach, labeled Top Sector Policy (Tweede Kamer der Staten-Generaal 2011). These sectors included Logistics and High-Tech Systems & Materials (HTSM), which were expected to play a central role in developing a smart mobility agenda.

Cabinet Rutte I also reorganized government institutions and created the Ministry of Infrastructure & Environment (I&W), by merging the former ministries of Transport & Water Management, and of Housing, Spatial Planning, & Environment (Koninkrijksrelaties 2010). This merging brought new issues to the top of the problem stream. First, reducing public expenditure in infrastructure was considered a top priority for mobility policy. A general guideline for this reduction was to achieve it without compromising the safety and traffic conditions of the road network (PPO_1). Together with this problem that policymakers were facing, environmental and societal issues were high on the agenda. Mobility forecasts suggested that the Netherlands would be facing increasing congestion, particularly due to a 10 to 25 percent increase in car use between 2011 and 2020 (IandW 2011a). Individual mobility was expected to rise by 20 to 50 percent between 2009 and 2040 (IandW 2012), having a direct impact on the environment (IandW 2012; KNMI 2009).

In contrast, the policy stream showed some preferred alternatives for organizing mobility policy. First, programs with an increased market involvement and deployment of mobility innovations were proven successful modes of collaboration between public and private parties. The best example of this approach was the program 'Better Utilization' ('*Beter Benutten', BB*), that fostered collaboration between public and private actors in co-creation processes of innovation (IandW 2011b). This program had a strong influence on the way in which policymakers placed their work in relation to private parties' activities. The BB experience suggested that private parties had the expertise to develop innovations that could improve the mobility system, which they should be included in the mobility system decision making, and that state institutions should be more open to new ideas coming from the private sector.

The promises of public and private cooperation, together with a strong pro-innovation environment, created suitable conditions to push forward a concept such as smart mobility. By 2012, at least three organizations in which policy-makers came together with entrepreneurs to study the potential of such concept: AutomotiveNL, Connekt, and the Dutch Integrated Test-site for Cooperative Mobility (DITCM). Automotive NL worked as the cluster organization for the Dutch automotive industry, mobility sector, and automotive education. In contrast, Connekt is a triple-helix collaboration platform for smart and sustainable mobility. Finally, DITCM was a purpose-built platform for the development, testing, and validation of cooperative driving technologies.

These organizations worked as venues in policy entrepreneurs managed to couple the politics, problem, and policy streams. These entrepreneurs increasingly championed their interests in developing such a technological approach and sell it in policy circles as potentially transformative. For instance, the document 'Towards a Smart Mobility Roadmap' (immediate predecessor of the smart mobility agenda) presented the types of technologically feasible services that could be "rolled-out" to achieve societal and policy goals (AutomotiveNL, Connekt, and DITCM 2012). This roadmap linked a technology-driven service with a societally relevant mobility issue (e.g. incident warning). It also reported ongoing related projects, evaluating them from an environmental, efficiency, and safety perspective. In total, 16 services were identified, with 47 enabling technologies. As a follow-up exercise, the second document was the 'Better Informed on the Road' *('Beter geïnformeerd op weg'*, BGOW) action program (IandW 2013a). This program is the origin of the smart mobility agenda. In summary, this document identified the problems and potential solutions outlined above and framed smart mobility in terms of a transition. Thus, smart mobility was seen as a potentially beneficial sector. linked to the Dutch Top Sectors logistics, ICT, and high-tech systems, demand experimental governance approaches (including public and private partnerships), new strategies for financing smart mobility experiments, and transition pathways (IandW 2013a; Beter Benutten 2016; Connecting Mobility 2016a; de Mooij 2013). It also outlined a demand-driven approach for rolling out new mobility services. BGOW identified four themes for further policy development: network mobility management, logistics, urban multimodal transport, and automotive & in-car technologies (IandW 2013b). By late 2013, each theme had at least one pilot project, as the I&W minister explained, "based on the results from these projects, we will determine the possible policy choices and next steps" for the BGOW program (IandW 2013b).

BGOW marked the end of the agenda-setting phase. The directions for the smart mobility agenda were set in two ways. Firstly, selecting a technology-driven mobility approach resonated with the Dutch innovation top-sectors to solve the social, environmental, and economic issues heading up the agenda. Secondly, by positioning the societal challenges of quality of life, reachability and safety as core ideas supporting policy interventions in smart mobility, AVs were presented as an innovation to gain public support, which materialized in the decision-making stage.

5.2. Decision-making (2013–2014): incorporating AVs on the smart mobility agenda

The original version of the BGOW program did not select any technologies *ex-ante* (e.g. automated vehicles) but only outlined what changes were required to make the smart mobility transition contribute to societal goals (de Mooij 2013). By early 2013, policymakers and entrepreneurs thought that automated driving was not a 'mature enough' innovation to receive public support (entrepreneur_1, PPO_1, PPO_3). For this reason, although AVs were not explicitly considered in the agenda-setting phase (PPO_1, PPO_3), their enabling technologies, particularly for vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication (see Hobert et al., 2015), were part of BGOW. We see this in programs initiated such as 'Practical Trial Amsterdam (PPA)' to integrate vehicle and infrastructure communication (Praktijkproef Amsterdam 2018), or 'Spookfiles' to reduce 'ghost' or shockwave traffic jams by providing speed advice (van Koningsbruggen and Kerstjens 2014).

These projects, which can be seen as cumulative steps towards an explicit recognition of automated driving in the Netherlands, were developed in a time in which AVs were rapidly becoming a central technology in the smart mobility field in the world. Several interviewees (PPO_1, PPO_3, entrepreneur_7) pointed out to developments of Google and Tesla as turning points for incorporating automated driving in BGOW (PPO_1, PPO_4). Interviewees shared an optimistic view regarding the potential short-term deployment of some type of AVs on public roads. Google reported that its autonomous cars had driven 300,000 miles by 2012 without an accident (Lardinois 2012). Apparently, by 2014, its AVs were able to handle thousands of urban situations (Associated Press 2014). Moreover, Tesla announced a commercial application of its autopilot system by October 2014, allowing auto-steering, automatic lane change, and traffic-aware cruise control (Tesla 2014). These events evoked a public policy response: Several U.S. states fomented favorable legislation for AVs deployment and experiments on public roads. The first AVs licenses were granted in the state of Nevada, coming into effect in March 2012 (*Reuters* 2012). Other states followed suit (sixteen by 2015), according to the U.S. National Conference of State Legislatures (NCSL 2019). These international developments were used to mobilize a sense of urgency for incorporating automated driving in BGOW. One interviewee indicated that together with development, other more specifics concerns such as the low penetration rates of automation functions (e.g. adaptive cruise control) required the attention of policymakers (entrepreneur_1). Another interviewee reflected upon the need for mobilizing knowledge to avoid making the Netherlands lag behind (PPO_4).

The Netherlands, despite having no 'big player' in the mobility field (e.g. a Nissan in Japan), has several tier-1 suppliers for original equipment manufacturers (OEM). For this reason, AVs development seemed to receive wide support from Dutch automotive players and policymakers (entrepreneur_5, Tweede Kamer der Staten-Generaal 2012). Moreover, at that time no explicit recognition of a particular direction within AVs has established: The general view was that vehicle automation could be used in various ways, from public transport to private vehicles. By such a framing, AVs supporters gave little room for political contestation. This framing resulted in a general impetus for AVs, which hindered the structuration of critical voices towards the development of automated driving. Even though we found that some interviewees were skeptical about their actual contribution to societal challenges and their technical feasibility, the political climate made almost impossible the formation of alternatives to automated driving (PPO_7, PPO_8).

The legitimization of AVs in the Netherlands was developed both within and outside the I&W ministry. Within I&W, entrepreneurs mobilized arguments to convince policymakers about the adoption of AVs in the smart mobility agenda. These arguments were developed both at a societal and economic level. Outside I&W, the ministry required to legitimize the adoption of AVs as a central feature of this agenda. In this respect, communication to the parliament and to the public 'sold' vehicle automation as a potential solution for problems of the Dutch mobility system. Thus, I&W mobilized facts and expectations to gain parliamentary and public support. For example, automated driving was presented as an innovation that could reduce human-related accidents, which accounted for 90% of the total vehicle accidents in the Netherlands (IandW 2014). AVs were also sold as solutions to improve traffic conditions with minimal environmental impact, enabling mobility access to underserved groups (e.g. older people), and giving public transit more space (Taskforce Dutch Roads 2016). These arguments resonate with interviewees' views. These interviewees suggested that automation would also reduce greenhouse emissions (PPO_5, IandW 2015a). Along with these promises was their significant economic impact: Knowledge of AVs could lift them to the status of 'export product' for the Dutch economy (PPO_5, de Mooij 2013; Smart Mobility Embassy 2018).

At this stage, entrepreneurs were the key actors in decision-making, ultimately defining the directions of policy change. They provided direct input for developing AVs. As part of the BGOW program, a steering group was established with entrepreneurs from industry, government, business, and knowledge institutes helping "to define a strategic course of action" (de Mooij 2013, 3). Policymakers were receptive to what entrepreneurs had to say about AVs development, on account of their technical expertise and knowledge (PPO_5, PPO_6).

This approach involving private parties in decision-making ran parallel with setting up institutions that gave private parties a voice in choosing what direction to follow. By early 2013, the Dutch Automated Vehicle Initiative (DAVI) was launched to foster automated driving developments in the Netherlands (Hoogendoorn et al., 2013). It became the organization responsible for researching and demonstrating automated driving, focusing on human factors and safety (Connekt 2016). The DITCM facility gained momentum, aiming to garner more public and private support for accelerating automated vehicle implementation (AutomotiveNL 2018). The Innovation Central ('Innovatie Centrale') was established to bring actors together for developing innovations, including automated driving (Innovatiecentrale 2016). The triple-helix collaboration network Connekt enabled governments, consultancy firms, universities, and industry to propose solutions for automated driving. Finally, the organization Connecting Mobility was established to execute and monitor the smart mobility transition under the terms established in BGOW (Connecting Mobility 2016a; Rijkswaterstaat 2014).

These institutions were 'spaces' where policy entrepreneurs and policymakers could work together on vehicle automation. Their main function was diffusion and adoption, rather than just technological development. For this reason, their activities focused on issues such as future legislation, human behavior, business partnerships, standardization and so forth. This focus enabled them to envisage AVs vehicles' potential contribution to the sharing economy or their impact on traffic and infrastructure management (entrepreneur_6). Other topics discussed included AVs integration in existing technologies such as mobile devices (entrepreneur_7) and establishing communication protocols (entrepreneur_1). At that time, an autonomous Dutch organization for mobility research (KiM) was working on potential scenarios to introduce AVs in society (Tillema et al., 2015). This allowed entrepreneurs to envision automobile design and its role in society, linking it to the I&W ministry's future policy actions.

The enthusiasm for self-driving vehicles reached policy circles and parliament. In June 2014, the I&W minister presented parliament with a letter suggesting that AVs developments would impact the mobility system in the following two decades and that her aim was to position the Netherlands as a frontrunner in this field (IandW 2014). To this end, the minister announced large-scale testing for automated vehicles' potential contribution to traffic, safety, and livability (IandW 2014). As a follow-up, the minister announced the first changes required in legislation by January 2015 (IandW 2015c). Factors beyond legislation were also considered, particularly by establishing in April 2015 a Knowledge Agenda ('*Kennisagenda*'). In this agenda, societal stakeholders identified knowledge areas for focus to enable automated driving. As a result, five research domains (legal, technical, impact, human factors, and deployment) became core areas of policy implementation. By December 2015, vehicle automation was officially incorporated in the BGOW program (IandW 2015e).

We consider the I&W ministry's communications to parliament in 2014 and 2015, as well as the announcement of the Knowledge Agenda, as the start of the implementation phase. The decision-making phase had led to incorporating AVs in the BGOW agenda, defining themes for implementation, and determining an approach later framed as '*learning-by-doing*' (large-scale testing) (IandW 2016b). During this phase, entrepreneurs 'shaped' directions by providing input for policy actions (participating in steering groups, experiments, and workshops). These directions, as we show in the following subsection, had a profound impact on the Dutch authorities' approach to AVs.

5.3. Policy implementation (2015–2018): experiments & deliberation spaces for AVs

Early 2015, soon after the minister announced an action agenda for experimentation in the Netherlands, the AVs initiative's implementation phase got off to a flying start. In less than a year, AVs transformed from an experimental technology lacking public support, to a flagship project on the smart mobility agenda. Autonomous driving had become a top priority for the ministry. For this reason, most of the transport authorities were involved in this initiative, including the road agency (Rijkswaterstaat), the Dutch Vehicle Authority (RDW), the Dutch Institute for Transport Policy (KiM), and several directorates of the I&W ministry, as well as regional and local transport authorities, such as in the city of Amsterdam. We see two major trends in the implementation phase. Initially, there was a strong focus on experiments and tests to show the feasibility and potential applications of vehicle automation. Then spaces were created for deliberation between policymakers and entrepreneurs to plan national and international actions for vehicle automation. These trends were supported by the I&W minister's political (sometimes referred to as 'personal') commitment to automated driving.

There were two different types of experiments. Some required amendments to existing legislation due to legal limitations (ANWB 2015, 5). Accordingly, the ministry proposed legal exemptions for market parties to experiment, on request to I&W ('*testaanvragen*'). By January 2015, at least five AVs deployment projects had been requested (2015c): two on vehicle automation for trucks, or platooning[2] (Scania & TLN; DAF, TLN & the Rotterdam port operator); two for public transit (Wageningen University, TNO, TU Delft & Gelderland province; and TU Delft); and one for private vehicles (DAVI). Similar projects followed, such as in Lelystad in October 2015 for adaptive cruise control (Prins et al., 2015). Exemption rules for testing automated driving on public roads came into force in July 2015 (IandW 2015b). The other types of experiments were projects to enable innovations for AVs, but not directly related to automation, including Praktrijkproef Amsterdam and Talking Traffic, facilitating real-time travel information in cars (Talking Traffic 2019).

These experiments resonated with the I&W ministry's two strategic focus areas. First, a *learning-by-doing*, 'hands-on' approach to overcoming the uncertainties related to implementing new technologies (IandW 2016b). It included executing and facilitating projects for their outcomes in terms of methods, results, and impacts (City of Amsterdam 2016, 22). This approach and experiments were also needed due to the rapid developments in the field of automotive innovation (entrepreneur_8). Secondly, the ministry was keen to facilitate experiments, using public infrastructure as an asset to encourage international players to test smart mobility innovations in the Netherlands.

The entrepreneurs hoped that these experiments would open up new markets to accelerate vehicle automation (entrepreneur_1). Experiments in platooning aimed to show industrial and business actors the feasibility of this technology and its application in the short term for the logistics sector (Janssen et al., 2015). A relevant aspect for fostering these experiments was the acknowledgement of policymakers and entrepreneurs that the major barriers for AVs deployment were not technical, but operational. The Dutch Organization for Applied Scientific Research (TNO) suggested that the main challenge with platooning was getting this innovation adopted in the field of logistics, rather than its technological development (IandW 2015a, 40). Similarly, an interviewee indicated that the problems for the adoption of innovations were not technical, as drivers nowadays barely use car applications at their disposal (e.g. cruise control) (entrepreneur_9). Other interviewees shared this view, stating that several AVs technologies have been tested and applied in other domains and that their adoption in the mobility system was the main focus of public intervention (entrepreneur_3). Entrepreneurs benefited from these experiments by presenting proofs-of-concept and business models for potential commercial partnerships in automation to industrial players. Without experiments, such collaboration would have been impossible (entrepreneur_1). Other policy entrepreneurs had less defined expectations of participating in this stage. They engaged in implementation activities to develop or adapt their business strategies based on policymakers' expectations and needs. Aiming to adapt their technologies based on AVs developments, they wanted to learn about the impact of sharing in-car data on traffic management and travel information (entrepreneur_6, entrepreneur_7).

Alongside these experiments, other activities fostered knowledge development in limiting automated driving. DITCM played a major role, taking as a starting point the five domains of the Knowledge Agenda, then organized roundtables for industrial partners and researchers to provide "answers for the steps to be taken" in the automotive field. They were set up to exchange information and enable discussion among experts in each domain; in general, these experts were industrial and business representatives, public officials, and policymakers. The roundtables provided input for future policy, as their agreements and recommendations were linked to future government actions, e.g. for standardization (DITCM 2016). Moreover, they examined advancements in legislation and the standardization of automated driving (entrepreneur_4).

The acquired knowledge from the experiments, together with the roundtables, contributed to policy developments in automated driving. In this way, entrepreneurs were able to shape indirectly the course of policy actions for AVs deployment. DITCM decisions linked national decision-making processes at the EU level, to position 'Dutch profiles' ahead of other alternatives for AVs (PPO_6; DITCM 2015; Holland 2016). These profiles aimed to "influence the [set of] international standards that will eventually be adopted for cooperative driving" (DITCM 2015, 7). Similarly, the European 'Truck Platooning Challenge' (IandW, 2015a) was to demonstrate the feasibility of vehicle automation in different countries, to harmonize policies and technical issues. The road agency (RWS) and Dutch Vehicle Authority (RDW) were leading actors in this challenge, establishing the guidelines and technical parameters (IandW 2015a). The input for this project, nevertheless, came from experiments and decision-making arenas with industrial and business partners.

Yet at this stage, the acknowledgement of AVs' contribution to societal challenges seemed to be fading. At the time of the interviews, most entrepreneurs argued that AVs could solve mobility challenges, by enabling Mobility-as-a-service schemes or car-sharing (entrepreneur_1) and reduce maintenance costs for public mobility services. However, we identified that entrepreneurs are more interested in societal challenges as a legitimizer to support AVs under the smart mobility agenda. One interviewee said that achieving societal goals is beyond their scope, and left that to policymakers (entrepreneur_4). This view is in sharp contrast with the original aim to incorporate automated vehicles in the BGOW agenda, making AVs the main rationale for public intervention. Interviews also signaled the 'inherent' societal benefits of autonomous driving, such as being safer or cleaner than human-driven cars. In most policy documents, we find limited progress in the arguments supporting AVs development. Their contribution to reducing CO2 emissions and human-related accidents feature repeatedly, without new insights or lines of argument (IandW 2015e; 2017; RLI 2016).

5.4. Recent developments (2017–2019): fading focus on automated driving

The implementation of autonomous driving seemed to gain 'momentum' in 2017, going by the intensification of events and experiments throughout the Netherlands. However, this momentum began to fade for various reasons. The political stream that had helped to support smart mobility in 2010, changed significantly. The general elections held in October 2017 led to the formation of a new cabinet (Rutte III). It restructured I&W and appointed a new minister. This change represented an important shift as the institutional landscape drifted and new priorities were established. One year after the elections, the new minister redefined the priorities for smart mobility in the Netherlands. She announced a shift from experimentation and trials to the integration of existing smart mobility technologies in practice (IandW 2018).

[2] Refers to "a group of lorries travelling safely and automatically in convoy, a short distance apart" in communication with each other (I&W 2015d).

This ended the interest in experimentation characterizing the implementation phase. Recent I&W ministry reports confirm the limited focus on AVs; in contrast, the priority is multimodal, greener, and fairer transport modes (IandW 2019a).

The BGOW agenda came to an end, and despite some changes proposed for 2016, there has been no updated version by 2019. The program Connecting Mobility, responsible for executing the BGOW agenda until 2023 (IandW 2016c), stopped in 2018. That year, DITCM's program, which was running from 2015 to 2019, also stopped. By 2019, there is no flagship project in platooning, and smart mobility innovations are no longer monitored (Connecting Mobility 2016b). Some websites are out-of-date or not even available anymore. Experiments such as the self-driving bus in Ede-Wageningen stopped due to technical and operational challenges, safety concerns, and low transit speeds (van Dinther 2019; NOS 2019; van Olst 2019). AVs remain on the I&W ministry's policy agenda, albeit not with the same momentum as before. Current policy actions are focusing on the legal operational frameworks to allow the short-term introduction of automated driving on open roads (Duursma 2019; IandW 2019b; Schenk 2019).

6. Discussion

The main goal of this research was to understand the role of policy entrepreneurs in defining the direction of the automated driving initiative in the Netherlands, which was part of a smart mobility agenda. Our guiding questions were: what role did policy entrepreneurs play in the adoption of AVs in the Dutch smart mobility agenda, how did policy entrepreneurs facilitate their adoption, and what returns did they get from it? By mapping out how policy entrepreneurs shaped the policy in three policy stages, we identified that they played a central role in gearing the smart mobility agenda towards automated driving, they facilitated their adoption by the use of policy strategies, and they primarily benefitted from access to knowledge and support that otherwise they would not have been able to get. In this section, we discuss what we can learn from our empirical analysis.

We found that throughout the first stages of the policy process, policy entrepreneurs played a central role in the adoption of AVs in the smart mobility agenda. This was possible by framing automated driving as potentially transformative. However, it was also because self-interests of entrepreneurs were aligned with expectations of policymakers, and had a shared belief about the transformative contribution of vehicle automation society. Thus, even though there is no doubt that entrepreneurs were the actors primarily championing this innovation, the presence of shared interests and beliefs between them and policy-makers played a key role to explain the uptake of AVs on the agenda.

Entrepreneurs facilitated the adoption of AVs in the smart mobility agenda by demonstrating to policymakers that automated driving was a technically feasible innovation in the short term. Drawing, among others, from similar developments abroad (e.g., in the U.S.), and using persuasive narratives (including the history of the Netherlands 'lagging behind' in an important emerging technological field), these entrepreneurs captured the attention of policymakers. Moreover, these strategies were successful, we believe, as entrepreneurs and public officials shared a strong motivation to sponsor automotive developments in the Netherlands. AVs were presented in a sort of 'competition' that the country could potentially win against other countries. However, this required to accelerate decision-making on automated driving, which policymakers agreed upon.

Strategies used by entrepreneurs were appropriately timed throughout the policy process. We observed how entrepreneurs narrowed down multiple alternatives during the first years. In a brief period (2010–2014), entrepreneurs increasingly pushed autonomous driving as an item to be considered in the smart mobility agenda (one innovation among many other smart mobility innovations). During the agenda-setting phase (2012), they were able to exploit opportunities that emerged from developments in the problem (e.g. orientation towards societal challenges and congestion) and politics (e.g. new national cabinet) streams. Entrepreneurs pushed forward a set of solutions, all technologically driven, that could solve the issues that the I&W ministry was facing. Soon after these entrepreneurs put AVs on the agenda, they demanded more concrete measures in policy circles to accelerate their development. In just a matter of months, the I&W minister took the AVs development as a priority, resulting in an increasing political and institutional support.

This moment represents an inflection point, as the prioritization of AVs by I&W sent a strong signal about the relevance of AVs in the future of the smart mobility agenda. This generated strong expectations of the role of AVs in the upcoming years for I&W. Moreover, it also resulted in the development of decision-making mechanisms in which entrepreneurs had a 'voice': They represented interested parties (e.g. electronic equipment or software companies) in vehicle automation. This resulted in entrepreneurs having access to arenas in which they could influence the content of the policy (e.g. technical standards). Decisions that were taken in these arenas still have an impact to date, as the knowledge produced in the AVs initiative has been pushed forward by the Dutch government at a European level.

What went wrong with the direction set by entrepreneurs? We believe that the orientation given by these entrepreneurs showed several limitations. First, we found that entrepreneurs were able to direct the smart mobility agenda towards AVs without any concrete commitments about their implementation and policy outputs. This lack of concrete commitments led to the lack of outputs that could legitimize the long-term policy efforts to AVs. Second, the societal direction of innovation was defined in vague terms, result in the lack of concrete measures or milestones to be achieved. During the policy implementation phase, AVs did not offer any concrete societal benefit. Third, no allocation of who was responsible for guaranteeing the achievement of the societal benefits of AVs was allocated. For these reasons, the AVs initiative and the smart mobility agenda turned out particularly oriented towards economic and business interests, with minimal attention to societal demands.

This case study suggests that without specific routes (e.g. in terms of technologies used societal applications), the policy can be easily captured by interests and result in disappointing outcomes such as in our case study. For this reason, a more active role of public authorities is required to define, together with societal actors, how a particular technology can contribute to the societal challenges that it intends to address. It is striking how this initiative, even though it has a societal-demand orientation, barely engaged with users to define its directions. In this way, public officials relied mostly on people with access to decision-making arenas to define them (the policy entrepreneurs). More attention should be given to how societal actors can participate more actively in the decision-making arenas of innovation policy (cf. Grillitsch et al., 2019). Additionally, these new actors may need to follow an 'entrepreneurial' approach, namely not only raising their voice about their views on a certain problem but also come up with solutions for those problems. The presence of a solution, in the form of AVs, we believe, was a key factor for entrepreneurs accessing the smart mobility agenda.

We should acknowledge, moreover, that this research mostly focused on the entrepreneurs that had access to policy arenas. We were not able to identify, through snowball sampling, other actors who could have had a more critical stand on AVs development. Public officials did not refer us to any of them, suggesting that the arenas were limited to only to actors with affinities on AVs development. More attention should be given to how critical voices could be granted access to decision-making venues. Otherwise, similar transformative innovation policies may be facing a similar risk, namely the lack of diverse voices that may nurture the development of the policy.

Finally, we observed how, even though a narrative of the societal benefits was kept in place during the nine years of policy that we studied, public authorities did not develop any capabilities to guarantee that innovations such as AVs can deliver their expected societal value. Capturing societal value is needed for the current generation of societal-challenge oriented innovation policies (Uyarra et al., 2019). This research shows that policy requires new modes to assess that: (1) the innovation process unfolds in the direction that was set in the early stages of the policy, and (2) outputs of the innovation process can be linked to societal benefits, and (3) the different elements of the policy design (e.g. policy instruments or implementing agencies) are in accordance with the expected goals of transformative innovation.

7. Conclusions

In this paper, we looked into the automated driving initiative in the Netherlands to study how policy entrepreneurs influence its direction. Using the Multiple Streams (MS) as our theoretical lens, we followed these actors over a nine-year period and studied how they influenced the smart mobility innovation agenda. Our research revealed that policy entrepreneurs played a central agenda-setting role by largely shaping the directions on how it unfolded.

Apart from the empirical analysis discussed in the previous section, we would also like to highlight the role of MS in understanding innovation policies with transformative aims. The case study mirrors the conditions of ambiguity identified by Kingdon (1984). Making choices in the context of societal-challenge oriented innovation policies is difficult and uncertain, resulting in a decision-making process largely influenced by actors that have access to decision-making arenas. Other frameworks and theories should be mobilized to explain transformative innovation policies under similar conditions. MS, moreover, shows that addressing societal challenges requires coupling exercises, in which solutions and problems come together. The case study shows that this coupling depends on the political environment, implying that the transformative solutions adopted in policymaking will depend on the ideologies and beliefs in charge of making decisions. Moreover, applying MS to our case study shows how the policymaking making process is composed of various windows of opportunity that actors can exploit to direct innovation policies towards their desired directions. This makes us believe that there is more to be said about transformative innovation policies if we look at them through the lenses of the policymaking process.

Our research also faced unexpected events. The automated driving environment saw a rapid shift between 2017 and 2018, as governmental priorities changed. This resulted in reduced access to interviewees particularly after the summer of 2018.

We identify two major avenues for future research. First, it is important to further study the mechanisms that can guarantee the alignment between societal goals and innovations beyond the agenda-setting phase. For instance, stronger attention should be given to assessments and evaluation of the contribution of technologies to transformative change goals. Second, we also believe that comparative studies should be carried out to systematize different contexts in which policy entrepreneurs may operate and their influence therein. We require to better understand how, considering that entrepreneurs are present in most policymaking contexts, policymakers may incorporate other societal actors with limited access to policy venues and capacity to influence policymaking.

8. Funding

This work was co-financed by the Dutch Ministry of Infrastructure and Water Management and Eindhoven University of Technology.

9. Author statement

Author	Statements
E. Salas Gironés	Conceptualization, Methodology, Validation, Investigation, Writing - Original Draft, Writing - Review & Editing
G. Verbong	Methodology, Validation, Resources, Writing - Review & Editing, Supervision
R. van Est.	Conceptualization, Validation, Resources, Writing - Review & Editing, Supervision

Bibliography

Ackrill, Robert, Kay, Adrian, Zahariadis, Nikolaos, 2013. Ambiguity, Multiple Streams, and EU Policy. Journal of European Public Policy 20 (6), 871–887. https://doi.org/10.1080/13501763.2013.781824.

ANWB. 2015. “Experiments on autonomous and automated driving: an overview 2015.” Press report. Netherlands: Algemene Nederlandse Wielrijdersbond.

Assarroudi, Abdolghader, Nabavi, Fatemeh Heshmati, Armat, Mohammad Reza, Ebadi, Abbas, Vaismoradi, Mojtaba, 2018. Directed Qualitative Content Analysis: the Description and Elaboration of Its Underpinning Methods and Data Analysis Process. Journal of Research in Nursing 23 (1), 42–55. https://doi.org/10.1177/1744987117741667.

Press, Associated, 2014. Google: our Driverless Cars Are Mastering City Streets. Business Insider 2014. https://www.businessinsider.com/google-our-driverless-cars-are-mastering-city-streets-2014-4.

AutomotiveNL, 2018. DITCM. 2018. http://www.automotivenl.com/ditcm.

AutomotiveNL, Connekt, DITCM, 2012. Towards a Smart Mobility Roadmap. Netherlands.

Bakir, Caner, Jarvis, Darryl S.L., 2017. Contextualising the Context in Policy Entrepreneurship and Institutional Change. Policy and Society 36 (4), 465–478. https://doi.org/10.1080/14494035.2017.1393589.

Bakir, Caner, Jarvis, Darryl SL, 2018. Institutional Entrepreneurship and Policy Change. Springer.

Battilana, Julie, Leca, Bernard, Boxenbaum, Eva, 2009. How Actors Change Institutions: towards a Theory of Institutional Entrepreneurship. Academy of Management Annals 3 (1), 65–107.

Beter Benutten, 2016. Platform Beter Benutten. Beter Benutten 2016. http://www.beterbenutten.nl/.

Cairney, Paul, Jones, Michael D., 2016. Kingdon's Multiple Streams Approach: what Is the Empirical Impact of This Universal Theory? Policy Studies Journal 44 (1), 37–58. https://doi.org/10.1111/psj.12111.

City of Amsterdam, 2016. Smart mobility: Action plan 2016 - 2018. Amsterdam: Netherlands. https://amsterdamsmartcity.com/projects/actieprogramma-smart-mobility-2016-2018.

Coenen, Lars, Grillitsch, Markus, Hansen, Teis, Moodysson, Jerker, 2017. An Innovation System Framework for System Innovation Policy: the Case of Strategic Innovation Programs (SIPs) in Sweden. 2017/8. Papers in Innovation Studies. Lund University, CIRCLE. https://ideas.repec.org/p/hhs/lucirc/2017_008.html.

Cohen, Michael D., March, James G., Olsen, Johan P., 1972. A Garbage Can Model of Organizational Choice. Adm Sci Q 17 (1), 1–25. https://doi.org/10.2307/2392088.

Cohen, Nissim, 2016. Policy Entrepreneurs and Agenda Setting. Handbook of Public Policy Agenda Setting October. https://www.elgaronline.com/view/edcoll/9781784715915/9781784715915.00019.xml.

Cohen, Tom, Cavoli, Clémence, 2018. Automated Vehicles: exploring Possible Consequences of Government (Non)Intervention for Congestion and Accessibility. Transport Reviews 0 (0), 1–23. https://doi.org/10.1080/01441647.2018.1524401.

Connecting Mobility, 2016. Connecting Mobility. Governmental website. Connecting Mobility. 2016. http://connectingmobility.nl/default.aspx.

Connecting Mobility, 2016. NDW Datafusie. ITS Overzicht NL - Connecting Mobility. 2016. http://itsoverzicht.connectingmobility.nl/projecten/MEecSjf4ap5S8vNPJ.

Connekt, 2016. DAVI – Dutch Automated Vehicle Initiative. DAVI 2016. http://davi.connekt.nl/.

Daimer, S., Hufnagl, M., Warnke, P., 2012. Challenge-Oriented Policy-Making and Innovation Systems Theory: reconsidering Systemic Instruments. Innovation System Revisited–Experiences from 40 Years of Fraunhofer ISI Research 217–234.

deLeon, Peter, 1995. Democratic Values and the Policy Sciences. Am J Pol Sci 39 (4), 886–905. https://doi.org/10.2307/2111661.

Dinther, Mac van, 2019. De Zelfrijdende WePod Staat Nog Vaak Stil: ‘Als Het Misgaat, Moet de Mens Het Oplossen. De Volkskrant February 25, 2019. https://www.volkskrant.nl/nieuws-achtergrond/de-zelfrijdende-wepod-staat-nog-vaak-stil-als-het-misgaat-moet-de-mens-het-oplossen~b9d0f123/?referer=https%3A%2F%2Fwww.google.com%2F.

DITCM, 2015. DITCM Programme 2015-2019: The Netherlands As a Living Lab For Cooperative Driving. DITCM. http://www.ditcm.eu/images/Publications/DITCM_programma_2015-2019_WEB.pdf.

DITCM, 2016. Dutch Involvement in Standardisation Gremia. Smart Mobility Community for Standards and Practices. 2016. https://smartmobilitycommunity.eu/node/376.

New Governance Challenges in the Era of ‘Smart Mobility.’. In: Docherty, Iain (Ed.), Governance of the Smart Mobility Transition. Emerald PointsEmerald Publishing Limited, UK, pp. 19–32. https://doi.org/10.1108/9781787543171.

Docherty, Iain, Marsden, Greg, Anable, Jillian, 2017. The Governance of Smart Mobility.

Transportation Research Part A: Policy and Practice. October. https://doi.org/10.1016/j.tra.2017.09.012.
Duursma, Mark. 2019. “De bus zonder bestuurder mag de weg op.” *NRC*, July 1, 2019. https://www.nrc.nl/nieuws/2019/07/01/de-bus-zonder-bestuurder-mag-de-weg-op-a3965704.
Edler, Jakob, Boon, Wouter P, 2018. ‘The next Generation of Innovation Policy: directionality and the Role of Demand-Oriented Instruments’—Introduction to the Special Section. Science and Public Policy 45 (4), 433–434. https://doi.org/10.1093/scipol/scy026.
Edler, Jakob, James, Andrew D., 2015. Understanding the Emergence of New Science and Technology Policies: policy Entrepreneurship, Agenda Setting and the Development of the European Framework Programme. Res Policy 44 (6), 1252–1265. https://doi.org/10.1016/j.respol.2014.12.008.
Elo, Satu, Kyngäs, Helvi, 2008. The Qualitative Content Analysis Process. J Adv Nurs 62 (1), 107–115. https://doi.org/10.1111/j.1365-2648.2007.04569.x.
Fagnant, Daniel J., Kockelman, Kara, 2015. Preparing a Nation for Autonomous Vehicles: opportunities, Barriers and Policy Recommendations. Transportation Research Part A: Policy and Practice 77, 167–181.
Flyvbjerg, Bent, 2006. Five Misunderstandings about Case-Study Research. Qualitative Inquiry 12 (2), 219–245.
Grillitsch, Markus, Hansen, Teis, Coenen, Lars, Miörner, Johan, Moodysson, Jerker, 2019. Innovation Policy for System-Wide Transformation: the Case of Strategic Innovation Programmes (SIPs) in Sweden. Research Policy, New Frontiers in Science, Technology and Innovation Research from SPRU's 50th Anniversary Conference 48 (4), 1048–1061. https://doi.org/10.1016/j.respol.2018.10.004.
Herweg, Nicole, Huß, Christian, Zohlnhöfer, Reimut, 2015. Straightening the Three Streams: theorising Extensions of the Multiple Streams Framework. Eur J Polit Res 54 (3), 435–449. https://doi.org/10.1111/1475-6765.12089.
Herweg, Nicole, Zahariadis, Nikolaos, Zohlnhöfer, Reimut, 2017. The Multiple Streams Framework: Foundations, Refinements, and Empirical Applications. pp. 17–54. https://doi.org/10.4324/9780429494284-2.
Hobert, L., Festag, A., Llatser, I., Altomare, L., Visintainer, F., Kovacs, A., 2015. Enhancements of V2X Communication in Support of Cooperative Autonomous Driving. IEEE Communications Magazine 53 (12), 64–70. https://doi.org/10.1109/MCOM.2015.7355568.
Holland, 2016. Cooperating and Sharing Knowledge to Accelerate the Implementation of Smart Mobility On a Bigger Scale. Holland. https://smartmobilitycommunity.eu/sites/default/files/RondeTafels_flyerENG_201608.pdf.
Hoogendoorn, Raymond, Arem, Bart Van, Happee, Riender, Espinoza, Riender Mazo, Kotiadis, Dimistrios, 2013. Towards Safe and Efficient Driving Through Vehicle Automation: The Dutch Automated Vehicle Initiative. DAVI - Connekt, NL. http://davi.connekt.nl/pdf/white-paper-davi.pdf.
Howlett, Michael, McConnell, Allan, Perl, Anthony, 2017. Moving Policy Theory Forward: connecting Multiple Stream and Advocacy Coalition Frameworks to Policy Cycle Models of Analysis. Australian Journal of Public Administration 76 (1), 65–79. https://doi.org/10.1111/1467-8500.12191.
Hsieh, Hsiu-Fang, Shannon, Sarah E., 2005. Three Approaches to Qualitative Content Analysis. Qual Health Res 15 (9), 1277–1288. https://doi.org/10.1177/1049732305276687.
Ingram, Helen, deLeon, Peter, Schneider, Anne, 2016. Conclusion: public Policy Theory and Democracy: the Elephant in the Corner. Contemporary Approaches to Public Policy. Palgrave Macmillan, London, pp. 175–200. International Series on Public Policy. https://doi.org/10.1057/978-1-137-50494-4_10.
Innovatiecentrale, 2016. The Traffic Innovation Centre. 2016. https://innovatiecentrale.nl/en/traffic-innovation-centre.
I&W, 2011. Programma Beter Benutten. Rijksoverheid, Netherlands Parliamentary letter IenM-BSK/2011-88715. https://www.rijksoverheid.nl/documenten/kamerstukken/2011/06/14/programma-beter-benutten.
I&W, 2011. Slim benutten: Bereikbaarheidsmaatregelen Op Een Rij. Overheid.nl.. https://www.rijksoverheid.nl/documenten/rapporten/2011/06/14/slim-benutten-bereikbaarheidsmaatregelen-op-een-rij.
I&W, 2012. Structuurvisie Infrastructuur en Ruimte. Minister van Infrastructuur en Milieu, Netherlands.
I&W, 2014. Kamerbrief Over Grootschalige Testen Van Zelfrijdende Voertuigen. I&W, Netherlands Parliamentary letter IENM/BSK-2014/124568. https://www.rijksoverheid.nl/documenten/kamerstukken/2015/01/23/grootschalige-testen-van-zelfrijdende-voertuigen.
I&W, 2015. European Truck Platooning Challenge 2016: A Fresh Perspective on Mobility and Logistics. Rijksoverheid, NL.
I&W, 2015. Ontwerpbesluit Ontheffingverlening Exceptioneel Vervoer. I&W, Den Haag. https://www.rijksoverheid.nl/documenten/besluiten/2018/04/13/ontwerpbesluit-ontheffingverlening-exceptioneel-vervoer-kentekenreglement-centrale-ontheffingverlening-bussen.
I&W, 2015. Kamerbrief Over Grootschalige Testen Van Zelfrijdende Voertuigen. I&W, Netherlands Parliamentary letter IENM/BSK-2015/12500. https://www.rijksoverheid.nl/documenten/kamerstukken/2015/01/23/grootschalige-testen-van-zelfrijdende-voertuigen.
I&W, 2015. Truck Platooning - Mobility, Public Transport and Road Safety. Government.Nl. October 12, 2015. https://www.government.nl/topics/mobility-public-transport-and-road-safety/truck-platooning.
I&W, 2015. Brief Van De Minister van Infrastructuur en Milieu. I&W, Netherlands Parliamentary letter 31305 nr. 214. https://zoek.officielebekendmakingen.nl/kst-31305-214.html.
I&W, 2016. Smart Mobility: Bouwen aan Een Nieuw Tijdperk Op Onze Wegen. I&W. https://www.rijksoverheid.nl/documenten/rapporten/2016/11/21/rapport-smart-mobility-bouwen-aan-een-nieuw-tijdperk-op-onze-wegen.
I&W, 2016. Intelligent Transport Systems and Smart Mobility. Onderwerp. Government of the Netherlands October 13, 2016. https://www.government.nl/topics/mobility-public-transport-and-road-safety/mobility/intelligent-transport-systems-and-smart-mobility.
I&W, 2017. Lijst Van Vragen En Antwoorden. I&W, Netherlands Parliamentary letter 31305 nr. 233. https://zoek.officielebekendmakingen.nl/kst-31305-233.html.
I&W, 2018. Brief Van De Minister van Infrastructuur en Milieu. I&W, Netherlands Parliamentary letter 31305 nr. 264. https://zoek.officielebekendmakingen.nl/kst-31305-264.html.
I&W, 2019. Schets Mobiliteit Naar 2040: Veilig, Robuust, Duurzam. Minister van Infrastructuur en Waterstaat, NL. http://www.beterbenutten.nl/assets/upload/files/Programma-Beter-Benutten-boek-2016.pdf.
I&W, 2019. Groen Licht Voor Tests Met Zelfrijdende Voertuigen Op De Openbare Weg - Nieuwsbericht - Rijksoverheid.Nl. Nieuwsbericht. Rijksoverheid. July 1, 2019. https://www.rijksoverheid.nl/actueel/nieuws/2019/07/01/groen-licht-voor-tests-met-zelfrijdende-voertuigen-op-de-openbare-weg.
I&W, 2013. Official publication. Kamerbrief ‘Beter Geïnformeerd Op weg: Koersbepaling Reisinformatie & Verkeersmanagement,’. February 7, 2013. https://zoek.officielebekendmakingen.nl/kst-31305-202.
I&W. Official publication. 2013b. “Brief van de Minister van Infrastructuur en Milieu,” November 4, 2013. https://zoek.officielebekendmakingen.nl/kst-31305-202.
Janssen, Robbert, Zwijnenberg, Han, Blankers, Iris, de Kruijff, Janiek, 2015. Truck Platooning: Driving the Future of Transportation. TNO.
Jones, Michael D., Peterson, Holly L., Pierce, Jonathan J., Herweg, Nicole, Bernal, Amiel, Raney, Holly Lamberta, Zahariadis, Nikolaos, 2016. A River Runs Through It: a Multiple Streams Meta-Review. Policy Studies Journal 44 (1), 13–36. https://doi.org/10.1111/psj.12115.
Kingdon, John W., 1984. Agendas, Alternatives, and Public Policies. Little, Brown.
Knaggard, A., 2015. The Multiple Streams Framework and the Problem Broker. Eur J Polit Res 54 (3), 450–465.
KNMI, 2009. Klimaatverandering in Nederland : Aanvullingen Op De KNMI'06 Klimaatscenario's. KMNI, Netherlands.
Köhler, Jonathan, Geels, Frank W., Kern, Florian, Markard, Jochen, Onsongo, Elsie, Wieczorek, Anna, Alkemade, Floortje, et al., 2019. An Agenda for Sustainability Transitions Research: state of the Art and Future Directions. Environmental Innovation and Societal Transitions 31 (June), 1–32. https://doi.org/10.1016/j.eist.2019.01.004.
Koningsbruggen, Paul van, Kerstjens, Oene, 2014. Spookfiles A58 Baant De Weg Voor Coöperatif Tijdperk. Technolution. technolution.eu/uploads/2014/12/2014-3-nmmagazine-spookfilesa58.pdf.
Koninkrijksrelaties, Ministerie van Binnenlandse Zaken en, 2010. Besluit Opheffing Ministeries Van Volkshuisvesting, Ruimtelijke Ordening En Milieubeheer En Van Verkeer En Waterstaat en Instelling Ministerie Van Infrastructuur En Milieu. https://wetten.overheid.nl/BWBR0028857/2010-10-20.
Kuhlmann, Stefan, Rip, Arie, 2018. Next-Generation Innovation Policy and Grand Challenges. Science and Public Policy 45 (4), 448–454. https://doi.org/10.1093/scipol/scy011.
Lardinois, Federico, 2012. Google's Self-Driving Cars Complete 300K Miles Without Accident, Deemed Ready For Commuting. TechCrunch (blog) 2012. http://social.techcrunch.com/2012/08/07/google-cars-300000-miles-without-accident/.
Lindner, Ralf, Daimer, Stephanie, Beckert, Bernd, Heyen, Nils, Koehler, Jonathan, Teufel, Benjamin, Warnke, Philine, Wydra, Sven, 2016. Addressing Directionality: Orientation Failure and the Systems of Innovation Heuristic. Towards Reflexive Governance. Fraunhofer Institute for Systems and Innovation Research. https://www.econstor.eu/handle/10419/145315.
Manders, T.N., Wieczorek, A.J., Verbong, G.P.J., 2018. Understanding Smart Mobility Experiments in the Dutch Automobility System: who Is Involved and What Do They Promise? Futures 96 (February), 90–103. https://doi.org/10.1016/j.futures.2017.12.003.
Markard, Jochen, Raven, Rob, Truffer, Bernhard, 2012. Sustainability Transitions: an Emerging Field of Research and Its Prospects. Research Policy, Special Section on Sustainability Transitions 41 (6), 955–967. https://doi.org/10.1016/j.respol.2012.02.013.
Marsden, Greg, Reardon, Louise, 2018. Governance of the Smart Mobility Transition. Emerald Publishing Limited. https://doi.org/10.1108/9781787543171.
Mazzucato, Mariana, 2016. From Market Fixing to Market-Creating: a New Framework for Innovation Policy. Industry and Innovation 23 (2), 140–156. https://doi.org/10.1080/13662716.2016.1146124.
Mazzucato, Mariana, 2018. Mission-Oriented Research & Innovation in the European Union. DG for Research and Innovation, Brussels. https://publications.europa.eu/en/publication-detail/-/publication/5b2811d1-16be-11e8-9253-01aa75ed71a1/language-en.
Milakis, Dimitris, Van Arem, Bart, Van Wee, Bert, 2017. Policy and Society Related Implications of Automated Driving: a Review of Literature and Directions for Future Research. Journal of Intelligent Transportation Systems 21 (4), 324–348.
Mintrom, Michael, Norman, Phillipa, 2009. Policy Entrepreneurship and Policy Change. Policy Studies Journal 37 (4), 649–667. https://doi.org/10.1111/j.1541-0072.2009.00329.x.
Mooij, Bart de, 2013. Better Informed on the Road. Roadmap 2013 - 2023. Connekt / Dutch Ministry of Infrastructure and the Environment, Netherlands.
NCSL, 2019. Autonomous Vehicles - Self-Driving Vehicles Enacted Legislation. In: National Conference of State Legislatures. 2019, . http://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx.
NOS, 2019. Zelfrijdende Busjes Uit Mislukte Proef Wageningen gaan De Grens Over. News agency NOS. February 2019. https://nos.nl/l/2272916.
Nowlin, Matthew C., 2011. Theories of the Policy Process: state of the Research and

Emerging Trends. Policy Studies Journal 39 (April), 41–60. https://doi.org/10.1111/j.1541-0072.2010.00389_4.x.
Olst, Hanneke van, 2019. Mysterie opgelost: gaat de WEpod ooit nog rijden? indebuurt Ede July 6, 2019. https://indebuurt.nl/ede/genieten-van/mysteries/mysterie-opgelost-gaat-de-wepod-ooit-nog-rijden~66797/.
Peters, B.Guy, 2016. Institutionalism and Public Policy. Contemporary Approaches to Public Policy. Palgrave Macmillan, London, pp. 57–72. International Series on Public Policy. https://doi.org/10.1057/978-1-137-50494-4_4.
Praktijkproef Amsterdam, 2018. Concorda. Praktijkproef, Amsterdam 2018. https://www.praktijkproefamsterdam.nl/over-ppa/concorda.
Prins, Pieter, Morsink, Peter, Gorter, Mark, Donker, Jaro, 2015. Bevindingen En Conclusies ACC Proef Lelystad Op 28 Oktober 2015. ACC proef Lelystad, Netherlands Final report 02. https://www.crow.nl/downloads/pdf/portals/dutch-roads/20151208-eindrapport-testen-lelystad-aon.aspx?ext=.pdf.
Reuters, 2012. Google Gets First Self-Driven Car License in Nevada. May 8, 2012. https://www.reuters.com/article/uk-usa-nevada-google-idUSLNE84701320120508.
Rijkswaterstaat, 2014. Rol En Positie Van RWS in Verkeersmanagement.
RLI, 2016. Dichterbij En sneller: Kansen voor Betere Bereikbaarheid in Stedelijke regio's. Raad voor de leefomgeving en infrastructuur, Netherlands 2016/05. https://zoek.officielebekendmakingen.nl/blg-809781.pdf.
Rogge, Karoline S., Pfluger, Benjamin, Geels, Frank W., 2018. Transformative Policy Mixes in Socio-Technical Scenarios: the Case of the Low-Carbon Transition of the German Electricity System (2010–2050). Technol Forecast Soc Change April, 119259. https://doi.org/10.1016/j.techfore.2018.04.002.
Sabatier, Paul, 2007. The Need of Better Theories. In: Sabatier, Paul (Ed.), Theories of Policy Process, 1st ed. Westview Press, Colorado, pp. 3–17.
Salas Gironés, Edgar, Vrščaj, Darja, 2018. Who Benefits from Smart Mobility Policies? The Social Construction of Winners and Losers in the Connected Bikes Projects in the Netherlands. Governance of the Smart Mobility Transition. Emerald Publishing Limited, pp. 85–101.
Schenk, Niek, 2019. Niet schrikken: Vanaf Nu Mogen Spookauto's Hier De Weg op. *AD.nl*, June 29, 2019. https://www.ad.nl/auto/niet-schrikken-vanaf-nu-mogen-spookauto-s-hier-de-weg-op-br-br~a90c6e82/.
Schot, Johan, Steinmueller, W.Edward, 2018. Three Frames for Innovation Policy: R&D, Systems of Innovation and Transformative Change. Res Policy 47 (9), 1554–1567. https://doi.org/10.1016/j.respol.2018.08.011.
Schreurs, Miranda A., Steuwer, Sibyl D., 2015. Autonomous Driving-Political, Legal, Social, and Sustainability Dimensions. Autonomes Fahren. Springer, pp. 151–173.
Smart Mobility Embassy, 2018. About the Smart Mobility Embassy. Smart Mobility Embassy 2018. https://www.smartmobilityembassy.nl/about-the-embassy/.
Steward, Fred, 2012. Transformative Innovation Policy to Meet the Challenge of Climate Change: sociotechnical Networks Aligned with Consumption and End-Use as New Transition Arenas for a Low-Carbon Society or Green Economy. Technology Analysis & Strategic Management 24 (4), 331–343. https://doi.org/10.1080/09537325.2012.663959.
Stirling, Andy, 2008. 'Opening up' and 'Closing down' Power, Participation, and Pluralism in the Social Appraisal of Technology. Sci Technol Human Values 33 (2), 262–294.
Talking Traffic, 2019. Motorists. Talking Traffic Partnership 2019. https://www.talking-traffic.com/en/whats-in-it-for/motorists.
Taskforce Dutch Roads, 2016. Wegbeheerdersatlas Zelfrijdende Voertuigen. Taskforce Dutch Roads, Netherlands Report. https://www.connekt.nl/wp-content/uploads/2016/10/Wegbeheerdersatlas-Zelfrijdende-Voertuigen-1.pdf.
Tesla, 2014. Dual Motor Model S and Autopilot. October 10, 2014. https://www.tesla.com/blog/dual-motor-model-s-and-autopilot.
Tillema, Taede, Berveling, Jaco, Gelauff, George, van de Waard, Jan, Harms, Lucas, Derriks, Harry, 2015. Chauffeur Aan Het Stuur? Kennisinstituut voor Mobiliteitsbeleid (KiM), Netherlands.
Tillema, Taede, Gelauff, George, van derWaard, Jean, Berveling, Jaco, Moorman, Saeda, 2017. Paden naar een zelfrijdende toekomst. Kennisinstituut voor Mobiliteitsbeleid, Den Haag Rapport. https://www.kimnet.nl/publicaties/rapporten/2017/03/27/paden-naar-een-zelfrijdende-toekomst.
Tweede Kamer der Staten-Generaal, 2011. Bedrijfslevenbeleid; Brief regering; Kabinetsreactie op De adviezen: 'Naar De Top, Het Bedrijvenbeleid in actie(s)' En De 'Visie Op De Noordvleugel.'. Officiële publicatie September 13, 2011. https://zoek.officielebekendmakingen.nl/kst-32637-15.html?zoekcriteria=%3fzkt%3dEenvoudig%26pst%3d%26vrt%3d%2522slimme%2bmobiliteit%2522%26zkd%3dInDeGeheleText%26dpr%3dAfgelopenDag%26sdt%3dDatumBrief%26ap%3d%26pnr%3d1%26rpp%3d10&resultIndex=4&sorttype=1&sortorder=8.
Tweede Kamer der Staten-Generaal, 2012. ITS-Plan the Netherlands 2013-2017. Tweede Kamer der Staten-Generaal, Netherlands Official publication. https://zoek.officielebekendmakingen.nl/blg-182357.
Uyarra, Elvira, Ribeiro, Barbara, Dale-Clough, Lisa, 2019. Exploring the Normative Turn in Regional Innovation Policy: responsibility and the Quest for Public Value. European Planning Studies 27 (12), 2359–2375. https://doi.org/10.1080/09654313.2019.1609425.
Wanzenböck, Iris, Wesseling, Joeri, Frenken, Koen, Hekkert, Marko, Weber, Matthias, 2019. A Framework for Mission-Oriented Innovation Policy: Alternative Pathways Through the Problem-Solution Space.
Weber, K.Matthias, Rohracher, Harald, 2012. Legitimizing Research, Technology and Innovation Policies for Transformative Change: combining Insights from Innovation Systems and Multi-Level Perspective in a Comprehensive 'Failures' Framework. Research Policy, Special Section on Sustainability Transition 41 (6), 1037–1047. https://doi.org/10.1016/j.respol.2011.10.015.
Weber, K.Matthias, Truffer, Bernhard, 2017. Moving Innovation Systems Research to the next Level: towards an Integrative Agenda. Oxford Review of Economic Policy 33 (1), 101–121. https://doi.org/10.1093/oxrep/grx002.
Wegrich, Kai, Jann, Werner, 2006. Theories of the Policy Cycle. Handbook of Public Policy Analysis. Routledge, pp. 69–88.
Zahariadis, Nikolaos, 2007. The Multiple Stream Framework: structure, Limitations, Prospects. In: Sabatier, Paul (Ed.), Theories of Policy Process, 1st ed. Westview Press, Colorado, pp. 65–92.

Edgar Salas Gironés is a PhD candidate at Eindhoven University of Technology. His-research focus on innovation policy and governance, with a focus on transformative innovation. He studied a MSc in Innovation Sciences at the same university, a Bachelor in International Relations at the National Autonomous University of Mexico (UNAM), and followed an undergraduate exchange program in Political Science at the University of California, Riverside. Edgar's research focuses on the policy processes and policy designs of STI, as well as new governance approaches.

Rinie van Est (1964) has more than twenty years of experience at the intersection between academia, government, politics and civil society. He is a lecturer in Technology Assessment and Foresight at Eindhoven University of Technology. Van Est is a leading expert on technology assessment, governance and public engagement in the Netherlands and internationally. Van Est is a physicist and political scientist by training, who is specialized in the politics of innovation. He studied applied physics at Eindhoven University of Technology and political science at the University of Amsterdam.

Geert Verbong is a Full Professor and Chair of System Innovations & Sustainability Transitions in the section of Technology Innovation & Society at Eindhoven University of Technology. His-areas of expertise include the history of technology, renewable energy technologies, power generation, energy, photovoltaics, distributed generation and grids. Geert's research focuses on the introduction of renewable energy technologies and the future of energy systems.