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# Interplay of Policy Experimentation and Institutional Change in Transformative Policy Mixes: The Case of Mobility as a Service in Finland

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## Abstract

Calls have been made for new ways of thinking about innovation policy to address pressing global sustainability problems. 'Transformative innovation policy' (TIP) is proposed as one such way. Given the newness of thinking on TIP, empirical insights are needed into how ongoing efforts by public administrations link to TIP, and how policy experimentation connecting to TIP intertwines with formal institutional change and policy mixes. We connect literatures on policy experimentation, institutional change and policy mixes for sustainability transitions to create an analytical framework on the interplay between these elements, which we apply to an in-depth case study of the development of Mobility as a Service (MaaS) in Finland. The findings show how a potentially disruptive innovation, MaaS, can be traced back to a longer process of administrative reorientation and restructuring, i.e. gradual transformation in formal institutions, and has benefitted from cycles of policy experimentation, new vision building and learning, combined with a sequence of policy strategies and major regulatory change. The evolving 'transformative' policy mix has influenced transition by supporting niche development through policy experimentation as well as changing the established mobility regime through formal institutional change.

**Key words:** innovation policy, sustainability transitions, policy experiments, transport, mobility-as-a-service, policy mixes

## 1. Introduction

Calls have been made for new ways of thinking about innovation policy to address 'wicked' global problems relating to environmental unsustainability, social inequality and poverty. Transformative innovation policy has been proposed as one such way (Schot and Steinmueller, 2018; Steward, 2012; Weber and Rohracher, 2012). It emphasises the need to move away from, or expand, conventional innovation policy that is not sufficiently equipped to address these problems and promote sustainable transformative change. TIP has been described yet incoherent field of investigation that moves from an economic policy framing to a societal one and adopts an understanding of innovation processes that goes beyond the commercialisation of science to include diverse actors and demand-side influence on innovation (Diercks et al., 2019). Recently, TIP scholars have received positive responses from innovation policymakers in the Global North and South. This may indicate a beginning of a policy paradigm shift, from innovation policy dominated by the ideas of competitiveness and growth, to new innovation policy taking environmental and social problems at its core (Diercks et al., 2019).

Schot and Steinmueller (2018) outline a TIP frame that pays attention to the directionality of innovation and *policy experimentation,* aiming for systemic and disruptive change. It draws from the sustainability transitions' view on experimentation. Based on that view, experimentation provides temporary 'niche' spaces for learning. However, Schot and Steinmueller conceive TIP experimentation also as activities that engage policymakers as 'regime' actors.

In the context of the sustainability transitions literature, policy experimentation is a novel research opening. Other writings on transformative innovation policy have not elaborated on policy experimentation (e.g. Diercks et al., 2019; Fagerberg, 2018). Overall, there is much uncertainty regarding what kind of policy strategies, processes and instruments TIP should comprise. Further, little attention has been paid to how TIP connects to change in formal institutions that coevolve with technology and actors in transitions.

Therefore, we will here draw on other literatures on policy experimentation, in particular, the recent literature on climate policy experimentation (Bernstein and Hoffmann, 2018; Huitema et al., 2018; McFadgen and Huitema, 2018). Environmental scholars see policy experiments increasingly as mobilisers for desirable societal transformation (Ansell and Bartenberger, 2016; Huitema et al., 2018). Ansell and Bartenberger (2016) identify different 'uses' of experimentation in environmental problem solving, including the encouragement of innovation leading to transitions, designing and evaluating institutional arrangements, and reassuring social and political learnings to mobilise support for sustainability.

The connection between policy experimentation and institutional change often remains distant, while there is an expectation that favourable changes prompted by experiments may become institutionalised over time (cf. Turnheim et al., 2018). Institutional change more broadly is necessary for existing regimes to transform.

During a relatively short period, an ample literature on policy mixes in sustainability transitions has emerged, calling for a broad conceptualisation of such policy mixes (Rogge and Reichardt, 2016). The analyses cover mixes of policy strategies and instruments (Ossenbrink et al., 2019), some emphasising also the importance of policy processes (Flanagan et al., 2011) and policy mix characteristics (Costantini et al., 2017). A recent special issue on policy mixes for sustainability transitions bridged across innovation and policy studies to appreciate the role of policy processes in transitions (Kern et al., 2019). However, the connections of policy mixes to policy experimentation and institutional change have scarcely been explored, beyond the broad similarities in how change processes are described in institutions (Beland, 2007; Thelen, 2003) and in policy mixes (Howlett and Rayner, 2007; Kern and Howlett, 2009) to contain the elements of layering, drift and conversion. We thus argue that bringing in discussions about experimentation and institutional change is a step forward in analysing change in policy mixes from the perspective of transformation.

We also argue that, given the newness of thinking on transformative innovation policy, empirical insights are needed into how ongoing efforts by public administrations link to TIP, and how experimentation connecting to TIP intertwines with formal institutional change and policy mixes. Thus, this paper makes two key contributions. First, we propose an analytical framework for the interplay of policy experimentation and institutional change in transformative policy mixes. For this, we will connect the concepts of policy mixes and policy experimentation with the idea of change in formal institutions from the perspective of sustainability transitions.

Second, we present findings from an in-depth case study of the development of Mobility as a Service (MaaS) in Finland that is a disruptive niche innovation, with potential to stimulate a transformation in urban mobility systems away from privately-owned personal transport. Finland was the first country, globally, to officially launch the MaaS concept, with the lead of the Ministry of Transport and Communications, and backed it up with major regulatory renewal, the Transport Service Act. The emergence of MaaS traces back to broader institutional and policy developments of the 1990s and early 2000s at the intersection of transport and communications policy, providing crucial contextual knowledge for other countries engaged in MaaS efforts.

From the perspective of sustainability transitions, MaaS offers potential for significantly altering mobility systems, if it replaces private car ownership and travel. However, this requires scaling MaaS

innovations and destabilising the private vehicle and combustion engine -based mobility system. Research on MaaS is in its early phases, and social science studies on governance changes connected to MaaS have been rare. Our study complements this emerging strand of literature (cf. Smith et al., 2018b) by providing a deeper account of the developments in formal institutions, policy experimentation and policy mixes influencing MaaS.

Section 2 grounds our analytical framework, followed by a review of the MaaS literature in section 3. Section 4 describes the research method, and section 5 presents the findings. Section 6 discusses the findings in connection to our framework and concludes.

## 2. A framework for the interplay of policy experimentation and institutional change in transformative policy mixes

In this paper, we propose an analytical framework to examine the interplay between policy experimentation and formal institutional change in transformative policy mixes for sustainability transitions. We acknowledge that other factors are also significant but argue that it is important to unpack the influences of temporary and entrenched policy changes, policy experiments and changes in formal institutions within the conceptualisation of policy mixes. Together, these have important temporal implications that have received little attention in the literature on policy mixes for sustainability transitions. We ground our proposition based on insights from the literatures on policy experimentation (section 2.1), institutional change (section 2.2) and policy mixes (section 2.3). We will end by introducing our analytical framework (Section 2.4).

### 2.1 Policy experimentation

Experimentation is a key activity in sustainability transitions, the idea based on experimental activities paving way for the development of new niches (Grin et al., 2010). The sustainability transitions literature defines experiments in multiple ways, ranging from niche-level experimentation in the multi-level perspective and strategic niche management frameworks (Schot and Geels, 2008), through entrepreneurial experimentation in the context of technological innovation systems (Suurs et al., 2010), to transition experiments in transition management (Frantzeskaki et al., 2012). More recently attention has begun to focus on how experimentation can also be used to support processes of niche acceleration (Wieczorek, 2018) and regime destabilisation (Ghosh et al., 2020) alongside niche creation.

Berkhout et al. (2010: 262) define sustainability experiments as '*planned initiatives that embody a highly novel socio-technical configuration likely to lead to substantial (environmental) sustainability*

*gains'*. Sengers et al. (2020:153), in a systematic literature review of experimenting for sustainability transitions, define an experiment '*as an inclusive, practice-based and challenge-led initiative, which is designed to promote system innovation through social learning under conditions of uncertainty and ambiguity*'. In another systematic literature review, Kivimaa et al. (2017) found a variety of experimentation but a lack of literature with empirical examples of policy and governance experiments pertaining to transitions.

Our focus here is on such, until now neglected, policy experimentation. We argue that policy experimentation pertaining to transitions requires a different definition from the transition studies' niche-oriented perspective and provide such a definition in section 2.4. We, thus, follow Schot et al. (2019) who in a recent work on experimental policy engagements in the TIP context began to think about the diverse ways in which policymakers engage with processes of societal experimentation for sustainable transformation. The ways may include initiating, supporting or mobilising experimental activities; enabling processes of social learning; and evaluating experimentation. Further, Schot et al. (2019) suggest different formats of policy experimentation: within the confines of traditional policy instruments and processes, in creating new experimental policy spaces, and policymakers supporting already ongoing experimentation by consolidating learning (via intermediary actors and platforms). Innovation programmes that open closed collaboration networks and break policy silos via novel designs (Grillitsch et al., 2019) may sometimes count as policy experiments. Other types of policy experiments can include, for example, the setting up of 'transition arenas' (Frantzeskaki et al., 2014) to re-direct policymaking; 'policy labs' or 'urban living labs' (von Wirth et al., 2019) to enable spaces for new network formation, vision creation or piloting, feeding back into policymaking; or other ways to deviate from the structure of traditional policy instruments and, often bureaucratic, policy processes. Such policy experimentation is needed because "*conventional policy interventions, such as R&D investments or targeted subsidies, will most likely not suffice to initiate and foster sustainability transitions*" (von Wirth et al., 2019:230).

The principal idea behind experimentation is learning (Brown and Vergragt, 2008; Tassey, 2014). Ansell and Bartenberger (2016) describe two types of learning: *epistemic*, connecting to the scientific understanding of the world, and *political*, learning about changes in the preferences, goals, and commitments of stakeholders. Similarly, McFadgen and Huitema (2017) consider learning of policy experiments to comprise *cognitive* learning (new knowledge and improved structuring of existing knowledge, a deeper understanding of the policy process) and *normative* learning (changes in perspectives, goals, or priorities). Others have used the terms first- and second-order learning. First-order learning concerns, for example, new insights into policy options relating to cognitive level of analysis, while second-order learning deals with learning about the policy problem and context

relating to the normative level of analysis (van de Kerkhof and Wieczorek, 2005). Thus, first and second-order learning correspond well to above categories of cognitive and normative learning.

These different forms of learning may feed into, and in some cases shape, pre-existing policy mixes and contribute to institutional change. However, it is not granted that learning has such influence, because knowledge generated in experiments is but one consideration for policymakers (Huitema et al., 2018). Policy experiments are embedded in political dynamics (Huitema et al., 2018) that are too easily ignored (Hoffmann, 2011). Moreover, "*experiments are infused with political ideas and they suggest that in practice experiments often confirm existing ideas rather than challenge them*" (Brodkin and Kaufman, 2000, quoted by Huitema et al., 2018).

Bernstein and Hoffmann (2018) describe the potential outcomes of experiments to transitions via three different mechanisms: catalysing normative change; building capacity to act differently by mobilising resources directly or via institutional change; and coalition building. They state that these "*mechanisms help to determine whether the changes the experiment promotes will scale up and become entrenched in the targeted system, whether directly because the intervention itself grows, diffuses, and/or becomes institutionalized or because its policies and practices take on a life of their own, spawning further interventions or scaling and entrenching in other ways (changing other institutions, creating new legislation, altering business practices, etc.)*" (Bernstein and Hoffmann, 2018:191). Thus, they view that experiments influence institutional change, while they do not detail how this happens.

## 2.2 Institutional change

The study of institutions is an extensive research field with multiple strands which is receiving increasing attention in transition studies (Andrews-Speed, 2016; Lockwood et al., 2017). North (1991:97) defines institutions as "*the humanly devised constraints that structure political, economic and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, laws, property rights).*" Institutions are described as building-blocks of social order that integrate collectively enforced expectations with respect to the behaviour of actors or the enactment of activities, including rights and obligations for actors (Streeck and Thelen, 2005).

Institutional change occurs when many actors switch from one logic of action to another (Streeck and Thelen, 2005). This is regarded as the beginning of a new path where the new general orientation of actors operates like a 'meta-rule' (Deeg, 2005). Mahoney and Thelen (2010:8) argue institutions are always exposed to changes, as they "*represent compromises or relatively durable though still contested settlements based on specific coalitional dynamics*". Streeck and Thelen (2005) identify four

classes of institutional change on the basis of change processes, incremental or abrupt, and result of change, continuity or discontinuity (Table 1). From the perspective of sustainability transitions, interesting are 'gradual transformation' that through incremental processes of change lead to discontinuity in institutions, and 'breakdown and replacement' that result in discontinuity from abrupt processes of change. What we can draw from this for TIP is that, breakdown is not the only mechanism of transformative change, and those that lead in pursuing sustainability transitions, can advance gradual transformation instead.

*Table 1: Forms of institutional change*

| | | Result of change | |
|---|---|---|---|
| | | Continuity | Discontinuity |
| Processes of change | Incremental | Reproduction by adaptation | Gradual transformation |
| | Abrupt | Survival and return | Breakdown and replacement |

Source: Streeck & Thelen, 2005

Institutional theory – especially Scott's (1995) work – is one of the building blocks of the multi-level perspective (MLP) (e.g. Geels and Schot, 2007). However, it has remained rather implicit in many empirical studies. Institutional barriers have been noted to prevent sustainability transitions (Foxon and Pearson, 2008; Mahzouni, 2015). Yet, until recently, explicit research on institutional change in sustainability transitions was only conducted by Fuenfschilling and colleagues (e.g. Fuenfschilling and Truffer, 2016; Fuenfschilling and Binz, 2018). Fuenfschilling (2017:2) argues that sustainability transitions can be '*characterized as processes of institutional change with specific focus on technologies and materiality*' and examining institutional change can provide for new insights into path dependence, stability or disruption in dominant structures, and the institutionalisation of new socio-technical configurations.

The importance of connecting experimentation to institutional changes has been highlighted in a recent special issue on institutional change in the context of urban experimentation, describing it a hitherto neglected topic (Fuenfschilling et al., 2019). The contributions showed that experimentation and institutions are closely connected, for example, via institutions defining the legitimate forms and degrees of experimentation in specific geographical contexts. However, these contributions did not specifically address policy experimentation and formal institutional change, nor policy mixes in this context.

## 2.3 Policy mixes for sustainability transitions

One of the first contributions to the policy mixes literature from an environmental perspective, by Sorrell and Sijm (2003), examined the introduction of carbon pricing to the climate policy mix. This stimulated further research on the interactions of different policy instruments. In environmental economics, policy mixes were defined as several policy instruments being used to address a particular environmental problem (Braathen 2007). In policy sciences, policy mixes were described as "*complex arrangements of multiple goals and means which, in many cases, have developed incrementally over many years*" (Kern and Howlett, 2007:395). These early efforts were replicated in innovation studies, initially focusing on the combination of policy instruments to influence R&D investments (Nauwelaers et al., 2009), and later broadening to more comprehensive "real world" policy mixes (Flanagan et al., 2011).

Policy mix thinking has witnessed a growing interest among transition scholars; the early focus on mere instrument interactions, while important, being criticised for omitting key policy aspects for transitions (Kern et al., 2019). The new generation of policy mix thinking, drawing from policy sciences and economics, differentiates between long-term policy strategies, such as climate plans for 2050, and instrument mixes, such as carbon pricing and feed-in tariffs (Schmidt et al., 2012). It pays attention to policy mix characteristics, such as the consistency of policy mixes (Howlett and Rayner, 2007), and policy making and implementation processes, including their indirect and direct influence on innovation (Flanagan et al., 2011). Rogge and Reichardt (2016), therefore, elaborated a conceptualisation of policy mixes for sustainability transitions that includes policy strategies, processes and characteristics alongside instruments. The policy mix research for transitions has also emphasised the need of policy mixes that both promote niche innovation and destabilise unsustainable socio-technical regimes (Kivimaa and Kern, 2016).

Empirically, most studies have focused on energy transitions, as evidenced in a special issue on the topic (Rogge et al., 2017). While some studies pay attention to policy mix development over time (Biesbroek and Candel, 2020; Huang, 2019), research has mostly neglected considerations of short-term and long-term policy interventions on the overall policy mix from the perspective of transitions. With the exception of Bahn-Walkowiak and Wilts (2017), studies neglect the interplay between institutional change and policy mixes.

## 2.4 Proposition for an analytical framework for the interplay of policy experimentation and institutional change in transformative policy mixes

The proposed analytical framework is built around the idea of transformative policy mixes and highlights the interplay between policy experimentation and formal institutional change but embeds

this in the context of existing policy mixes. By drawing on Flanagan et al. (2011) and Rogge and Reichardt (2016), we define policy mixes as a changing combination of policy strategies, instruments, implementation mechanisms and policy processes that interact "in the real world" and influence – and are influenced by - transition dynamics. We argue that transformative policy mixes include also policy experimentation and are closely connected with institutional change. Yet, these elements have not been explicitly discussed in the context of policy mixes and their role is often ignored in policy mix thinking (for an exception on the institutional effects of policy mixes see Edmondson et al. (2019)).

Our first building block is policy experimentation. Drawing from Tassey and McFadgen and Huitema (2018), we define 'policy experimentation for sustainability transitions' as temporary and reflexive policy interventions, both instruments and processes, that contribute to niche creation and acceleration as well as regime destabilisation by mechanisms of learning (and unlearning), articulation of expectations and visions, and networking. We differentiate between two types of policy experimentation both limited in scale and time: (1) incrementally innovative policy interventions which occur within the boundaries of the established policy mix, including, for example, the testing of new instrument designs or more inclusive target groups for innovation funding; and (2) more radically innovative policy interventions often falling outside the boundaries and rules of the established policy mix, including, for example, the generation of deep learning from transition arenas or urban living labs.

Experiments are bound by formal and informal institutional rules that define who is included or excluded, who does what, how authority is distributed and how decisions are made, and what kind of knowledge is generated and how it is transferred (McFadgen and Huitema, 2017). Thus, our second building block is institutional change. Given our focus on public policy in this paper, we concentrate on formal institutions, described by Streeck and Thelen (2005), as social regimes characterised by stability and including rule makers, formalised rules, rule takers and third-party enforcement.

Policy is typically viewed as a part of the (formal) institutions in a given socio-technical system. A more nuanced view would argue that formal institutions and policy mixes overlap when public policies give normatively backed rights and responsibilities to actors other than the policymakers themselves. Following this view, policy strategies, instruments and processes within policy mixes which meet these criteria and have become stabilised can be seen as formal institutions. In addition, we regard public administration organisations as institutions "*to the extent that their existence and operation become in a specific way publicly guaranteed and privileged, by becoming backed up by societal norms and the enforcement capacities related to them*" (Streeck and Thelen, 2005:12). This would include, for example, government departments and ministries and their agencies. Consequently, 'institutions as

organisations' create conditions for the policy mix and 'institutions as regulations' contribute as its more stable parts. Change in formal institutions, therefore, may have significant implications on the nature of the policy mix.

When zooming in on the interplay of policy experimentation and formal institutional change, we propose in our framework (Figure 1), first, that policy experimentation, at times, impacts institutional change and policy mixes via the different forms of learning and knowledge it generates. The political dynamics of experiments (Huitema et al., 2018) and, more broadly, the policymaking process influence the degree to which this happens. Fuenfschilling et al. (2019:222) argue that *'[e]xperiments can contribute to the deinstitutionalisation of dominant, unsustainable configurations'* and act as spaces where new institutional environments for novel practices and narratives are created.

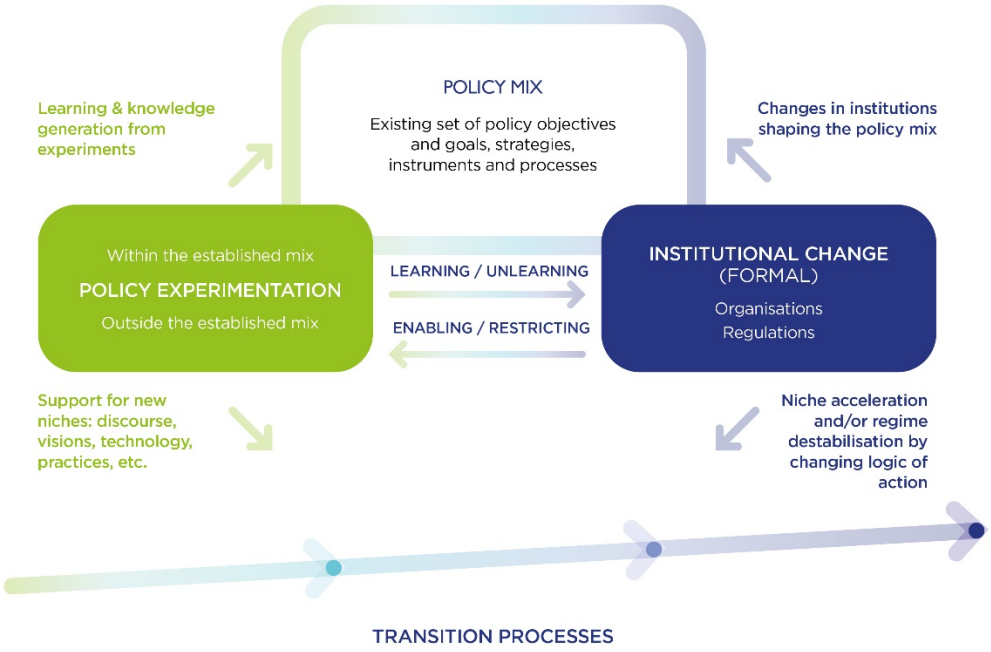


*Figure 1. Analytical framework for transformative policy mixes*

Second, we propose that formal institutional change can enable or restrict the occurrence and format of policy experimentation based on the degree to which regulatory frameworks and organisational structures encourage and allow, or discourage and restrict, experimentation by policymakers and civil servants. The previous literature suggests that *"[i]nstitutional settings define the degree and form of experimentation that is deemed legitimate..."* (Fuenfschilling et al., 2019:p.225), being bound by institutional rules (McFadgen and Huitema, 2017).

Our framework also addresses the influence that policy experimentation and formal institutional change have on sustainability transitions. First, policy experimentation can influence transition processes by actively supporting the development of niches. While the influence of a single experiment can be limited, sequences of experiments can lead to novel socio-technical configurations (Torrens et al., 2019). The mechanisms by which this happens include experiments spurring changes in discourses, technology, infrastructure, business models and practices, the latter being most difficult to influence (Kivimaa et al., 2017). If successful, sequences of experiments may institutionalise as novel actor-configurations, governance models and practices (Turnheim et al., 2018; von Wirth et al., 2019). Second, institutional change is likely to have a larger impact on transitions than policy experimentation by being able to accelerate niche build-up by the removal of barriers and destabilise regimes from within. By deinstitutionalising regime structures, institutional change becomes part of broader transitions processes (Fuenfschilling and Truffer, 2016).

## 3. Mobility as a Service

Mobility-as-a-service (MaaS) does not refer to a single technology. It is a new way of thinking about how mobility is provided and used. The use of MaaS in the academic literature has been argued to lack conceptual clarity (Audouin and Finger, 2018; Flügge, 2017). According to Smith et al. (2018a), the understandings of MaaS sit along a spectrum from '*a wide range of transport services, from peer-to-peer services… to services that attempt to optimize the connection between personal cars and [public transport]*' to more narrow understandings of MaaS as specific 'packaged offerings' with '*intermodal planning, booking and payment functionalities, as well as multiple transport modes and mobility packages*' (Smith et al., 2018a:2). Our case study is oriented to the latter.

When MaaS is understood in a narrower sense, as packaged offerings combined with intermodal planning, the existence of specific MaaS integrators and operators is required. MaaS integrators '*mediate the offerings from several transport service providers (and potentially other suppliers) to MaaS operators through activities such as technical integration, contract management and financial clearing*', while MaaS operators '*deliver MaaS to end-users by enabling them to seamlessly plan, pay for and execute use of public transport and other transport services, through a single interface*' (Smith et al., 2018a:2). The formation of new business models around MaaS has particularly oriented around MaaS operators (Auduoin and Finger, 2018; Sochor et al., 2015), while also business models, for example, around shared mobility relate to broader MaaS developments (Cooper et al., 2019; Skeete, 2018).

Given the relative newness of the concept (Heikkilä, 2014), the literature on MaaS is only emerging. Utriainen and Pöllänen (2018) reviewed scientific literature on MaaS, finding that the early literature had focused on different transport modes and services, findings of pilots, and the expected effects of MaaS. In our review of this literature, we found emerging attention since 2018 on the user perspective (Hesselgren et al., 2019) and public governance aspects (Audouin and Finger, 2018; Smith et al., 2018a,b, 2019). Previous research has also explored potential customer markets and consumer behaviour (Sochor et al., 2016; Strömberg et al., 2016) and the configuration of business models for MaaS provision in Sweden (Sochor et al., 2016), Germany (Giesecke et al., 2016) and Finland (Audouin and Finger, 2018).

Research on the governance of past and ongoing MaaS developments has been lacking (Audouin and Finger, 2018) with the exception of Smith et al. (2018a,b, 2019). The few analyses have focused on the roles of public and private sectors (Smith et al., 2018a), and multi-level governance (Audouin and Finger, 2018). Audouin and Finger (2018) investigated the launch of the WHIM app in the Helsinki Metropolitan Region, and found supportive roles of governance processes, such as the development of a MaaS stakeholder network, launching MaaS initiatives in parallel with one another, lobbying efforts from local government, a strong shared vision of MaaS pushed by public authorities, and the development of the Transport Service Act. Furthermore, Smith et al. (2018b) found how top-level support and inter-organisational collaboration have played a role in Finnish MaaS developments. Our study complements Audouin and Finger (2018) and Smith et al. (2018a,b) by providing a deeper account of the role of public governance, institutional change and policy experimentation. Further, it adds empirical insights, covering a period from 2017 to early 2019, missing from earlier studies.

Although often equated with an environmentally sustainable transition, transformation to MaaS does not necessarily guarantee sustainable, low-carbon outcomes. While MaaS provides a disruption to the traditional private ownership model of vehicles (Skeete, 2018), the sustainability of MaaS is dependent on the technology used to provide transport services as well as changes in consumer patterns (Giesecke et al., 2016).

## 4. Methods

We undertook exploratory case study research (Gerring, 2004), examining the process of MaaS development, with specific focus on public governance activities. The study included two phases, with sufficient period in between to follow up the development and the impacts of institutional changes on MaaS. Phase I explored the Finnish mobility transition and different innovation niches. MaaS arose in this phase as the least developed niche but with substantial potential to change the mobility system,

not only in terms of the vehicles and fuels but also practices and routines around mobility. MaaS can also be a potential connecting niche for the more technical niches of biofuels and electric vehicles. Phase II examined MaaS specifically and, based on the initial insights emerging from Phase I, focused on the role of policies and institutional change. One such institutional change is the Transport Service Act, implemented from July 2018, also necessitating Phase II interviews. Table 2 shows the empirical material gathered.

*Table 2. Empirical material used in the study*

| **Phase I: May- June 2017** | **Unstructured interviews & innovation history workshop for scoping analysis** |
|---|---|
| Interviews of 7 experts | Business x 2 (I1, I6)<br>University x 1 (I2)<br>Innovation agency x 2 (I3, I5)<br>Research institute x 1 1 (I4)<br>Ministry x 1 (I7) |
| Innovation history workshop involving 9 experts | Business x 2<br>University x 1<br>Innovation agency x 3<br>Research institute x 1<br>Ministry x 1<br>Transport agency x 1 |
| **Phase II: January-May2019** | **Semi-structured interviews for case study construction** |
| Interview of 17 experts in 16 interviews | Business x 3 (I16, I19, I20)<br>Innovation intermediary x 2 (I15, I22)<br>Ministry x 3 (I9, I10)<br>Transport agency x 3 (I11, I12, I18)<br>Network organisation x 3 (I13, I17, I21)<br>Think tank x 1 (I8)<br>Public transport provider x 1 (I14)<br>Innovation agency x 1 (I23) |

The first seven face-to-face interviews in 2017 were unstructured and utilised to scope the development and central issues in the Finnish mobility transition. Invitations had also been sent to different stakeholders (researchers, businesses, civil servants from innovation and transport domains) assumed to have detailed information on transport transitions in Finland to participate in an innovation history workshop. The 4-hour workshop presented an initial timeline of the events drafted by the organisers and sought feedback and elaboration from its participants on the turn of events and their significance to create a shared understanding of the innovation process, i.e. an 'innovation history'. The discussion was recorded, and the timeline was amended based on stakeholder feedback. It was used as a basis for more detailed questioning in the second round of interviews. The interviews

and workshop were conducted in connection to collaborative work with the first author and the Finnish Funding Agency for Innovation Tekes (now Business Finland) through the Transformative Innovation Policy Consortium. The interviews and workshop discussions were recorded and partially transcribed. They were analysed by the first author following the elements in our analytical framework.

The second round of sixteen semi-structured interviews was conducted by the first author following an early version of the analytical framework. The interviewees were asked to describe: (a) the most significant events and influencing factors on the development of MaaS; (b) related institutional change and public governance; (c) the role of public governance experiments / experimental culture; (d) the transport service act and administrative changes in the sector of transport and communications; (e) the role of the administrative sector of the Ministry of Economic Affairs and Employment and the innovation funding agency Business Finland; and (f) the current status of MaaS and its future potential. In addition, supplementary questions were asked based on the interviewees' expertise. The interviews were conducted in 2019, face-to-face (12 interviews) or over the phone (4 interviews), and with different people from the first phase to deepen the insights on the case. The interviews were recorded and transcribed verbatim and analysed by the first author to create a detailed case narrative. The narrative was then sent to all the interviewees for fact checking.

## 5. The MaaS case study

MaaS in Finland embraces an idea of freedom of mobility, to ease people's lives via providing novel mobility solutions independent of car ownership, by combining public and private providers. MaaS describes a vision of future mobility that is greenhouse gas emissions free, affordable to everyone, should not waste monetary resources, should not waste our time, should not occupy the urban space, and aim to end road fatalities (Suikkanen and Hietanen, 2017). While MaaS in Finland has largely been pursued from a market-driven perspective, environmental drivers, especially reducing the carbon emissions from transport, have contributed (I10, I12, I17, I21)[1]: "*Our basic idea is that it should guide people to use more sustainable solutions, the basics of that being public transport and other shared mobility solutions*" (I10).

Initially, the development focused on urban areas. More recently, 'rural MaaS' has gained interest to generate costs savings to the public sector coupled with improved and less expensive services for

[1] I1-I23 refer to the interviews conducted. See Appendix 1 for the full list of interviews.

private consumers (I15, I20, I22). MaaS, thus, links to reduced availability of public funds, lowered public transport service level, and environmental and security challenges (I21).

Regarding new MaaS services, Maas Global is the only fully operational MaaS operator company in Finland, while another start-up, Kyyti, is a platform and solution provider. The telecommunications operator TeliaSonera has also run MaaS pilots. There are also associated business developments, for example, by a banking and car insurance company OP. Generally, MaaS is still in an early, conceptualisation phase (I12). The following describes the chronological development of MaaS in Finland from the perspective of public governance.

## 5.1 Early developments towards an intelligent transport system

The development of MaaS links strongly to how transport and communications policy have been made in Finland since the mid-1990s (WS[2]). Transport and communications have, for long, been located in the same ministry, the Ministry of Transport and Communications (MTC), and both the ministers and high-level civil servants have created visionary policy strategies in the interface of transport and communications - the intelligent transport systems.

Intelligent Transport Systems Finland (ITS Finland) was launched in 2004, initially as a three-year project, to advance the development of transport and logistics telematics services and products. It is an open forum for the collaboration of companies, researchers and the public administration (ITS Finland 2019a; I21). Later, in 2006, ITS Finland became a non-profit association, a public-private network partially funded by the MTC, with an aim to "*increase the safety, security and efficiency of the transportation systems and help to create more traffic free zones in cities*" (ITS Finland, 2019b), make visible intelligent transport options and facilitate networking between actors (I21). It has been described as a 'primus motor' in advancing MaaS (I8, I10).

In 2006, Sampo Hietanen, then CEO of ITS Finland, got an idea to compare the transport sector to telecommunications in terms of future opportunities: in telecoms, there is an operator that connects to customers and uses infrastructure by offering different 'packages' to consumers (I1, I6, I2, I10, I17, I19).

Around the same time, the MTC began developing new transport policy. In 2006, Harri Pursianen was appointed as the MTC's Permanent Secretary, taking a broad view to change (I7). Anu Vehviläinen (Centre Party), appointed as Minister in 2007, supported Pursiainen and said that he should make proposals to develop the sector and policy further (I7). In 2007, government officials at the MTC prepared a new strategy, *Transport 2030*. It described climate change as the most significant challenge

[2] WS refer to discussions in the innovation history workshop.

and proposed means, such as stopping the fragmentation of urban structures and growth in the use of private cars, improving the energy efficiency of transport, and new low-emission fuels to meet this challenge (Kivimaa and Mickwitz, 2010).

Finland's Strategy for Intelligent Transport, a key policy influencing MaaS, was published in 2009 (MTC, 2009; WS), acknowledging the need to renew transport services, containing ideas around public-private collaboration, technology neutrality and user orientation (I10). Its preparation included experts in telecommunications feeding into transport policy (I21). It emphasised better and environmentally friendlier services, where "*integrating the conventional, physical transport system with the ubiquitous intelligence of the information society*" was adopted as a response to major forces of change, such as climate change, globalisation and limited finances (MTC, 2009:4). More broadly, the emergence of new transport policy meant that transport was perceived in the ministry from a different viewpoint than before (I19).

In 2010, the administrative sector underwent an organisational change. The previously separate agencies for aviation, road, rail and marine transport were merged into new multimodal transport agencies, the Transport Agency and the Transport Safety Agency (Trafi), enabling '*more coordinated planning of different transport modes with potential benefits to low carbon transition'* (Kivimaa and Temmes, 2016, p. 141; I2, I19). The organisational change was connected to a shift of attention in the ministry from building roads to solving problems first, the utilisation of intelligent transport systems to save money and make smarter solutions, and user orientation; forming the basis of new transport policy, this had a significant impact (I17, I19). "*After this administrative renewal, a certain drive to lead in 'enabling' has been very good all the time*" (I12). This administrative structure, with transport and communications being on the same level in the ministry, "*enabled quite open thinking that led to… giving quite a lot of space for markets to operate, innovate, provide services, and the role of the public sector is to support those innovations and create a market framework that has space for different types of actors, easy access to markets, not many bottlenecks*" (I17), supporting also the emergence of MaaS thinking (I21). We regard this as the demonstration of **first institutional change** supporting MaaS.

In 2011, the MTC published the Transport Revolution programme, aimed "*at developing a new mind-set for urban and transport planning and policies and policy implementation*" (MTC 2011:1; I19) with Sitra the Finnish Innovation Fund, the Ministry of Economic Affairs and Employment (MEAE), the Ministry of Finance, the Ministry of the Environment, two administrative transport agencies, and two strategic centres for science, technology and innovation. The programme highlighted that transport and logistics will be approached as a service and placed user-centred development of transport

services and new innovative forms of operation in focus (I7). More broadly, the programme consisted of four parts: creating a new way of thinking about transport, enabling administrative renewal and development, experimental projects, and piloting new service concepts and business models (Sitra, 2019).

The government's Transport Policy Report to the Parliament was published in April 2012. This high-level policy report explicitly described a 'serving transport system', the electrification of services, and seamless transport under its vision of 'competitiveness and wellbeing from responsible transport' (MTC 2012a). MaaS was not then explicitly used as a concept, yet, supported by this policy report (I13).

Locally, an early experiment was conducted in 2012 by Helsinki Regional Transport Authority HSL setting up a pilot of on-demand public transport, Kutsuplus. While this was discontinued in 2015, it illustrated how new ICT technologies enable new mobility services (WS).

## 5.2 Active vision formation

Things started really developing after Merja Kyllönen (Left Alliance) was appointed as the Minister (I15). In September 2012, she established a New Transport Policy Club, a new way of policymaking, for a 2.5 year period to meet 2-4 times per year (MTC 2012b) to renew transport policy and respond to the challenges of emissions, automatisation and servitisation (I13). In the ministry, it was thought, *"we need something more to help us implement our strategy*" (I7). The participants to the club were handpicked to include visionary people from the public, private and research sectors (not just limited to transport) and the minister herself to create a common vision and goals (I7, I10, I13, I15, I17). It discussed how to renew the tightly regulated structures in the transport sector (I13), whether transport and associated services can be reorganised, and how to enable this change (I12). Several interviewees mentioned the New Transport Policy Club as an influential part of MaaS development in Finland (I1, I7, I10, I13, I21, WS). As this was a novel way of doing policy with a time-limited mandate, we regard the New Transport Club as the **first policy experiment, type 2**.

A key event was a meeting of the club in early 2013. In the event, Sampo Hietanen, from ITS Finland, held a presentation on transportation as a service, listening to which a leading civil servant Minna Kivimäki realised that this means they need to renew the whole transport policy*: "This can be described as the moment when MaaS truly began progressing*" (I1). The ministry took a strong role: "*Without the ministry, this would have probably never happened*" (I15).

The conceptualisation of MaaS was still vague at the time (I5). Clarification was provided in May 2014, when Sonja Heikkila published an MSc thesis '*Mobility as a Service - A Proposal for Action for the Public*

*Administration, Case Helsinki*', with Sampo Hietanen as one of the thesis advisors (Heikkilä, 2014; WS). The thesis was commissioned by the Helsinki City Planning Department (I15), developed a vision for MaaS (I16), and was a driving force for MaaS (I18). Some months later, the main newspaper in Finland *Helsingin Sanomat* published a news article referring to the thesis, and also presented a vision how in ten years' time, the residents of Helsinki do not need to own cars (HS, 2014). The thesis ended up being important and gained international attention; Ms Heikkila delivered hundreds of talks in different countries (I1, I8, I13, I15, I16): "*Afterwards there has been a lot of this, requests internationally to both Sampo and I. That resulted in the fact that the MaaS vision overall became world-famous, and then many people have begun working on it.*" (I16).

Multiple actors recognised that Finland had the opportunity to do something that others had not yet done: "*It was seen that digitalisation comes and affects transport. Emissions and environment-related pressures will influence transport transition, so it was successfully and well-timed recognised that we should as a nation take the forefront to solve this*" (I8). In June 2014, the MTC launched the idea of MaaS (Figure 2), with a supportive animation in YouTube (https://www.youtube.com/watch?v=ZQieTU7_5xo, accessed 7/3/19). This coincided with the organisation of ITS Europe Congress in Helsinki, hosted by ITS Finland, the MTC and the City of Helsinki (I19). The conceptualisation work for MaaS by the ministry and ITS Finland has been important (I20).

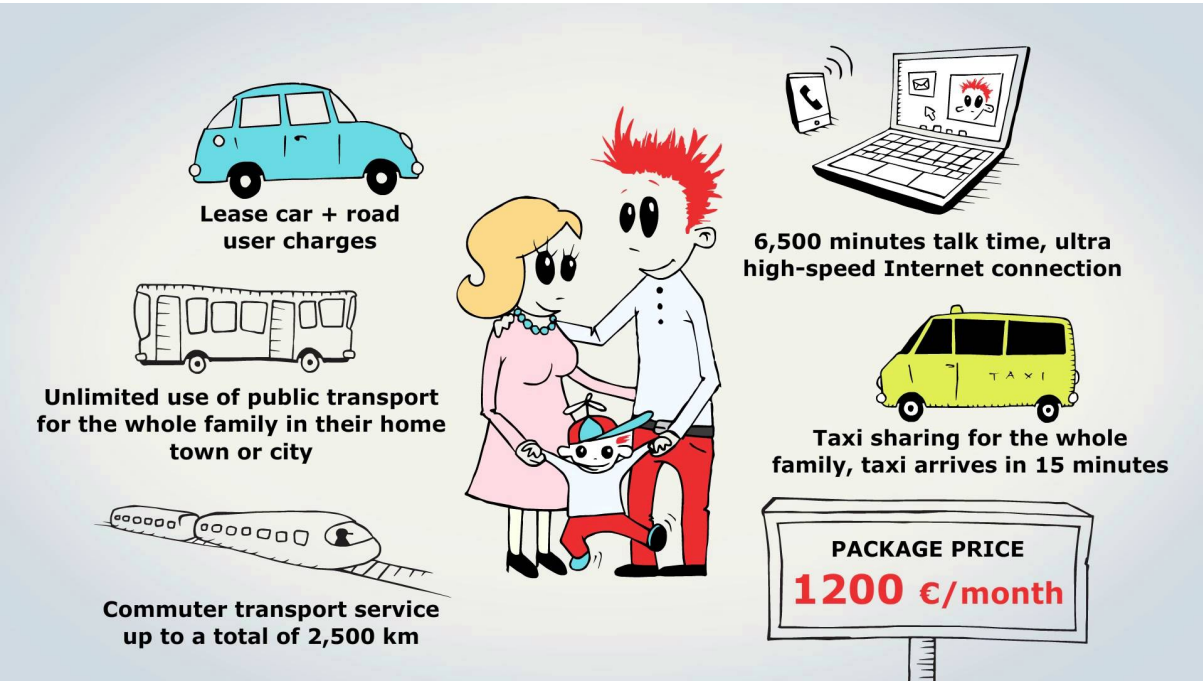


*Figure 2. Example picture of MTC launch of MaaS (Source: MTC video animation of MaaS)*

Also, in June 2014, the MTC established the Traffic Lab to enable new market creation for intelligent transport services and to develop ideas how to implement road-charging systems (I5, I7, I11, I12, I13).

It was initially an experimental, fixed-term project, operating as an umbrella for digital service initiatives (I11, I13), and set to end in 2015 (MTC, 2014). It aimed to experiment in connection to intelligent transport services via collaboration between the public sector, companies and research (MTC, 2014). "*It was a new way of operating in collaboration, so that there is facilitation and the government authority comes closer to the company interface…to enable that from the perspective of mutual benefit, we can communicate, facilitate workshops and seminars and such that promote the advancement of this thing*" (I12). We regard the Traffic Lab as the **second policy experiment, type 2**.

People did not initially talk about MaaS in the context of the Traffic Lab. However, after the New Transport Policy Club ended, at the end of its term, 30-40 experiments under the club were placed in the Traffic Lab, widening its scope (I13). "*With Traffic Lab we had very good discussions. At the time there was Seppo Öörni from the ministry, he was in charge of Traffic Lab. We started figuring out how these new technologies enable market disruption, what is the reason behind*" (I5). The innovation agency Tekes (later Business Finland) also participated in the Traffic Lab (I5, WS).

## 5.3 New business model and market creation

Initially in the innovation agency, MaaS was a small, informal initiative, a campaign to activate new companies to start market disruption, testing and developing new technologies and services (I3, I5): "*It was a bit nonlinear. There were internal discussions, discussions with the ministry, consultations, group forming. I do not know the details. It was much more informal*" (I3, innovation agency). A joint campaign with the MTC organised round tables on themes linked to MaaS, inviting companies to discuss the vision, needs of municipalities, public transport providers, designers to think about service design, and some focused on logistics (I5, I6). "*Tekes organised, so that they then had a big role, even as a thought leader, to make sure it advanced*" (I6).

In early 2015, MaaS support in Tekes became more formal when the innovation agency launched a two-stage call to fund MaaS operators (I3, I5, I16), driven by existing collaboration between the MTC and Tekes (WS). Tekes' MaaS team hired Sonja Heikkila, the MSc thesis author, as Senior Advisor and gathered together business sector actors to formulate a shared understanding of MaaS (I16). The first stage was about funding projects that plan real MaaS pilots and co-design them with potential partners; Tekes funded several pre-studies to support new business model construction and new partnerships (I5, I16): "*That was the biggest turning point"* (I5). *"When we launched the call to fund MaaS operators, then it became a funding decision on our side"* (I3). "*We were very open-handed in the sense that, if the project proposal made any sense, we'd just fund it. We didn't select that much"* (I5). In the second stage, an idea of a test bed, good collaborators, external investors and some

connections to capacity builders were needed (I5). Many companies received this funding (I21) that was regarded instrumental (I19).

Tekes was influential in enabling concrete activities to back the emerging MaaS vision at the right time (I6, I16, I15). "*This big market disruption, how we really can serviticise… How these new mobility services can start to be created. That started happening. That development started happening just after our very specifically defined call for MaaS operators and their supporting services and technologies. It was very interesting how different models emerged. We did not say how you should do it… they started a new company and started finding investors. Then other guys, they were just starting, with their own money, smaller projects*" (I5). FinPro, an agency supporting Finnish exports (subsequently merged with Tekes under Business Finland) also initiated a MaaS Growth programme in May 2015, in collaboration with Team Finland, ITS Finland and companies; specifically targeting business development in Germany, UK, Italy, Spain, US and South Korea (I5, I15, ITS Finland, 2015).

Simultaneously with developments in Tekes and Finpro, MaaS business activities were initiated on the ground. Questions were posed regarding who takes responsibility, how much does it cost to establish a MaaS operator and does this work as a business (I1). Nobody knew and, therefore, ITS Finland, via its network of organisations interested in intelligent transport, asked different companies for their interest to establish an operator, and 24 actors (Siemens, Ericsson, Uber, Taksiliitto, HSL, TeliaSonera, Elisa, etc.) agreed to fund the preparation of a business plan; an ecosystem of companies was formed (I1, I19). In January 2016, Sampo Hietanen resigned from ITS Finland and became the CEO of a new company MaaS Global; the first to develop MaaS operator services (I6). Its establishment as a front-runner company has been one of the key events in the Finnish MaaS trajectory (I6, I13, I16, I19). MaaS Global received funding from Tekes (I5, I6, I19), including a 50,000 euro subsidy and 1.4 million euro loan in 2015 (Kauppalehti, 2016), and investments from some car industry companies, including Toyota Financial Services (I19).

## 5.4 High-level policy support and supporting experimentation

The timing of MaaS developments fitted well with the start of a new government term and the preparation of a new government programme, formed by the Centre Party, the National Coalition Party and the True Finns, in 2015. While the programme was not ambitious in terms of sustainability, it highlighted digitalisation, new services and experimental culture (I10, I8, I11, I12). "*The administrative culture has perhaps traditionally been such that one needs to be 100 percent sure that it will work before something is done. Experiments sort of released that and gave a permission to fail; so I think that has been significant*" (I17).

The programme also explicitly mentioned MaaS (I13): "*Innovation and service platforms will be promoted in sectors where the public administration plays a role in terms of the functioning of the markets. Such sectors include mobility as a service... The introduction of new technologies, digitalisation and new business concepts will be promoted by legislative means. With the help of open data and the better use of data resources, favourable conditions will be provided for new business ideas"* (Government Programme, 2015:28). The government programme made explicit and allowed the advancement of major regulatory change that followed later in 2017 (I10).

The MTC's new Minister Anne Berner (Centre Party) was personally committed to taking MaaS forward (I10, I12), as had others before her. "*Our minister has been extremely active, and kind of come with new eyes outside politics to see these things…bringing a lot of new perspectives*" (I12). "*Berner as minister has bravely taken a stand on things, and she has invited many people together to discussions about different themes concerning mobility and has clearly listened to actors in the sector and brought them together*" (I16).

Later in 2015, the results of the Traffic Lab were communicated in an intelligent transport conference, enquiring the need for this kind of experimental forum to function more permanently (I11). Following positive response, the MTC updated the Traffic Lab in line with the government programme (I7, ministry), the Lab developing into a forum for advancing a broad range of experiments, on MaaS and beyond (e.g. movement of data, people and goods) to encourage innovation; to create a better understanding of ongoing projects and the future of passenger and goods transport and the impacts of certain developments; and to activate and grow the network around it (I11, I12). By 2018, the network had grown to 2000 people and 42 network organisations. The innovation and transport agencies have collaborated in the Lab (I5), some of its projects received funding or low-interest loans from Tekes (later Business Finland) (I12).

The Traffic lab has typically not provided funding for participants (I11); it has acted more as an umbrella for experimentation, where the public sector has co-experimented with companies and the research sector, aiming to explore future markets and if regulatory changes are required (I12). Later, the emphasis has shifted increasingly to enabling companies to innovate and cooperate by themselves and to monitoring, aggregating and sharing information on pilots and experiments (I18).

In 2016, the MTC had an organisational change, where the separate transport and communications departments were merged and divided into four new departments: ministerial governance, networks, data, and services; the latter three comprising all transport modes and communications (I10, I19). The drivers for this were the integration of communications thinking into transport since 2009 and change in thinking in the ministry towards more holistic policy (I21). We regard this as the demonstration of

**second institutional change** in the form of organisational change, preceded by deep, second-order learning from policy experiments.

## 5.5 Entrepreneurial experiments and pilots

The first to start a MaaS experiment was a telecommunications company, TeliaSonera. In January 2016, they launched the Reissu app in the Häme region combining national rail services and local taxi services; an initiative part of the Traffic Lab (I15; YLE, 2016). This discontinued due to change of the responsible person with the national rail company VR.

MaaS Global has been described as the world's first integrated mobility operator, combining multiple transport modes under one app and offering monthly packages. The company became operational in January 2016 "*when the founder, Sampo our CEO, and co-founder, Kaj Pyyhtiä, started actually working in MaaS Global. After that, new employees started coming. That is how this story really began. The development of service started, at full steam, in March 2016*" (I6). Finding funding from foreign investors was aided by Finpro that provided market information and advised DENSO, a Japanese automotive company. MaaS Global began pilots in Helsinki, Finland (October 2016), Birmingham, the UK (December 2016), and Antwerp, the Netherlands (September 2017) (I19). In December 2017, it launched the Whim application commercially in Helsinki.

Also, in 2016, different smart mobility entrepreneurs (e.g. TUUP and PayIQ), VTT Technical Research Centre, the MTC and the City of Helsinki collaborated under a research project VAMOS! - Value Adding MObility. This project was funded by the innovation agency, and it aimed "*to examine and promote productisation, piloting and scaling of innovative customer-oriented ecosystem-based mobility and associated services into international markets*" (Vamos, 2019). After the initial MaaS funding had ended in Tekes, funding for MaaS-related projects was integrated into and streamlined with Tekes's ongoing Smart City Programme (2014-2017) that funded, for example, the Vamos! Project, and the Innovative Cities Programme (2014-2020) to create a more structured context for funded projects (I5). The first pilots have been significant, providing plenty of first-order learning and enabled the formation of larger companies and their associated ecosystems (I18).

In Europe, an independent organisation MaaS Alliance was established in June 2016, hosted by ERTICO ITS Europe, and influenced by Finnish stakeholders from public and private sectors (I17). Its founding members included the Finnish Ministry of Transport; ERTICO – ITS Europe; ACEA; IRU; FIA; Cubic; MaaS Global; RACC; Siemens; Xerox; and eight other representatives from public authorities, transport companies and organisations (FIA, 2016). MaaS was getting popular in Finland and Sweden, and broader international potential was perceived: "*How MaaS succeeds or fails, it requires a much broader collaboration or larger number of actors than perhaps the traditional transport sector supply*

*chain has had. This collaboration needs to be based on completely new kinds of values and new kind of division of risk and profit than traditionally. MaaS Alliance facilitates this public-private collaboration*." (I17)

## 5.6 Major institutional change and merging transport and innovation policy

Based on the government programme, in 2017, the Ministry of Economic Affairs and Employment (MEAE) began coordinating the development of a National Growth Programme for the Transport Sector 2018-2022 (MEAE, 2018), with an aim to combine transport policy with business and innovation policy more closely (I21). The programme is a collaboration between MEAE, MTC, the Ministry of the Environment, the Ministry of Agriculture and Forestry, the largest cities in Finland, Business Finland, the Finnish Innovation Fund Sitra, and ITS Finland among some other actors. It aims to support Finland's growth and expertise in the transport and mobility sector and get international attention: "*This kind of thing is probably unique [globally] that these things are jointly deliberated from the start*" (I11). MaaS was identified as one of six areas where growth in the global transport market was forecasted and ecosystem development promoted (MEAE, 2018; I9, I10).

More importantly, under the MTC's administrative sector, new framework legislation was created in 2017, initially called the Transport Code, later the Transport Service Act. The idea was to proactively support new transport services and innovation through significant regulatory change. "*We have found that Mobility as a Service is a good issue and it is a revolutionary change for policy and we want to go in that direction*" (I7). The Act granted access to data on timetables and pricing of different transport providers (in a format that can be electronically read) and deregulated taxi transport (I7, I10, I8). It also allowed third parties to sell transport tickets by opening up ticket interfaces (I8, I10, I14). It was described as ground-breaking and unique transport sector legislation globally (I14, I17, I19, I21). "*Many of those [international] investors… it had more credibility and visibility, so when we said that there will also be this kind of law in force in Finland that will enable experimentation and doing things much faster than elsewhere…it has had a really big impact*" (I19). We consider this as the demonstration of third **institutional change**.

The Act was openly prepared involving different stakeholder groups (I19). It was supported by the government programme and driven by civil servants in close collaboration with industry actors (I16, I21, WS). The preparation was influenced by developments in digitalisation and intelligent transport systems, recognising the need to enable future transport solutions and improved services to citizens and users (I9, I11, I12), issues explored in the policy experiments. It was also prompted by specific discussions on MaaS (I6) and the need for open interfaces and access to information and ticket sales to third parties (I11, I12, I15). "*The 'Information Society Code' of the telecommunications side, that*

*collected telecommunications market regulation together to make it easier for businesses and users, was a little bit on the background. Then it was thought that, if we think of transport system holistically, and if we want services that cover all transport modes, the transport market legislation should be the same for all modes"* (I21).

It was deliberated that this kind of regulatory change will promote novel service concepts and innovation in businesses by forcing old and new actors to rethink things (I12, I13). The legislation also made it easier for new mobility services to operate by removing barriers (I6, I7). Several interviewees regarded this change as a significant step in the MaaS development (I2, I8, I10, I12, I13, I16, I19, I20, I21). "*Certainly the preparation of the Transport Code is the largest [supporting factor from the public governance side], both as an enabler and a clear signal that there is willingness to support this [MaaS] development*" (I18). However, not all stakeholders were merely positive about it (I16). The regulatory change was strongly opposed by taxi drivers (I2; WS; YLE, 2017).

The enforcement of the new law occurred in stages, starting in January 2018. Some public transport providers were reluctant to allow MaaS operators to access their ticket sales, seeing MaaS services as competition instead of complementing their service offering and prevented market formation (3 interviewees, anonymous). In March-April 2019, in response to such problems, the Transport and Communications Agency Traficom issued a warning of penalty payment to the Helsinki metropolitan region transport provider HSL failing to comply with the Transport Service Act regarding opening up its ticket and data interfaces (Kauppalehti, 2019) and to a bus and coach service company Matkahuolto regarding terms of use (MTV News, 2019), both later resolved. While some see that most cities are positive about MaaS (I18), others highlight that MaaS would have proceeded faster if the legislation had been fully complied with (I19, I21; MTV News, 2019).

The change in legislation has been followed by further business developments and pilots. One area of attention has been rural MaaS, for which the Kyyti Group has been a key ecosystem player. Kyyti is a partner in rural MaaS developments in Finland and globally (Netherlands, Switzerland, United States) (I20). In May 2018, Sitra granted funding to a project aiming to develop a digital platform in three pilot areas for rural MaaS services; four companies, Infotripla, Kyyti Group, Sitowise and Vinka, will develop the technical solution with an idea to combine different customer groups (public sector funded taxi services and private customers) to create on-demand transport in sparsely populated areas (I22). The idea is to create a national technology platform for rural MaaS (I20).

Important further developments have also occurred in the public administration side. In November 2018, Business Finland awarded subordinated loans as part of its new Growth Motor Funding, in total 28.4 million to five different companies, two related to MaaS (Business Finland, 2018), enabling

ecosystem development (I22). Kyyti Group received a loan of 5 million euros, perceived instrumental (I20). Growth Motor Funding was created as a result of the government awarding Business Finland an additional 60-million-euro budget to be used for company loans during 2018-2019 (I23). It is an innovative instrument, a new type of subordinated loan, allocated to new business ecosystems via a competitive procurement procedure, aiming for value creation both for the funded ecosystem companies and actors more broadly, such as the customers of new solutions. While the decision and evaluation process is the same for the applicants, the design of the lending sequence is case specific. Business Finland regards this a globally innovative policy instrument, with specific vision, goals and a stepwise procedure, and has proposed to the government that this instrument is continued (I23). We regard this as the **third policy experiment**, type 1.

In the beginning of 2019, a climate and environmental unit was established to MTC's network department and the administrative agencies were reorganised (I10), continuing the third institutional (organisational) change that began in 2016. Transport Agency became the Finnish Transport Infrastructure Agency, responsible for road, rail and marine transport as well as integrating transport and land use (Väylä, 2018). More importantly, a new integrated Transport and Communications Agency (Traficom) was created (Traficom, 2018).

## 5.7 Summary

MaaS thinking operationalised in Finland has attracted a lot of interest internationally and, hence, it is useful to understand the influencing factors. In Finland, the public sector at the national level has taken an active role in the conceptualisation and facilitation of MaaS, systematically enabled by institutional change. Part of this significant interest is explained by the dwindling business of the telecommunications sector, built around Nokia.

The development has seen the merger of two previous policy domains, communications and transport, into a new policy domain of intelligent transport and communication systems. Moreover, interaction with innovation policy has been crucial, and increasingly sought, for example, via the new Transport Sector Growth Programme. Several interviewees stated that the funding implemented via Business Finland has been essential for MaaS-ecosystem development.

Publicly-funded organisations, including the MTC, Traficom, Business Finland and the public-private network ITS Finland have been instrumental. Numerous interviewees acknowledged the way in which the ministry guided its agencies, has enabled and positively influenced the discussion regarding new mobility services. One interviewee stated that the MTC's administrative sector "*has been a leader in enabling and seeking to look into the future, brought new ways of working, and created an experimental culture*" (I12). It has perceived the traditional transport-mode-specific governance as a

barrier and opened discussions with other ministries, such as the Ministry of Economic Affairs and Employment (MEAE, in charge of innovation policy). Underlying this has been the political support received from several ministers from different political parties, including the Left Alliance, the National Coalition Party and the Centre Party. Experimental culture has grown strongly in the administrative sector giving a permission to fail, while some still perceive experimentation too small and short-lived.

While active support from actors in public governance has been vital, our focus here, it is important to recognise the role of other contributing factors, especially the active and growing actor-network around intelligent transport and MaaS, and the innovation champion Sampo Hietanen. Figure 3 illustrates the development trajectory from vision formation to new market emergence.

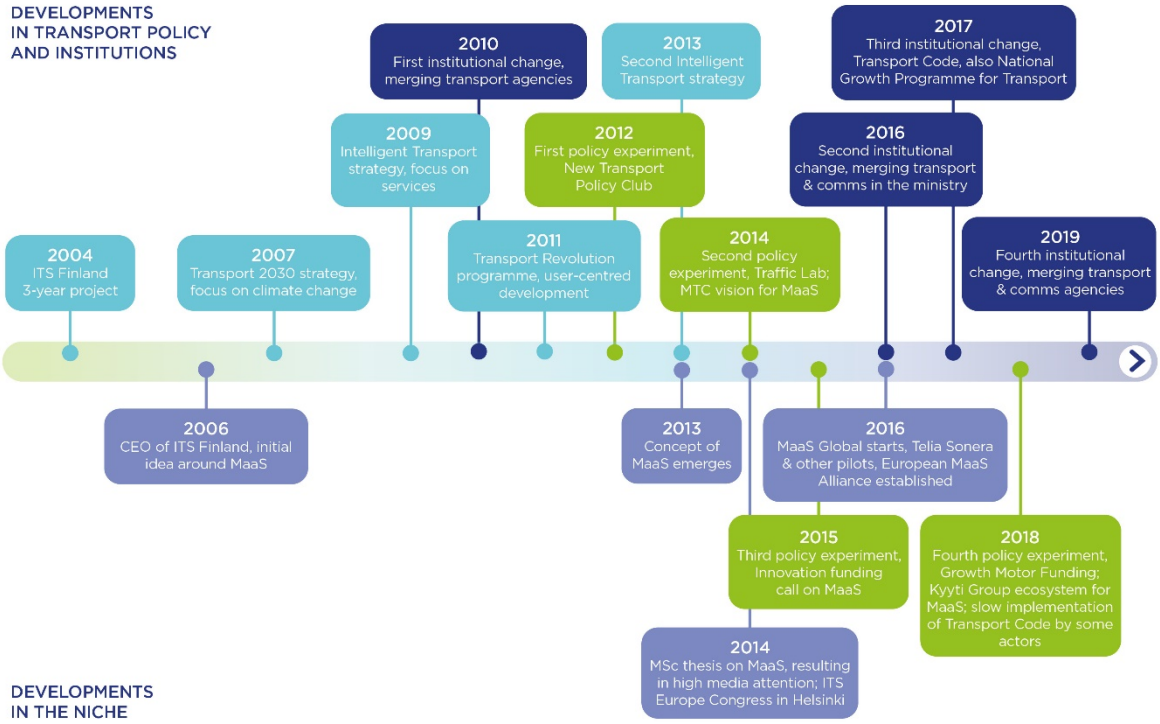


*Figure 3. From early development towards intelligent transport systems to formation of the mobility-as-a-service niche and supportive institutional change*

## 6. Discussion

We developed an analytical framework on the interplay of policy experimentation and formal institutional change in transformative policy mixes and used this to analyse the case of mobility-as-a-service (MaaS) in Finland. Our analysis shows how policy experimentation can contribute to both first-

order (cognitive) and second-order (normative) learning which in turn influence the policy mix, and how institutional change (regulatory and organisational) can enable or restrict policy experimentation. Further we recognised two types of policy experimentation: experimentation occurring within the established policy mix (type 1) and outside it (type 2). The following discusses the empirical study in connection to our framework and to transformative innovation policy (TIP).

## 6.1 Experimentation and institutional change in the policy mix for MaaS

The MaaS case illustrated how the evolving policy mix influences a transition by supporting niche development via new forms of policy platforms and funding for innovation (policy experimentation) as well as changing the established mobility regime via organisational and regulatory change (formal institutional change). These contributed to the overall – and eventually transformative – policy mix, including a sequence of new strategies for intelligent transport and mobility transition.

The first institutional change, removing silos between transport modes, acted as an enabler for policy experimentation, creating a whole system perspective on mobility and giving a 'permission' to experiment. As a result, the New Transport Policy Club and the Traffic Lab were established. The former was akin to a transition arena (cf. Loorbach et al., 2015) collecting together frontrunners to develop a shared direction and vision for the mobility transition and produce learning how policy should change. It was a space for cognitive and normative first- and second-order learning (cf. McFadgen and Huitema, 2017) about future mobility system options and how they are shaped by changing perspectives and priorities. The latter, initially a space for experimentation outside the established policy mix, generated cognitive (first-order) learning about how new technologies are likely to influence market disruption. However, deeper second-order learning from these policy experiments also revealed that mobility systems can be organised around novel services, that public-private collaboration and new business ecosystems are vital, and that the new services require institutional and policy change to remove existing barriers. The specific idea of MaaS was presented by an 'innovation champion' in one of the Transport Policy Club meetings, and soon developed into a vision advocated by the ministry, also endorsed in the Government Programme. The support was visible in the national-level policy mix, including transport policy strategies and innovation funding, and across different policy domains.

The learning generated through policy experimentation coupled with the development of MaaS pilots and companies influenced further institutional change. These included the creation of holistic transport and communications governance, major renewal of transport sector regulations, and the institutionalisation of one of the policy experiments, the Traffic Lab, to operate on a permanent basis. The institutional change we detect represents gradual transformation where incremental processes

of change have led to discontinuity in institutions (Streeck and Thelen, 2005). When institutional discontinuity is needed to enable socio-technical transitions, this approach appears superior to breakdown and replacement that may occur when policymakers have failed to react early and must respond to abrupt changes in the system.

When we examine this case through Bernstein and Hoffmann's (2018) mechanisms of how experimentation may instigate transitions, we can observe (1) catalysing direct and indirect normative change by the institutionalisation of the Traffic Lab; (2) building capacity to act differently by mobilising human and financial resources (via innovation agency) and via contribution to institutional regulatory change, namely the Transport Service Act; and (3) coalition building stimulated by the Transport Policy Club and continued, for example, in the work of the public-private network ITS Finland.

Figure 4 shows how the overall development was influenced by all the components in our analytical framework. The case also emphasises that the impact of transformative policy mixes happens over time (Huang, 2019), rather than in a given moment, and therefore, the directionality and consistency of the policy mix across administrative sectors and temporally is crucial.

What is distinctive in this development is the active contribution of the public sector and new forms of public-private collaboration in the early stages of niche development. This indicates that also institutional barriers were removed sooner than in many other cases. The involvement of high-level policymakers explains the rapid development of MaaS in Finland, in comparison to Sweden (e.g. Smith et al. 2018a,b). The case also shows the overall dynamics of visioning, learning and network formation (cf. Schot and Geels, 2007) which benefitted from the establishment of an innovation intermediary ITS Finland and subsequent policy experimentation. Innovation champions played a role in niche creation and regime change, and the circulation of people between public administration, business and public-private networks has been a noticeable driver.

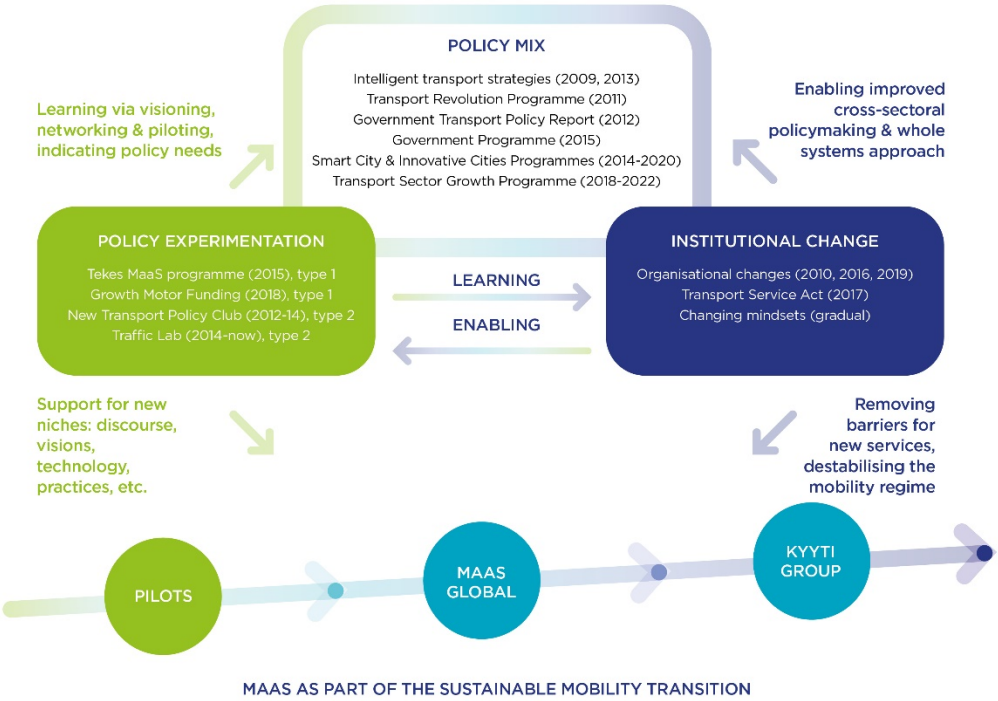


*Figure 4. Mobility as a service in Finland put in context of the analytical framework*

It must be noted that Finland is a special case in many respects. First, the case showed a relatively long history of integrated policymaking across the policy domains of transport and communications. This long history enabled the policy changes and reorientation in thinking in the past five years. Second, policymaking across administrative sectors has a long history in Finland, and civil servants are used to engaging in cross-sector strategy formation in an informal manner. Third, Finland does not have a major car manufacturing industry, and rather the strong history of the telecommunications sector has created a progressive position in advancing intelligent transport systems. Thus, the broader learnings from this case must be adjusted to country-specific contexts, more as a guide to how, in each context, policy experimentation can be used to contribute to the institutional changes and transformative innovation policy needed for net-zero transitions.

## 6.2 Interconnections between policy experiments and institutional change

Our empirical findings show the complex interconnections between policy experimentation, formal institutional change and the overall policy mix. The enabling influence of formal institutional change (organisational) for policy experimentation may be crucial both in terms of breaking down silos between policy domains and in creating an environment where civil servants dare to experiment, allowing the risk of failure. This also links to change in informal institutions, to become more attuned to experimental working cultures. In turn, because formal institutional change is not an easy

endeavour and likely to face opposition, generating policy learning before it takes place is vital. For this, policy experimentation can provide the temporary space and more flexible conditions than existing policy mixes. Interestingly, in the Finnish MaaS case, the politicians and civil servants implemented the institutional (regulatory) change despite strong opposition from some regime actors, such as taxis and public transport operators.

As noted by Huitema and McFadgen (2018), it is not self-evident that policy experimentation leads to changes in the policy mix or institutions. First, of course, it may generate learning that indicates that a certain change is not desirable. Second, the learning generated may, for example, be cognitive and not useful on its own, when also normative learning about societal changes is needed. Third, even if policy experimentation demonstrates viable policy alternatives, the political dynamics and resistance may prevent changing the established policy mix. Indeed, some politicians may use policy experimentation as a smoke screen to hide the lack of more permanent changes. The successful transfer of learning from policy experimentation to result in more permanent changes in the policy mix and formal institutions may be dependent on supportive innovation champions and transition intermediaries. The Finnish MaaS case shows that the leading civil servants' and ministers' role has been crucial for transformative change.

## 6.3 Concluding remarks

This paper presented that policy mixes, in the context of transformative innovation policy, are likely to need policy experimentation and institutional change alongside more typical policy strategies and instruments. These two aspects also illustrate important temporal changes in policy mixes from the perspective of transformation.

Based on the empirical study of MaaS in Finland we suggest that policy experimentation is more likely to lead to substantial changes in the policy mix when there is political backing and support to use the learning from experimentation to form new policies. In addition, broad acceptance from the network of actors associated with a green niche enables the institutionalisation of experimental policies. These factors can overcome regime resistance. Moreover, our case shows that policy experiments' broader influence and formal institutional change are more likely when the socio-technical system is already changing, and when incumbent actors have begun to question their assumptions, beliefs and values and being more explorative about how to address a global 'wicked' problem.

It is too early to say how the policy experiments and institutional changes observed in this case influence the mobility transition in the long term, despite creating good settings from a governance perspective for sustainability transitions. However, how the transition will unfold also depends on the broader cross-sectoral and multi-level policy mix, including the policies implemented by cities and

towns, and, importantly the changes in the everyday practices of businesses and citizens using transport services.

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**Appendix 1: List of interviewees**

I1 Sampo Hietanen, MaaS Global

I2 Armi Temmes, Aalto University Business School

I3 Christopher Palmberg, Innovation Agency Tekes / Business Finland

I4 Nilf-Olof Nylund, VTT Technical Research Centre

I5 anonymous, Innovation Agency Tekes

I6 Satu Kantola, MaaS Global

I7 anonymous, Ministry of Transport and Communications

I8 Henrik Suikkanen, Demos Helsinki

I9 Kirsti Vilen & Antti Eskola, Ministry of Economic Affairs and Employment

I10 Saara Reinimäki, Ministry of Transport and Communications

I11 anonymous, Traficom

I12 Juha Kenraali, Traficom

I13 Marko Forsblom, ITS Finland

I14 anonymous, HSL Helsinki Region Transport

I15 Sami Sahala, Forum Virium

I16 Sonja Heikkilä, formerly OP Group

I17 Piia Karjalainen, MaaS Alliance

I18 anymous, Traficom

I19 Krista Huhtala-Jenks, MaaS Global

I20 Pekka Möttö, Kyyti Group

I21 Laura Eiro, IST Finland

I22 Heikki Sorasahi, Finnish Innovation Agency Sitra

I23 anonymous, Business Finland

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