Institute of Transport Economics
Norwegian Centre for Transport Research

Mobility as a Service provided by Public Transport Authorities: is it an attainable vision?

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Summary

If public stakeholders like public transport authorities (PTAs) take on the role as a provider of Mobility as a Service (MaaS), this may contribute to attaining key targets, including reduced car use, congestion and transport poverty. Therefore, we ask: Can PTAs provide MaaS, and if so, how can they achieve this target? This study applies three complementary theoretical approaches to public innovation to analyse the service innovation of the Norwegian MaaS leaders, the PTAs Kolumbus and Ruter. These are theories about public risk tolerance, reorganisation, and collaborative innovation. Methods applied are interviews, comparative analyses, event participation and document studies. Our analyses demonstrate that the selected PTAs exercise a "loose" form of meta-governance, or partnerships, and gradually innovate and have become early MaaS providers. Hence PTAs may be able to lead MaaS development. Moreover, various public authorities may, by setting environmental standards and providing funding, be essential in attaining innovation in MaaS and electrification.

Kort sammendrag

Hvis offentlige aktører som kollektivselskaper tar rollen som tilbyder av mobilitet som tjeneste (mobility as a service, MaaS), kan dette bidra til at viktige mål nås, slik som redusert bilbruk, kødannelse og transportfattigdom. Derfor spør vi: kan kollektivselskaper tilby mobilitet som tjeneste, og hvordan kan de oppnå dette målet? Denne studien benytter tre komplementære teoretiske tilnærminger til offentlig innovasjon for å analysere tjenesteinnovasjonen i de norske MaaS-lederne, kollektivselskapene Kolumbus og Ruter. Dette er teorier om offentlig risikotoleranse, omorganisering og innovasjon gjennom samarbeid. Metoder anvendt er intervjuer, komparative analyser, deltakelse i arrangementer og dokumentstudier. Våre analyser viser at de utvalgte kollektivselskapene utøver en type "løs" nettverksstyring, altså partnerskap, og har gradvis utviklet seg til å bli MaaS-tilbydere. Derav kan kollektivselskaper lede utviklingen mot mobilitet som tjeneste. Videre kan ulike offentlige myndigheter, gjennom å sette miljøstandarder og tilby finansiering, være essensielle i å oppnå innovasjon i MaaS og elektrifisering.

Preface

This publication stems from the research project Regulating smart mobility (REGSMART), which was a research project financed by the Research Council of Norway (project number 283327). The project dealt with regulation of smart mobility. Project partners included international research institutes VTT Technical Research Centre of Finland Ltd and The Swedish National Road and Transport Research Institute (VTI), and national partners: Faculty of Law at the University of Oslo, the Norwegian Board of Technology, Public Transport Norway and ITS Norway.

Several publications have already been published based on REGSMART, including in international top journals (Aarhaug & Tveit, 2023) and other journals (Fearnley et al., 2020; Ydersbond et al., 2020), in a book (Fearnley, 2020). A report (Valevatn, 2022), a working paper (Paulsson & Aarhaug, 2021), analyses (e.g. Ydersbond, 2019) and policy briefs were also published. This report is part of the publishing from WP6 in REGSMART.

Inga Margrete Ydersbond is the first author of the report, which has been made in collaboration with Claus Hedegaard Sørensen (VTI and K2). A heartfelt thanks to the interviewees who took their time to be interviewed, sometimes in more than one session, and follow up with quotation checks.

It has been presented at research seminars, at the Virtual ITS European Congress in 2020 and at the Norwegian National Conference in Political Science in 2022. We thank Anna Herzog for language editing of the text that forms the basis of this report.

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Summary

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If public stakeholders like public transport authorities (PTAs) take on the role as a provider of Mobility as a Service (MaaS), this may contribute to attaining key targets, including reduced car use, congestion and transport poverty. Therefore, we ask: Can PTAs provide MaaS, and if so, how can they achieve this target? This study applies three complementary theoretical approaches to public innovation to analyse the service innovation of the Norwegian MaaS leaders, the PTAs Kolumbus and Ruter. These are theories about public risk tolerance, reorganisation, and collaborative innovation. Methods applied are interviews, comparative analyses, event participation and document studies. Our analyses demonstrate that the selected PTAs exercise a "loose" form of meta-governance, or partnerships, and gradually innovate and have become early MaaS providers. Hence PTAs may be able to lead MaaS development. Moreover, various public authorities may, by setting environmental standards and providing funding, be essential in attaining innovation in MaaS and electrification.

This study has enquired into the MaaS development of the Norwegian MaaS leaders, PTAs Kolumbus and Ruter. Through expanding the services over many years, coupled with technological innovation, the complete penetration of smart phones and collaboration, Kolumbus and Ruter now offers what would have been a dream in the beginning of the 2000s: a large number of mobility services available via one ticket or subscription, easily bought in one app. Ruter and Kolumbus thus contribute to an increased mobility offer, reduction of greenhouse gas emissions and more user friendly services. They have become early MaaS providers, here defined as integrated mobility services where the user gets access to public transport and other transport services via one ticket/subscription, bought in one app.

The study has applied approaches that may contribute to explaining innovation in the public sector: Mazzucato's (2015) public sector innovation approach, an organisational approach, and Sørensen and Torfing's (2011) collaborative innovation approach.

In line with the expectation based on Mazzucato (2015), public sector stakeholders like PTAs and their owners may be risk-willing and take on the role as MaaS provider by launching initiatives in the field, reorganise to innovate. This may succeed if the owners ask for MaaS, allow for such development and there is sufficient funding. Such development is also

dependent on contextual factors, like national rules enabling it, and substantial economic support from various external governmental sources.

The expectation based on the organisational approach was also supported. To become a MaaS provider, obtaining the right competence in the organisation, and creating an organisational structure supporting innovation was imperative. The expectation based on Sørensen's and Torfing's (2011, 2018) collaborative innovation approach received conditional support, if innovation is operationalised as they suggest. Innovation was carried out by stakeholders involved in networks. However, the study shows that the concept of collaborative innovation may only describe the cases well, if it includes stakeholder networks that are changing from one innovation to another.

The analysis also demonstrates that the PTAs may label themselves early MaaS providers. Through gradual service development, both PTAs and their owners have adjusted to new standards and expectations about what is normal and desirable for a PTA. They perceive the new standards as "small moves." When assessing the development since the year 2002, however, the developments altogether have been significant, such as the number of transport services available, that they are accessible via a digital ticket, and that this digital ticket can be bought through an app. Moreover, the PTAs and their owners' innovation work includes electrification across all modes of transport. Hence, the PTAs' service development has led them to contribute significantly to attaining important transport policy goals, such as increased modal share of public transport and active mobility, lower use of personal cars, lower noise, and reduction of the sector's environmental footprint. The PTAs are thus key enablers of a more efficient, equitable and environmentally friendly transport system.

There is a need to find out more about how the public transport system best may be organised to attain various key policy goals. This is not least because the EU's new intelligent transport system (ITS) directive and the multi-modal travel information services (MMTIS) directive, which applies to the European Economic Area, will likely make ticketing across various services easier (Commission, 2017; European Parliament & Council of the European Union, 2023). This may give increased room for new conflicts, as it may for example not seem fair to PTAs, which are not-for-profit companies, to let private MaaS providers benefit from revenues that are largely based on infrastructure established by PTAs og other public investments and efforts (Interview Ruter, 2020). Private MaaS providers may be quicker at providing encompassing MaaS, as demonstrated in Helsinki with MaaS leader Whim. The PTAs hold another legitimacy, are publicly governed and serve all customer groups. As demonstrated here, when PTAs are given the necessary mandate and resources to pursue it, they may well become MaaS providers/operators.

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Sammendrag

Mobilitet som tjeneste tilbudt av kollektivselskapene: er det en oppnåelig visjon?

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Hvis offentlige aktører som kollektivselskaper tar rollen som tilbyder av mobilitet som tjeneste (mobility as a service, MaaS), kan dette bidra til at viktige mål nås, slik som redusert bilbruk, kødannelse og transportfattigdom. Derfor spør vi: kan kollektivselskaper tilby mobilitet som tjeneste, og hvordan kan de oppnå dette målet? Denne studien benytter tre komplementære teoretiske tilnærminger til offentlig innovasjon for å analysere tjenesteinnovasjonen i de norske MaaS-lederne, kollektivselskapene Kolumbus og Ruter. Dette er teorier om offentlig risikotoleranse, omorganisering og innovasjon gjennom samarbeid. Metoder anvendt er intervjuer, komparative analyser, deltakelse i arrangementer og dokumentstudier. Våre analyser viser at de utvalgte kollektivselskapene utøver en type «løs» nettverksstyring, altså partnerskap, og utvikler seg og har blitt tidlige MaaS-tilbydere. Derav kan kollektivselskaper lede utviklingen mot mobilitet som tjeneste. Videre kan ulike offentlige myndigheter, gjennom å sette miljøstandarder og tilby finansiering, være essensielle i å oppnå innovasjon i MaaS og elektrifisering.

Denne studien har undersøkt Kolumbus' og Ruters utvikling mot å bli tilbydere av mobilitet som tjeneste (mobility as a service, MaaS). Gjennom å utvide sine tjenester over mange år, kombinert med teknologisk innovasjon, samarbeid og at det høyt eierskap av smarte mobiltelefoner, tilbyr disse kollektivselskapene det som har vært en ønskedrøm på starten av 2000-tallet. Dette er et høyt antall ulike mobilitetstjenester tilgjengelig via en billett eller ett abonnement, enkelt kjøpt i deres apper. Dermed har de blitt tidligere tilbydere av MaaS. Her er MaaS definert som integrerte mobilitetstjenester hvor brukeren får tilbud om tilgang til kollektivtransport og andre transporttjenester via en billett/ett abonnement, kjøpt i en app.

Studien har anvendt teoretiske tilnærminger som kan bidra til å forklare innovasjon i offentlig sektor: Mazzucato's (2015) tilnærming til slik innovasjon, en organisatorisk tilnærming, og Sørensen og Torfing's (2011) tilnærming til innovasjon gjennom samarbeid.

I tråd med forventningene basert på Mazzucato (2015), kunne aktører i offentlig sektor slik som kollektivselskapene og deres eiere, fylkeskommunene, være risikovillige og villig til å gå inn i rollen som tilbyder av MaaS gjennom å lansere ulike initiativer, omorganisere for å skape nye innovasjoner, og nå sine mål. Dette avhenger av at eiene etterspør MaaS, tillater en slik

utvikling, og det er tilstrekkelig finansiering til å utvikle slike tjenester. En slik utvikling er avhengig av kontekstuelle faktorer slik som at nasjonale regler tillater kollektivselskapene å ta denne rollen, og vesentlig økonomisk støtte fra ulike eksterne offentlige kilder.

Forventningen basert på en organisatorisk tilnærming fikk også støtte i datamaterialet. Får å bli en tilbyder av MaaS, var det å få riktig kompetanse i organisasjonen, og å skape en organisatorisk struktur som støttet innovasjon, svært viktig. Forventningen basert på Sørensen og Torfing's samarbeidsbaserte innovasjon fikk betinget støtte, hvis innovasjon operasjonaliseres slik de selv foreslår. Innovasjon ble oppnådd gjennom samarbeid mellom aktører i ulike nettverk. Imidlertid viser studien at samarbeidsbasert innovasjon kun beskriver prosessene godt dersom nettverket av aktører endrer seg fra innovasjon til en annen.

Analysene viser også at kollektivselskapene selv kaller seg tidlige tilbydere av mobilitet som tjeneste. Gjennom gradvis å utvide sine tilbud, har både kollektivselskapene og deres eiere gradvis justert seg til nye standarder og forventninger om hva som er normalt og ønskelig for et kollektivselskap å gjøre. De oppfatter selv standardene som "små skritt". Når utviklingen siden år 2002 vurderes er imidlertid den samlede utviklingen stor. Dette gjelder for eksempel antall transportmodus som er tilgjengelige gjennom deres billetter, at disse er tilgjengelige via elektroniske billetter, og at billettene kan kjøpes i apper. Videre inkluderer kollektivselskapenes og deres eieres innovasjonsarbeid elektrifisering på tvers av alle transportmidler. Derav har kollektivselskapenes utvikling av ulike tilbud bidratt signifikant til å oppnå viktige mål i transportpolitikken som økt bruk av offentlig transport og aktiv mobilitet, lavere bruk av personbiler, mindre støy, og reduksjon av sektorens miljøfotavtrykk. Kollektivselskapene er viktige parter for et mer effektivt, rettferdig og miljøvennlig transportsystem.

Det er behov for å finne ut mer om hvordan det offentlige transportsystemet kan bli organisert for å oppnå ulike mål. Dette er ikke minst tilfelle fordi EUs nye direktiv om intelligente transportsystemer (ITS-direktivet) og direktivet om multi-modal reiseinformasjon (MMTIS-direktivet) vil gjøre det enklere med billettering på tvers av ulike tilbydere enklere. Dette kan gi rom for nye konflikter, fordi det for eksempel for kollektivselskapene, som er selskaper som ikke har profitt, vil være urettferdig at private selskaper skal oppnå profitt basert på tjenester som er basert på kollektivselskapenes og andre offentliges investeringer og innsats. Private tilbydere av MaaS vil kunne være raskere i å tilby en omfattende type MaaS, som demonstrert i Helsinki med det internasjonalt ledende selskapet Whim. Kollektivselskapene har en annen legitimitet, styres av det offentlige og tilbyr tjenester til alle kundegrupper. Som demonstrert her kan kollektivselskapene bli tilbydere av mobilitet om de gis det nødvendige mandatet og ressurser til å følge det opp.

1 Introduction

1.1 Background

Mobility as a Service (MaaS) is a hot topic in the popular and in the scientific debate. For example, Wong, Hensher, and Mulley (2020), view it as "the ultimate vision for our cities," because MaaS has the potential to radically improve urban mobility. With ideal, encompassing MaaS services, citizens do not have to own their own transport vehicles and can easily and affordably obtain access to the desired transport mode(s) through a single digital ticket or subscription. The concept of MaaS is subject to a number of different understandings, and there is no joint definition of it (e.g. Hensher et al., 2021; Jittrapirom et al., 2017; Vorotovic, 2020).

We here define MaaS as: "[…] a type of service that through a joint digital channel enables users to plan, book and pay for multiple types of mobility services" and includes public transport as a backbone (Smith, 2020, p. 3). "MaaS provider" here means the private or public stakeholder that holds the overall responsibility for integrating transport services from various transport operators into a MaaS offer and for delivering it to end-users through a user interface (for example an app) (see also International Transport Forum, 2020; the approach is also inspired by Kamargianni & Matyas, 2017). In other words, the MaaS provider combines the roles that for example Smith et al. (2018) label "MaaS integrator" and "MaaS operator."

MaaS has been argued to constitute a trillion-dollar market globally, providing opportunities of large income and market power to several different stakeholders, not least investors (e.g. Kamargianni & Matyas, 2017). With increasing urbanisation, digitalisation, focus on emissions reduction globally, introduction of autonomous vehicles and tendency to lower personal vehicle ownership, the market potential for MaaS has seemed ever growing. In addition to public organisations sizable international companies such as car maker Tesla and taxi company Uber have worked to take part in and benefit from the development towards ever more MaaS.

A core question is whether and how public stakeholders like public transport authorities (PTAs) or private business should take the role as MaaS provider and thus interact directly with the customers. The stakeholder that holds the direct customer relationship, and thereby obtains access to various types of valuable and sensitive commercial data, may moreover benefit from this, since such data is regarded as "gold" (International Transport Forum, 2020). Therefore, "all" stakeholders want to provide this customer interface.

There is no joint understanding of which types of stakeholders should take on what roles regarding MaaS. However, there is wide agreement that involvement of many different stakeholders is needed in such an offer. Probably, no single actor can deal with all roles in a MaaS package. National legislation, institutional set-up, as well as political initiatives, are among the factors that can impact which stakeholders are taking the role of providing MaaS in a country (e.g. Mukhtar-Landgren & Smith, 2019; Ydersbond et al., 2020).

1.2 Research question

Analyses envisage that public authorities, such as PTAs, might adopt a leading role as MaaS provider, not least because the PTAs hold social responsibility for providing sustainable mobility to all (e.g. Hirschhorn et al., 2019; Isaksson et al., 2019). Smith et al. (2018, p. 4) for example suggest a development scenario for MaaS based on a "public-controlled development" since "public control is arguably needed in order to steer the development towards societal good." If the PTAs hold this customer relationship, the commercially attractive data will stay with the public owned entities and potentially

be used for serving the publics' best interests. The public sector arguably also possesses characteristics that could stimulate to MaaS innovation, including pressure from political leaders who want to satisfy popular demands, national and international commitments, and budgets that enable innovation (Hartley et al., 2013). However, some stakeholders and analysts argue that PTAs may be too slow in innovation to deliver the needed services efficiently to take lead in the development towards ever more integrated MaaS transport services (e.g. Kamargianni & Matyas, 2017, p. 7). Moreover, it seems that PTAs taking the lead and becoming providers of MaaS is rather unusual internationally (e.g. International Transport Forum, 2020). These factors warrant attention to the PTAs taking on such roles. Thus, our main research question is:

> Can public transport authorities provide Mobility as a Service, and if so, how do they achieve this target?

MaaS provision here is to offer access to the means of private and public transport that are the most frequently used in an area, for all customers. This is relevant because the common means of transport varies around the world. The development of MaaS is following different paths as regards which stakeholders take the lead in Europe. In Finland and elsewhere, private stakeholders often have played this role. National and EU law is interpreted to prohibit or make it challenging PTAs from developing into MaaS providers in Scandinavian countries Denmark, Finland and Sweden (Sarasini, 2019, Interview 2020a; Transportministeriet, 2023). Accordingly, PTAs and other public authorities there seem to consider their own role as enabling private business to establish themselves as MaaS providers, by delivering public transport services as a significant share of a MaaS offer (Hirschhorn et al., 2019; Sørensen et al., 2020).

In contrast, in Norway, development of MaaS is led by the public organisations (Ydersbond et al., 2020). Two of the largest PTAs in Norway, Kolumbus, operating in the Stavanger region, and Ruter, operating in the greater Oslo region, envisage themselves as leaders of the development. They aim to function as well-developed MaaS providers in the future, in other words giving access to "all" means of transport common in their business area (Kolumbus, 2019; Ruter, 2015; Ydersbond et al., 2020).

MaaS development in Norway is particularly interesting, because the potential for it is high: Smart phone ownership and internet access, preconditions of MaaS use, is almost 100%. Norway moreover possesses an excellent digital infrastructure and substantial digital competence in the private and public sectors (European Commission, 2019; Eurostat, 2019; Fjørtoft, 2017; KMD, 2020, p. 41; Medienorge, 2021; SSB, 2022). A number of Norwegian stakeholders are working to develop the concept already. Nevertheless, there are, to our knowledge, few studies of the development of MaaS services in Norway, particularly in-depth studies dealing with the PTAs and organisational innovation. Existing research has rather investigated related topics: Aarhaug (2017) discusses the potential for MaaS in Norway's large urban regions. Isaksson et al. (2019) enquire into PTAs and problem discourses in Stockholm, Oslo and in Copenhagen, while Sørensen et al. (2020) study the PTAs' activities in the field in several European cities. Ydersbond et al. (2020) compare smart mobility and MaaS developments in Finland and in Norway. Last, Olsen et al. (2022) discuss the future organisation of public transport in Oslo and Viken, including their work dealing with MaaS.

Collaborative innovation has been hailed as a productive strategy for the public to attain service innovation (e.g. Torfing, 2018). A share of the literature on MaaS has focused on governance (e.g. Hirschhorn et al., 2019; Kamargianni & Matyas, 2017; Smith et al., 2018; Sørensen et al., 2020). There are, however, seemingly few studies dealing with PTAs' work on achieving innovation to create new and innovative MaaS mobility packages to their customers. Therefore, this study will shed light on how PTAs may achieve innovation through various collaborative and other strategies, and their interaction with their owners.

1.3 Limitations

The report will due to the project scope only deal with PTAs in Norway, not also PTAs in other countries, although that would also yield interesting results. Moreover, it delves into the PTAs administering transport in Norway's largest and fourth largest region population-wise: Oslo and Stavanger, not other regions where other PTAs are administering public transport. The report will to some extent describe technological innovations that are related to the sustainability of the PTAs but will mainly focus on innovation made by stakeholders collaborating, i.e. collaborative innovation.

1.4 Structure of the Report

Chapter 2 will describe the theoretical approaches selected: public risk tolerance, re-organisation, and collaborative innovation and outlines expectations based on these. In chapter 3, methods and data are presented. Chapter 4 applies the three selected theoretical approaches and discusses whether the expectations are supported or not. Chapter 5 discusses the results, while chapter 6 concludes and outlines suggestions for further research.

1.5 Definitions

MaaS: Mobility as a Service

PTA: Public transport authority

2 Hypotheses guiding the research

2.1 Public risk tolerance

For several decades, the private sector normally has been considered as *the innovative sector*. The public sector, in contrast, often has been associated with lack of innovation capacity, and is argued to suffer from an "innovation deficit" (Mulgan & Albury, 2003; Sørensen & Torfing, 2011). The explanations for this alleged weakness vary, but lack of management support and economic incentives, a risk-averse culture, red tape bureaucracy, lack of competition, as well as involving private actors too late in innovation processes have been mentioned. The public sector has, moreover, been associated with rigidity, hierarchical structures and slowness, which all should prevent innovation (Halvorsen et al., 2005; Sørensen & Torfing, 2011, 2018; Torfing, 2018).

A branch of literature, however, has taken a radically different position. Public sector innovation has developed as an important academic field during the past thirty years (e.g. Acker, 2018). A landmark publication in this respect, is Mazzucato's (2015) book *The Entrepreneurial State*. Here, she scrutinises several important innovative technical developments and what role of the state (i.e. United States) has taken in stimulating these innovations. Mazzucato (2015, 27) concludes that *the state* – rather than private business – *has been the main driver behind several innovations through the last 50 years:*

> *Evidence abounds of the State's pivotal role in the history of the computer industry, the Internet, the pharmaceutical-biotech industry, nanotech and the emerging green tech sector. In all these cases, the State dared to think- against all odds- about the "impossible": creating a new technological opportunity; making the initial large necessary investments, enabling a decentralised network of actors to carry out the risky research; and then allowing the development and commercialisation process to occur in a dynamic way (Mazzucato, 2015, p. 27).*

Mazzucato (2015) suggests that the state not only provides frameworks for innovation and funds research and development costs, but also is brave, foresighted, and takes the first steps in high-risk investments, although the profits of these investments are mostly private. One of the conclusions that she draws, is that the entrepreneurial state exists because of concrete institutions and organisations, and that considerable attention should be directed towards this aspect. Hence, risk taking and public funding of new and undiscovered topics through various public projects is key for attaining innovation essential for societal progress (Mazzucato, 2015).

2.1.1 Empirical application of the public sector innovation approach

In Norway, the PTAs are fully publicly owned by the (regional) counties (*fylkeskommuner*), and often organised as semi-independent shareholding companies. Therefore, the PTAs may be conceptualized as part of the public sector, i.e. the state. When the PTAs are developing MaaS, this may be understood as public risk taking, since it is not known exactly whether and how MaaS provision will be economically beneficial. The PTAs, due to their semi-independent role, likely have some leeway in influencing the development of their own services. Hence, we expect that:

> ***H_1**: PTAs will be risk tolerant if their owners allow for and ask for MaaS innovations and there is budgetary room for new service development.*

Here, risk tolerance is understood as the degree of variability in monetary investment returns that the PTAs and their owners are willing to withstand in their planning of the PTA's future operations (inspired by Twin (2020)). It will also entail risk about obtaining compromised public reputation. Risk

tolerance be measured by a) the leeway for PTAs for testing and developing new services, b) whether the PTAs are reluctant to establish new and innovative projects, and c) if relevant, the impact of previous scandals.

2.2 Re-organisation to become MaaS providers

The publics sector's bureaucracy, here conceptualised as the PTAs' own bureaucracy, could hamper the needed process of organisational innovation to become MaaS providers (Halvorsen et al., 2005; Kamargianni & Matyas, 2017, p. 8). A typical way that the public sector's organisations meet new challenges, needs and opportunities is through reorganising. The reason is that the organisational map decides who holds which decision-making power and influences how the members act in order to solve problems and attain various targets (Egeberg, 2013; Olsen, 2005).

2.2.1 Empirical application the re-organisation approach

PTA Kolumbus has from 2002, and PTA Ruter has from 2008, been administration companies of regional public transport services in counties Rogaland and Oslo/Akershus respectively. Both PTAs have since their establishment been organised as publicly owned limited shareholding companies, where they operate at an arms' length from their owners. Ruter is by far the largest PTA in Norway and operates around 50% of the total public transport trips. Rogaland county owns Kolumbus 100% while Ruter is owned 60% by Oslo Municipality and 40% by Akershus County.

Kolumbus featured approximately 72 employees as of March 2023 and had a turnover of around 169,5 million Euros in 2022 (Kolumbus, 2023). Ruter employed around 300 persons and earned approximately 935,25 million Euros in 2022 (Ruter, 2023). Except for Kolumbus' electric city bikes, the buses in service under the PTAs' names have since their establishment been owned and run by various private and public transport businesses who have won the PTAs' tenders. The same goes for the buses and ferries operated in Oslo. In contrast, metros and trams in Oslo are operated by the public company Sporveien, which is owned by Oslo Municipality.

Their monetary support is issued yearly through detailed delivery contracts with the counties, which include issues such as economy, product development, tickets and prices (Kolumbus, 2021b). Ticket sales is an important source of revenue. Kolumbus' tickets are publicly subsidised with around 70%, and the rest of the revenue comes from the ticket sales, while Ruter's tickets under ordinary circumstances are subsidised with close to 50%. Moreover, the tolling of vehicles at the local roads are redistributed to them through the so-called City Growth Agreements (*byvekstavtaler*). Here, a key target is that all transport growth shall be met with increased use of public transport, biking and walking (i.e. the zero-growth target, *nullvekstmålet*). The PTAs have a large leeway to suggest and decide which pilots to run, but little power in deciding which routes to offer, because the counties steer them with detailed yearly delivery contracts.

According to various data, the PTAs in combination with other measures contribute to modal change towards much increased use of public transport, biking and walking. For example, over the last decades, there has the last decades been a modal shift in Oslo towards ever larger use of public transport. Today (2024) about 30% of all travels are made by public transport. This likely has to do with public transport having high quality and often being able to serve people's needs, and that there are car restrictive policies including road tolls and parking restrictions.

There is a chance that lack of organisational capacity in terms of manpower and competence impedes the PTAs' chances of becoming MaaS providers. Therefore, we propose:

> ***H_2**: The PTAs will re-arrange intra-organisationally to gather MaaS expertise and to expand their role as MaaS providers.*

Arrangement and rearrangement will here be understood as whether the PTAs are: a) employing persons in new positions dealing specifically with MaaS, b) establishing new departments or sub-sections within their organisations, and c) whether their owners, the counties, are actively seeking board members with competence on MaaS.

2.3 Collaborative innovation: innovation through networks

Collaborative innovation between various public and private actors is, according to Torfing (2018, pp. 3-5), potentially a superior strategy to develop and implement innovative solutions in the public sector. Moreover, such collaboration may reinvigorate the public sector by giving it new ideas, networks and tools (Sørensen & Torfing, 2011). In collaborative innovation, the relevant and affected public and private stakeholders participate in "institutional arenas that facilitate collaborative innovation based on joint agenda-setting and problem definition, joint design and testing of new and untried solutions, and coordinated implementation drawing on public and private solutions" (Torfing et al., 2016, p. 11). Such innovations are based on "governance networks, partnerships and other forms of governance" between public and private actors (Torfing, 2018, p. 8). To contribute to public policy and service innovation, governance networks should be meta-governed with this purpose in mind (Sørensen, 2014).

2.3.1 Empirical application of the collaborative innovation approach

Based on the above theoretical arguments about collaborative innovation, we expect:

> ***H_3**: The PTAs will establish relevant collaborative governance networks with public and private stakeholders to create new MaaS services.*

In this study, governance networks carrying out collaborative innovation are described as a network of public and private stakeholders that either: a) hold relevant knowledge, ideas and resources, or b) are influenced by the challenge or its innovative solution. Examples of participants are politicians, bureaucrats, non-governmental organisations, firms, citizens and service users (Torfing, 2018, p. 4). Networks will be identified by for example what the PTAs conceive as the networks that their organisations participate in, as well as by what might be identified as their networks in various sources. Collaborative innovation will here be conceptualised as collaborative processes with public transport agencies, public and private stakeholders that have been established with the purpose of developing new mobility services.

3 Methods and data

The main sources of data collection are: nine in-depth research interviews/correspondences with key informants, including representatives of the PTAs; counties and interest organisations; document studies; and participatory observation in several stakeholder events.

3.1 Case selection

Norwegian PTAs Ruter and Kolumbus have been selected as cases for several reasons: First, they are the Norwegian PTAs with the highest ambitions regarding operating as MaaS providers in the future in Norway (see Ydersbond et al., 2020). Second, these PTAs have been active in the Norwegian public discourse highlighting such ideas, as well as launching their own initiatives within the field (e.g. Public Transport Norway, 2020a, 2020c). Third, both operate in Norway's largest city areas, which are sizeable and densely populated, and thus also hold the largest potentials to expand their offers. Hence, Kolumbus and Ruter may both be regarded as pathway cases in exploring the role of PTAs as MaaS providers in Norway, and possibly also elsewhere: They are representative organisations of the public and may meta-govern public innovation processes leading to service innovations (Gerring, 2007, p. 216). The study follows the PTAs from 2002 onwards, because Kolumbus was established then, and because the gradual inclusion of services under the PTAs umbrella started in the early 2000s in Norway.

3.2 Interviews

The interviewees were selected based on our knowledge and on which roles they held in their organisations. They included two representatives of Ruter and three of Kolumbus, and one of Oslo Municipality, one of Akershus/Viken county,[1] one of the employer interest organisation Abelia and one of the International Organisation of Public Transport (UITP). The interviews were carried out in the period from 2020–2022 and were recorded and transcribed. All references to the interviews were sent to the interviewees for approval and commenting in a manuscript draft. In addition, the analyses are based on interviews and other data that originally was collected in connection to previous studies (Ydersbond et al., 2020; Ydersbond & Veisten, 2019). Moreover, this study has been updated as the PTAs have expanded their services.

3.3 Document studies

Document studies were also carried out. Documents included existing research publications, reports from public agencies including the PTAs, media coverage and other sources. Data from interviews, documents and participatory observation was triangulated to ensure that the inferences made were correct. This provided new data and insights.

[1] From 1 January 2024 Viken county was split into its former entities. In the greater Oslo region, the county of Akershus was thus reestablished. Ruter is public transport authority in Oslo and Akershus.

3.4 Inductive iteration

The research process has been characterised by inductive iteration (Yom, 2015). The expectations were formulated after the first round of interviewing in 2020, which served mostly as background information and inspiration for research questions for the second rounds in 2021 and 2022. The interview guides were modified as new data was gathered in the analysis. Persons who were sceptical to the PTAs' and the publics' approach to innovation were invited for research interviews and conversations to provide their positions to get a balanced picture of the selected cases. The project was notified to Norwegian Agency for Shared Services in Education and Research (SIKT) according to good practice.

3.5 Event participation

Information has also been gathered through participatory observation in several relevant stakeholder events from 2020 onwards that would shed light on the development of MaaS in Norway and internationally. Advantages of this approach include experiencing stakeholders live, seeing their interaction, thereby obtaining first-hand information about how the key stakeholders organise their processes and their ongoing projects (e.g. Gains, 2011). The selected events include:

- The conference Virtual ITS European Congress 2020
- "Ruterbreakfast" November 2020
- Public transport conferences organised by Public Transport Norway in 2020 and 2021
- Dialogue conference on the establishment of a car fleet, organised by Kolumbus, 2020
- "Mobility for lunch", a digital lunch seminar organised every Tuesday with several stakeholders dealing with mobility, spring 2022 to spring 2024
- Mobility 2022 in March 2022, Mobility 2023 in March 2023, a national Norwegian conference dealing with transport.

During the Covid-19 closedowns, which in Norway lasted from 13 March 2020 to 25 September 2021, and subsequently from December 2021 to January 2022, these events were fully digital. Such participation was very different from participating in physical meetings: they were much less rich in information, and it was more difficult/impossible to discuss with various participants. Moreover, the events were telling of how the selected PTAs were handling the Covid-19 pandemic, which decimated their number of passengers.

4 Innovation actions towards MaaS provision

4.1 How far have the PTAs come in becoming MaaS providers?

Since year 2000 onwards, both Kolumbus and Ruter, like many other PTAs and other transport companies internationally, have offered access to an increasing number of transport modes through their tickets (Kamargianni et al., 2016; Ruter Interviews, 2020/2021). This presently includes local boats, buses, and trains, as well as other modes and services, accessible via one joint physical or digital ticket valid across the transport modes. The PTAs differ somewhat in the modes provided in their ordinary service offering; Ruter's tickets also includes access to the metros and the trams in Oslo, while Kolumbus' tickets include use of electric city bikes and car ferries. In October 2021, Kolumbus launched car sharing with the aim of offering such mobility to either persons without cars, or to enable persons and families to decide not to own more than one car (Kolumbus, 2021a; Tveit et al., 2021). Kolumbus has also organised ride sharing, leasing of electric bikes, and lending out of various types of electric bikes and kick scooters (e.g. Public Transport Norway, 2020b; Ydersbond & Veisten, 2019). Travel information, booking and ticket payment is currently (2024) available in one app (Ruter) or two apps (Kolumbus). If single tickets are bought on board in a bus, they cost more.

However, both PTAs have some way to go to become MaaS providers offering access to all common transport modes, see also Table 1 below. Ruter does so far (2024)[2] not offer access to micromobility in the form of shared city bikes[3] or electric kick scooters, and car-based services, like car sharing and taxis. Kolumbus' tickets do not (2024) give access to electric kick scooters and taxis. Such modalities may, however, be launched in the future. Both Kolumbus and Ruter generally conduct trials before a new service is rolled out to their ordinary customers. In various trials the PTAs have offered access to the means of transport that they currently lack as part of their ordinary offer. Ruter for example organised a "MaaS for work"- trial where access to all conventional transport modes could be bought in their RuterPilot app (Bærum municipality, 2018, 2020; Ruter, 2020c and interview Ruter, 2020). An overview of what the PTAs' tickets provide access to, their targets and achievements as to offering zero emission and autonomous transport, and their apps is presented in Table 4.1. Zero emission and autonomous transport are relevant to a smart transport transition to achieve key targets such as emissions reduction and customer friendliness (e.g. Docherty et al., 2018).

[2] However, in 2023, electric kick scooters were visible in the Ruter app. The customers could be directed to the page for the company owning the vehicle that the customer wanted to rent, and by the end of 2023, customers could also open and pay for an electric kick scooter in the Ruter app.

[3] In Ruter's new app, the parking places for these city bikes and electric kick scooters and their accessibility is displayed, and the customers may easily buy rides and open the locks for these vehicles there.

Table 4.1: PTA score on typical MaaS provider features, inspired by Kamargianni and Matyas (2017) and Reyes Garcia et al (2020).

Service	Kolumbus	Ruter	Comments
Travel planning, booking and payment in one app	So far (2024) two apps, but travel planning and payment has been in the same app since 2023	Yes, since 2021	Ruter provides information and communication technology infrastructure to other Norwegian PTAs
One ticket gives access to all regional public transport modes	Yes, access to buses, trains, boats and ferries	Yes, access to buses, trains, boats, metros and trams	Kolumbus was first with electronic tickets in Norway (2015)
Car-based services	Yes, launched car sharing with one operator October 2021 and with another one February 2022	No, but has organised trial offering participants all conventional transport modes	Kolumbus sends their customers from their real-time app to the interface of their collaborators for booking and payment
Micromobility	Yes, with the electric city bikes for all customers since February 2020. Leases out e-bikes	No, but the app has since 2022/2023 showed where the city bikes are located and lets you pay for the services in an easy way	Kolumbus' electric city bike scheme was first in Europe
Autonomous transport	Yes, in the FetchMe bus offer in pilots	No, but conducts various trials in- and outside Oslo	Kolumbus together with partners[4] spring 2022 in a trial launched Europe's first large autonomous bus in ordinary city traffic
Taxi services	In several rural areas booking of transport via Kolumbus' offer	Yes, door-to-door for the elderly in Oslo. In rural areas, booking of transport via Ruter's offer	
Electrification	Yes, across all transport modes. Stimulates innovation through e.g., tenders	Yes, across all transport modes. Stimulates innovation through e.g., tenders	Both have launched and will launch electric vehicles that are the first of their kind nationally and/or in the world[5]
Offer completely zero emission transport	Yes, by 2024. Aims to be the most progressive PTA in Norway	Yes, by 2028, but the target will likely be attained already by the end of 2024[6]	Kolumbus won the 2020, 2021 and 2022 public transport awards in Norway, partly because of its environmental ambitions, while Ruter was nominated

Sources: Interviews 2023, PTA documents, previous studies (Ydersbond et al., 2020; Ydersbond & Veisten, 2019).

Summing up, Kolumbus and Ruter are arguably early MaaS providers by our definition, and Kolumbus is to some extent already a bit more advanced MaaS provider after it launched access to shared cars in 2021 (Public Transport Norway, 2020a; Skoglund, 2019 and interviews Kolumbus 2019, 2020). This is also how Kolumbus and Ruter tend to view themselves: as early MaaS providers. Representatives of both PTAs argue that the future lies in expansion of their existing offer, such as through providing access to cars and taxis on a permanent basis (Interview Kolumbus, 2021; Ruter Interviews, 2020/2021).

[4] Vy, Applied Autonomy, Karsan and Adastec.

[5] E.g. various types of passenger ferries and electric buses, like Kolumbus' passenger speed ferry Medstraum.

[6] https://ruter.no/om-ruter/presse/presserom/#/pressreleases/oslos-busstilbud-utslippsfritt-tilgjengelig-og-sikkert-3245976 and Kolumbus i førersetet for bærekraftig mobilitet - ForUS, https://www.norled.no/hurtigbatene-i-oslofjorden-blir-utslippsfrie-sommeren-2024/

4.2 To what extent are the PTAs risk tolerant?

4.2.1 Kolumbus' MaaS strategy

The hypothesis/expectation based on Mazzucato (2015) seems to receive support in the evidence and data regarding Kolumbus: it is willing to take risk if the owners and their budgets allow for it. There is little room for innovation within Kolumbus' ordinary budget (Interview 3 Kolumbus, 2022, Interview Kolumbus, 2020). However, not least through the state funded reward mechanism (i.e. the local City Growth Agreement)[7] Kolumbus gets access to earmarked funding for the development of new services. This support amounts to around 5 million Euros[8] yearly and is viewed as key to Kolumbus' success in developing new and innovative services, as it allows for some risk taking. Moreover, this funding is significantly larger than what other PTAs in Norway enjoy (Interview 3 Kolumbus, 2022; Interview Kolumbus, 2020). Kolumbus has in addition managed to obtain substantial monetary support through research project participation and funding from state programmes. These extra revenues also seem key for electrification and MaaS service development, both features that are instrumental for the reduction of greenhouse gas emissions in combination with restrictive measures such as reduction of parking places and payment for parking places.

Kolumbus' employees do not fear a compromised reputation from trying out new concepts (Interview Kolumbus, 2021), possibly because they, to our knowledge, have not experienced any scandals earlier. The administrative staff in Rogaland county, however, do not expect any risk-willingness, and have asked Kolumbus not to work on innovations. However, they are content when new and innovative Kolumbus projects obtain public praise. Kolumbus' key personnel find that there is no point in waiting to launch a new service until it is widespread in society and assess what is possible within the current procurement regulations (Interview Kolumbus, 2021). Quick response and complex solutions to address new challenges and a rapidly changing mobility market seem imperative (Interview Kolumbus, 2020):

> *Generally, the more innovative you want to be, the more risk you must take. That is the nature of innovations… If we want to be relevant in 10 years, we have to renew ourselves today, including using money on what we will earn revenue from in the long term (Interview Kolumbus, 2021).*

When Kolumbus' staff have a new idea, they start talking with various relevant stakeholders, and use procurements to obtain new services. Innovation is integrated in the PTA's work, and the leadership talks a lot about MaaS. To avoid large unnecessary expenses, they generally seek to discover errors in an early phase in a project and adjust or quit it (Interview Kolumbus, 2021).

4.2.2 Ruter's MaaS strategy

Ruter is also risk tolerant if budgets allow for it. Ruter's representatives and the county representatives do *not* view Ruter's MaaS projects as very large (Ruter Interviews, 2020/2021). Moreover, Ruter

[7] Parts of the revenues from the tolling of vehicles at the local toll roads are redistributed to the PTAs through the so-called City Growth Agreements. Key targets in these agreements are reductions of a) greenhouse gas emissions, b) congestion, c) local emissions and d) noise through efficient area use and environmentally friendly transport; all growth in personal transport shall be met with increased use of public transport, biking and walking (Ministry of Transport, 2021)

[8] Under ordinary exchange rates, where 1 Euro equaled approximately 10 Norwegian kroner. The last 2–3 years, a Euro equaled 11–12 Norwegian kroner.

and Kolumbus have independently taken several initiatives to improve their services. An interviewee noted: "They [Ruter] have over time had very many initiatives that are very hard not to be positive to" (Interview Viken County, 2021). At the same time, owner representatives and analysts assess Ruter to be following their mandate loyally and keeping owners informed (Olsen et al., 2022). Other research notes that some Ruter is by some of their interviewees perceived as enterprising, ambitious and risk willing (Olsen et al., 2022, p. 59). One interviewee also perceived Ruter to be self-willed and wanting to maximise their influence (Olsen et al., 2022, p. 54).

This may demonstrate that the PTA's stepwise approach of gradual service expansion in terms of modalities included, in ticketing, use of apps and other issues that impact the customer experience, means that both the professionals involved, and the customers, gradually adapt to their new standards and services, even though these services a decade ago likely would have seemed to be high tech and futuristic. By piloting for all service development, and subsequent systematic assessment, they increase the chance that services launched in ordinary operations are positively received. This testing may also include involvement of professional research organisations, their subcontractors, and technology suppliers. However, an interviewee thinks that they still could be even better at translating this learning into incorporating the piloted services in their ordinary offer (Interview Ruter, 2021).

Some willingness to take risks is expected, and even demanded, among the county (owner) representatives that Ruter collaborates with, while their subcontractors, Ruter's leader and national politicians are motivating them to take risks (Ruter Interviews, 2020/2021). This includes entering new markets (Ruter, 2020b, p. 45).

> *In the context that there so far are no clear examples of MaaS that have gained a solid market, we could perhaps say that we are very willing to take risks (Interview Viken County, 2021).*

Ruter has the last eight years had large backing in testing new services and was supported by politicians from the environmentally ambitious Oslo Municipality[9] coalition government and Viken county. In the period 2015–2023 Oslo municipality was headed by the Labour Party, the Socialist Left Party and the Greens. Some leading county politicians from the Greens, according to an interviewee, think that Ruter could have been even more progressive (Interview Oslo County, 2021; Interview Viken County, 2021). Reduction of transport emissions is imperative to meet ambitious targets such as 95% lower greenhouse gas emissions in Oslo within 2030. Politicians do not view Ruter's projects as risky, and seem eager to participate when new services and pilots are opened:

> *The pilots are giving the politicians political gains by enabling them to show that they are innovative, like with self-driving buses (Interview Viken County, 2021).*

Ruter has been praised internationally for taking a frontrunner role, because the various modes are used according to their benefit for the travellers and the city (Interview UITP, 2021). Its owners also perceive it to be taking the lead in the development of various services: "Ruter is clearly a leader and a guiding star" (Interview Viken County, 2021).

Our interviewees see Kolumbus as more innovative and willing to take risks than Ruter. This likely has several reasons. First, Kolumbus has less prestige to defend, as it is a much smaller organisation (Interview 3 Ruter, 2021; Interview Kolumbus, 2021; Interview Viken County, 2021). Second, Kolumbus' financing for developing MaaS services seems stronger than Ruter's. Third, history may play a role. Ruter, in contrast to Kolumbus, fears damage to its reputation, because it previously experienced a large scandal: When it took over the ticketing system "Flexus" when Ruter was

[9] Oslo is both a municipality and a county.

established in 2008, Flexus functioned badly. The system cost tens of millions of Euros until it was finally removed in 2015. The Flexus scandal became something that Ruter used as a case for organisational learning (Interview 3 Ruter, 2021; Interview Viken County, 2021; Stenerud, 2018; Waale, 2018). However, the scandal was attributed to the stakeholders that started the project, i.e. the operator of the metro and trams in Oslo,[10] the PTA responsible for transport in Akershus county, and the national railway operator (NSB).[11] This meant that Ruter was at least partly avoiding the blame, but was instead made responsible for fixing the problem (Interview 3 Ruter, 2021).

4.3 How do the PTAs reorganise to provide MaaS?

4.3.1 Kolumbus' reorganisation

In 2016, Kolumbus launched a document called "Strategy for Kolumbus 2016–2021." Here, Kolumbus argues that it will become a mobility stakeholder that makes it simpler for its customers to get from A to B without using their own car (Kolumbus, 2016, p. 3). These were formulations not far from what later was decided on in the Rogaland county board in 2017, that customers in Nord-Jæren (a mostly urban part of the Rogaland county) should "get from A to Z without using their own car," and that Kolumbus was mandated to become a mobility provider (Kolumbus, 2019). One interviewee (Interview Kolumbus, 2020) thinks that Kolumbus' acquisition of the popular electric city bike scheme ("Bysykkelen") in 2015 opened the eyes of county politicians regarding Kolumbus and MaaS, because it demonstrated that Kolumbus could function as more than a traditional PTA. In 2020, Kolumbus' mobility provider-mandate was expanded to include the whole county of Rogaland, from 2022 onwards (Kolumbus, 2021c, p. 13). Summing up, it seems that Kolumbus has been promoting the MaaS agenda locally and were, together with their forward leaning owners, Rogaland County, the main driver for the development towards becoming a MaaS provider.

When Kolumbus was asked to become a mobility provider, this meant that the PTA not only had to launch new mobility services, but also had to "reinvent itself" and create a new self-image as a mobility provider (Interview Kolumbus, 2020). Contrary to Ruter, Kolumbus features no dedicated department for innovation (Interview Kolumbus, 2021). The development of MaaS is rather the responsibility of persons within different departments, but the mobility department was established after Kolumbus changed into a mobility provider in 2017 (Interview Kolumbus, 2021). One of the interviewees also highlights the importance of a balanced approach to innovation in the organisation where other departments are more conservative to secure the best potential outcome of the various innovation processes (Interview Kolumbus, 2021). To solve new tasks, including offering MaaS-related services, Kolumbus employs new people with skills needed but not already held in the organisation (Interview Kolumbus, 2021).[12] Summing up, the second expectation based on organisational theory also seems to fit well with the data.

4.3.2 Ruter's reorganisation

In recent years, Ruter also appears to have been pushing the Norwegian agenda regarding MaaS (Olsen et al., 2022; Ruter Interviews, 2020/2021). For example, Ruter has been earlier than its owners in its search to become a mobility provider. Ruter, with the aid of a consultancy, in 2015

[10] Currently called Sporveien.

[11] Currently called Vy.

[12] For example, the acquisition of the City Bike scheme and HomeWorkHome offer implied that they employed new persons to follow up the project.

launched a key issue/concept visionary landmark report called "M 2016: From today's public transport to mobility solutions of the future" (Ruter, 2015). This document envisions Ruter as a mobility provider for the customers. The process behind it catalysed several discussions on, for example, what is needed for public transport to replace car driving for various types of journeys (Ruter, 2020a). The PTA views it as its responsibility to lead the MaaS development, but also expresses that Kolumbus is even faster and more flexible in developing MaaS in Norway (Interview Ruter, 2021). Ruter views the private car as a main barrier to people using MaaS:

> *The barrier to really make MaaS take off is to get to a point where people choose not to buy a new car. And that is a very large decision. Because the car that is parked outside the house is the guarantee that if everything else goes wrong, at least you can take the car and drive there yourself (Interview Ruter, 2020).*

Ruter's owners, the counties of Akershus and Oslo, have actively looked for the optimal board leaders and board members for the PTA, based on their insight in innovation. As Ruter holds a high public reputation, candidates are glad to receive a request for board membership (Interview Oslo County, 2021). Ruter has previously established new sub sections within the organisation to delve into MaaS. The current sections to develop MaaS include the Department for radical innovation and the Department of digital services (Ruter, 2022). Ruter has recruited employees to the new innovation departments on the basis of innovation and how open they have been to change (Interview Viken County, 2021). The new department with radical innovation as a core task has been responsible for developing new mobility services for the PTA. Other staff are, however, also heavily involved in the development of Ruter's MaaS services.

A precondition for the integration of new mobility services for PTAs is their integration into the IT-systems. Since the software needed for development has been hard to get access to, Ruter has hired skilled personnel and developed software itself, such as new services and integrating their apps to include both trip planning and ticket payment. This software has subsequently also been used by other PTAs in Norway, including Kolumbus (Ruter, 2020a). Moreover, several of the key personnel in both Kolumbus and Ruter seem to have a background from the IT sector. This is also well compatible with Ruter's target of being "a data driven company:"

> *But the largest part of those working with MaaS is in a way those who work with IT development, because they do a lot to lay the grounds for us to become a MaaS provider. It must be data driven to become a MaaS provider, which is part of our strategy. And you need to test things out and integrate the services in an app (Interview 3 Ruter, 2021).*

Whether this process of expanding the PTAs role as a mobility provider may be viewed as fast or slow, depends on the sector of comparison. As one interviewee put it: "Ruter is dynamic to be a PTA, slow to be an IT business" (Interview 3 Ruter, 2021). From a democratic point of view, this slowness is likely an asset, because a main reason for this is that the processes are well discussed with the county representatives and others, so as to ensure legitimacy and broad support regarding MaaS.

4.4 Are the PTAs meta-governors of innovation networks to attain MaaS innovations?

4.4.1 Kolumbus' network governance

The PTAs use several strategies as part of their meta-governance in various innovation processes. For example, they arrange several regular and irregular seminars with their owners, the counties, and others, like businesses. To gather information, but also to create a public agenda, and get access to

various stakeholders, they have both organised public and non-public stakeholder events (Interview Kolumbus, 2020; Ruter Interviews, 2020/2021). These include arranging several public physical and digital seminars in recent years on various MaaS-related topics.

It seems that Kolumbus rather works through partnerships than through established, long-term networks where agents share ideas about what the problems and their solutions are when it comes to establishment of concrete new services. Kolumbus, for example, arranged a seminar in December 2020 with a sizeable number of relevant stakeholders to get input to its strategy of including car-based services in its tickets (Kolumbus, 2020). Subsequently, in October 2021, it launched a car sharing service in collaboration with a private non-profit car sharing company.

Kolumbus views many stakeholders as important collaboration partners in its MaaS development. This includes Rogaland county, municipalities, technology companies, transport service providers, and for example the owner of railway infrastructure in Norway, BaneNor (Interview 3 Kolumbus, 2022; Interview Kolumbus, 2020, 2021). Previously, Kolumbus regularly informed county politicians about its work on MaaS. During the Covid-19 pandemic, economic hardship combined with higher costs necessitated the politicians to cut costs, with ensuing focus on cost reductions rather than MaaS (Interview 3 Kolumbus, 2022). As regards networks, Kolumbus employees do not perceive that there is a joint understanding of what problems are and what might be their solutions between private businesses and itself, a prerequisite for participants of a collaborative network, according to Sørensen and Torfing (2018). One reason is that the target of private business ultimately is to earn profits, while Kolumbus is a non-profit transport provider with society's best interest as a main target. This may also include the possibility that people do not use public transport at all, or, for example, reduce their use of public transport (Interview Kolumbus, 2021).[13]

When Kolumbus procures new services, it clarifies expectations and demands, and makes sure that the providers of the services follow up the collaboration to ensure that the product meets its expectations. Thus, Kolumbus tends to lead the innovation processes with partners (Interview Kolumbus, 2021). Summing up, it seems more that Kolumbus' innovations are created through partnerships with various stakeholders rather than the innovation networks described by Torfing (2018). Thus, the third expectation developed based on Sørensen's and Torfing's (2011) collaborative innovation approach does not seem to receive support if network is interpreted as a stable group of persons or organisations creating the various innovations.

4.4.2 Ruter's network governance

The counties of Oslo and Viken[14] and Ruter closely interact through, for example, four status meetings with the ruling politicians and four information meetings with the county administration per year, plus the annual general assembly where the county politicians in the governing county departments participate. In addition, Ruter may invite county bureaucrats to meetings when developing projects. A very significant part of Oslo municipality's competence on MaaS is located within Ruter (Interview Oslo County, 2021; Interview Viken County, 2021). The counties are more active when it comes to asking for PTA initiatives in areas that are less commercially attractive, such as transport in the more remote areas (Interview Viken County, 2021).

Both Kolumbus and Ruter seem to seek broad stakeholder involvement in their development. On March 1, 2017, Ruter arranged a breakfast meeting with MaaS/Combined mobility as the main topic.

[13] A Ruter interviewee commented on the same issue: "No actor, apart from shoe sellers, perhaps, and us, thinks that it is good when people reduce their travel with various types of transport services."

[14] Viken county consisted of the previous counties Akershus, Buskerud and Østfold. Viken county was an unpopular organisational construction and was dissolved from 1 January 2024.

Here, national and international stakeholders were present (Ruter, 2017). May 2021, Ruter invited various stakeholders to provide input on how to attain its target of sustainable freedom of movement. Here, many private stakeholders presented their solutions, and a considerable number of public officials and others participated. Ruter also engaged a number of organisations in an elaborative process to develop its new strategy/vision launched in 2020, Strategy for sustainable freedom of movement (Ruter, 2020b). Subsequently, this strategy was launched in a large public digital event, pertaining to the emphasis Ruter puts on collaboration:

> *It is through collaboration that we create trust, and thereby can succeed in our mission (Ruter, 2022).*

Ruter participates in a number of organisations that may be viewed as networks, including ITS Norway,[15] SAMS Norway,[16] Digital Norway, the International Association for public transport (UITP) and others (Ruter, 2022). For Ruter's leader, the Skift network[17] is particularly important (Interview 3 Ruter, 2021; Ruter, 2020a; Ruter Interviews, 2020/2021). They have also established collaboration with the national travel planner Entur, the Ministry of Transport and the Directorate of Railways to discuss matters happening at the EU level, like the EU's ITS Directive. Moreover, Ruter's county owner Viken actively collaborates with and engages with various stakeholders with development of the transport system as a motivation and is also a member of ITS Norway (Interview Viken County, 2021). Both Kolumbus and Ruter participate in the Innovation Network in the Norwegian Public Transport Association. Here, "open space" is a principle, and the participants are co-creating the agenda and discuss various ideas openly (Public Transport Norway, 2021). The Public Transport Association might also be described as a network.

The selected cases are not independent of each other: The two PTAs also collaborate extensively. In several fields, Kolumbus has been a first mover, and inspired Ruter in the development of new services (Interviews Kolumbus, 2021). Kolumbus willingly shares products that it has developed, like the "FetchMe" app, and knowledge, for example from its success Bysykkelen/HomeWorkHome (Interview Kolumbus, 2021). Moreover, representatives participate in some of the same public events, in each other's events, and also in research projects (e.g. Pedersen et al., 2021).

[15] A member organisation for all actors within the transport sector that works do develop, support and coordinate ITS development in Norway.

[16] Business cluster for autonomous mobility and transport systems.

[17] Business leader network with the aim of creating a more sustainable society.

5 Discussion

The outcomes regarding innovations in services, as well as the electrification of various vehicles, seem to support Mazzucato's (2015) notion; the public sector, including various research councils, public agencies, the county politicians, the PTAs, and others, may be risk willing and foresighted actors. They have provided money and other resources to help the PTAs to develop various innovations regarding MaaS, autonomous vehicles, and electrification that would not have existed without such support.

Piloting is inherent in the PTAs' current practices, is expected of them, and viewed as a natural part of their business by the counties. Their new services, like apps, ticketing systems, access to micromobility, ride sharing and autonomous buses, are tested in pilots before they are launched full-scale. Trial and error seem to have become an inherent part of Kolumbus' and Ruter's service development. Some errors are widely accepted by the owners (Ruter Interviews, 2020/2021). It seems that the county politicians generally are more eager to take risks and push for innovation and service expansion than the county bureaucrats in both the Oslo and the Stavanger regions. This likely has to do with their respective roles; politicians are to create a sense of direction and the bureaucrats are to manage the rules set.

The PTAs, as expected in the organisational approach, have reorganised to become MaaS providers. Initially, the PTAs have launched ideas about becoming MaaS providers that their owners subsequently have supported, giving them new mandates. To become MaaS providers, the PTAs have then reorganised, applied for and received additional funding, as well as recruited personnel with the right competence to adjust to their new role as not only providers of transport, but also of mobility. This underlines the entrepreneurial role that PTAs might take. Both of the PTAs established new departments and hired persons with new competences and openness to change. The counties selected members to the PTAs' boards that had strong knowledge in MaaS and innovation in order to help the PTAs with developing into MaaS providers. The PTAs' employees have had to learn to think about themselves in new ways. This shows that reorganisation, in combination with recruitment of personnel with new competences and increased funding, may be necessary conditions for PTAs to develop into MaaS providers.

The county politicians have asked for and allowed for MaaS developments in both cases that were selected for this study, demonstrating the importance of political support, public agenda setting and substantial economic stimulation for the PTAs' transformation to MaaS providers. High environmental ambitions among the involved counties and municipalities have stimulated this development. At least in those cases where various innovations and service expansions receive positive public attention, are widely used, and demonstrate positive results, the PTAs' systematic service development and expansion seem to constitute "win-win situations" for PTAs, county bureaucrats and county politicians. Kolumbus' frontrunner role is likely enabled by substantial stable public funding that has been allocated to the development of MaaS services, underlining the importance of dedicated funding for such development.

Sørensen and Torfing (2011, p. 847) argue that the problem with public innovations is that they are accidental events, created as a response to new laws, the entry of new persons in the leadership, and various types of crises. Thus, they hold that the public sector should establish an innovation agenda to make innovation a persistent feature. Here, however, the studied PTAs are arguably systematically innovative already, at least in some respects. First, they are, for a sustained period over several years, bringing new innovative MaaS-related physical and digital services to the public as a gradual expansion of their existing offer. Second, both Kolumbus and Ruter have reorganised so that parts of, and also other employees within their organisations, are working with MaaS. Third, their ambition to launch new types of mobility services is also described in their strategies. Thus, innovation may be

assessed as a systematic feature in these organisations, a part of their general agenda, and not just a series of accidental events.

Contrary to the expectation based on Sørensen's and Torfing's concept of collaborative innovation (2011), the PTAs do not seem to create their innovations through stable networks of public and private stakeholders, but rather through numerous different strategies that involve various networks. Similar to the stakeholders described by Sørensen et al. (2023), the PTAs in this study seem to meta-govern various innovation processes in different networks. The PTAs also collaborate extensively, using each other's innovations and sharing insights, and participate in several of the same networks. At the same time, Ruter as the by far largest PTA, seems to participate in more networks than the much smaller Kolumbus, likely because of larger organisational resources. This also shows that various types of networking may be instrumental for PTAs aiming to become MaaS providers, including extensive collaboration with innovative businesses and between the PTAs. Ruter and Kolumbus may thus be conceptualised as meta-governors of the process of leading the innovation of their services.

Summing up, these three theoretical approaches may complement each other when public sector innovation is studied, but collaborative innovation may need specification to be suitable for such analysis. Moreover, the core concepts like risk willingness, reorganisation and collaborative innovation are connected in various ways. For example, when PTAs are risk willing and allowed and enabled to make changes, they can reorganise and enhance their innovation capacity. Then they may innovate to create new services through collaboration with other organisations and develop into MaaS providers.

The approach chosen here has strengths and pitfalls: by comparing two cases, the study has both been comparative while also enquiring these in depth and detail. On the other hand, if more cases were selected, other insights could possibly also have been made. However, it is hard to know how large this effect would have been. It seems that other large PTAs in Norway's largest urban regions, like Skyss in the Bergen region and AtB in the Trondheim region, also evolve towards becoming MaaS providers (AtB, 2022; Interview Oslo County, 2021; Nice, 2021; Olsen et al., 2022; Spare, 2020; Sylta, 2015). AtB has for example launched a pilot scheme including access to micromobility and car sharing to ordinary customers through their tickets in Trondheim. Access to these means of transport is available through the AtB app.

Moreover, it would have been interesting to contrast the chosen cases with an updated analysis of the company that before it went bankrupt was described as a global MaaS leader, Finnish Whim, a private company which has been entering into new mobility markets around in Europe. Whim has previously provided the most encompassing MaaS offer internationally, with services including not only public transport, but also taxis and bikes in the cities where it has been established (e.g. Hirschhorn et al., 2019; Ydersbond et al., 2020).

There has, unsurprisingly, been controversies between PTAs and private MaaS providers like Whim, not only in Helsinki (Carey, 2021, interviews conducted for Ydersbond, 2020), but also elsewhere. One reason is that all mobility providers want to hold the customer interface. A leader of Transport for London put it this way:

> *"[…]cooperation [with private stakeholders] is inherently difficult, as our objectives do not align. They want to have access to our data, but they are not interested in sharing their data with us."*[18]

[18] Presentation at the Virtual ITS European Congress, 2020.

There are also other potential competitors on the transport market. Google, Uber, Apple and others may, depending on regulation, enter and take over the market, by for example selling PTA tickets together with other services. Google would have an advantage because of its dominant position, plus extreme amounts of user data. Data protection may also be an issue with non-PTA MaaS providers. Their collection of data potentially could threaten the personal right of not being supervised even more – and "Big brother sees you"-problems would then become even more imminent. This development thus deals not only with a discussion about who to provide MaaS, but also who to provide IT competence for the public in general and the PTAs in particular (Jørgenrud, 2020). In-house or ex-house or both? With the public in charge, there is a higher likelihood that public concerns like social equity, data protection and environmental sustainability will be considered. At any rate, public regulation is key to develop MaaS services in societally beneficial ways.

There is a growing belief among cities that they can be the ones to set the rules for MaaS, and this confidence could see the emergence of a MaaS 2.0 model, that also incorporates social factors like equity into the mix (Carey, 2021).

6 Conclusion

This study has enquired into the MaaS development of the Norwegian MaaS leaders, PTAs Kolumbus and Ruter. It has asked: How do two leading PTAs innovate to become MaaS providers, and how is this related to their innovation capacity? The study has applied approaches that may contribute to explaining innovation in the public sector: Mazzucato's (2015) public sector innovation approach, an organisational approach, and Sørensen's and Torfing's (2011) collaborative innovation approach. Methods employed were interviewing, document studies, event participation and inductive iteration.

All expectations based on the approaches have received support, but to varying degrees. In line with the expectation based on Mazzucato (2015), public sector stakeholders like PTAs may be risk-willing and take on the role as MaaS provider by launching initiatives in the field, reorganise to innovate, and succeed if the owners ask for and allow for it and there is sufficient funding. Such development also is dependent on contextual factors, like national rules enabling it and substantial economic support from various external sources.

The expectation based on the organisational approach was also supported: To become a MaaS provider, obtaining the right competence in the organisation, and creating an organisational structure supporting innovation seems imperative. The expectation based on Sørensen's and Torfing's (2011, 2018) collaborative innovation approach received conditional support. Innovation was carried out by stakeholders involved in networks. However, the study shows that the concept of collaborative innovation may only describe the cases well if it includes networks that are changing from innovation to innovation.

The analysis also demonstrates that the PTAs may label themselves early MaaS providers, but that they still have a way to go to become MaaS providers giving universal access to all common transport modes in their areas. Through gradual service development, both PTAs and their owners have adjusted to new standards and expectations about what is normal and desirable for a PTA to offer. They perceive the new standards as "small moves." When assessing the development since the year 2002, however, the developments altogether have been significant, such as the number of transport services available via a digital ticket. Moreover, the innovation work includes electrification across all modes of transport.

Hence, the PTAs' service development, stimulated by signals and partly also financing from their county owners, seems to have led them to contribute significantly to attaining important transport policy goals, such as higher market shares of public transport and active mobility, lower use of private cars, lower noise, and reduction of the sector's environmental footprint. The PTAs are thus key enablers of a more efficient, equitable and environmentally friendly transport system and increase their importance for such goal attainment in this by providing MaaS. Private MaaS providers may be quicker at providing encompassing MaaS services, as demonstrated in Helsinki, while the PTAs hold another legitimacy, are publicly governed and serve all customer groups. As demonstrated here, when PTAs are given the necessary mandate and resources, they may well develop towards MaaS providers and become innovators.

6.1 Suggestions for further research

There is a need to find out more about how the public transport system best may be organised to attain various key policy goals. This is not least because the EU's new intelligent transport system (ITS) directive and the multi-modal travel information services (MMTIS) directive, which applies to the European Economic Area, will likely make ticketing across various services easier (Commission, 2017; European Parliament & Council of the European Union, 2023). This may give increased room

for new business models and also new conflicts, as it may for example not seem fair to PTAs, which are not-for-profit companies, to let private MaaS providers benefit from revenues that are largely based on infrastructure established by public investments and efforts (Interview Ruter, 2020). Moreover, when PTAs are expanding their services and taking some risks in this regard, they also take on new roles. Such relationships can be studied closer. Last, data sharing, which is necessary for MaaS, entails a risk of data of, for example, people's movements and travelling patterns being available to parties that should not have access to such information. Therefore, it is relevant to investigate more into how such data can be protected and which stakeholders should have access to what data in which way.

References

Acker, W. v. (2018). An Introduction into Public Sector Innovation – Definitions, typologies and an overview of the literature. *Social Science Research Network*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3231503

AtB (2022). Mobee - Appen for en enklere hverdag. Retrieved from https://www.atb.no/aktuelt/mobee-appen-for-en-enklere-hverdag-article17799-28.html

Bærum municipality (2018). Pilot – Ruter Kombinert mobilitet - arbeidsreiser. Sandvika: Bærum municipality. Retrieved from https://www.baerum.kommune.no/politikk-og-samfunn/samfunnsutvikling/smart-kommune/pilot--ruter-kombinert-mobilitet---arbeidsreiser/

Bærum municipality (2020). Pilot – Ruter Kombinert mobilitet - arbeidsreiser [Press release]. Retrieved from https://www.baerum.kommune.no/politikk-og-samfunn/samfunnsutvikling/smart-kommune/pilot--ruter-kombinert-mobilitet---arbeidsreiser/

Carey, C. (2021, 8 September). MaaS faces its make-or-break moment. *Cities Today*. Retrieved from https://cities-today.com/maas-faces-its-make-or-break-moment/

Docherty, I., Marsden, G., & Anable, J. (2018). The governance of smart mobility. *Transportation Research Part A: Policy and Practice, 115*, 114–125. https://doi.org/10.1016/j.tra.2017.09.012

Egeberg, M. (2013). How Bureaucratic Structure Matters: An Organizational Perspective. In *The Sage Handbook of Public Administration* (pp. 116–127). London: Sage.

European Commission. (2017). Commission delegated regulation (EU) 2017/1926 of 31 May 2017 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide multimodal travel information services.

European Commission (2019). Digital Economy and Society Index (DESI)[1] 2018. Brussels: European Commission. Retrieved from https://ec.europa.eu/digital-single-market/en/desi

European Commission (2023, 9 June). Sustainable transport: rules to boost intelligent transport systems for safer and more efficient transport agreed. Retrieved from https://transport.ec.europa.eu/news-events/news/sustainable-transport-rules-boost-intelligent-transport-systems-safer-and-more-efficient-transport-2023-06-09_en

European Parliament and European Council (2023). Directive (EU) 2023/2661 of the European Parliament and of the Council of 22 November 2023 amending Directive 2010/40/EU on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport.

Eurostat (2019, 16 May). Individuals using mobile devices to access the internet on the move. Retrieved from https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tin00083&plugin=1

Fearnley, N., Johnsson, E., & Berge, S. H. (2020). Patterns of E-Scooter Use in Combination with Public Transport. *Transport Findings, July.* Retrieved from https://findingspress.org/article/13707-patterns-of-e-scooter-use-in-combination-with-public-transport

Fearnley, N. A. (2020). Micromobility - Regulatory Challenges and Opportunities. In *Shaping Smart Mobility Futures: Governance and Policy Instruments in times of Sustainability Transitions*. Leeds: Emerald Group Publishing Limited.

Fjørtoft, T. O. (2017). Norge i Europatoppen på digitale ferdigheter. Oslo: Statistics Norway. Retrieved from https://www.ssb.no/teknologi-og-innovasjon/artikler-og-publikasjoner/norge-i-europatoppen-pa-digitale-ferdigheter

Gains, F. (2011). Elite ethnographies: potential, pitfalls and prospects for getting "up and personal". *Public Administration, 89*(1), 156–166. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9299.2011.01912.x/pdf

Gerring, J. (2007). *Case Study Research: Principles and Practices*. Cambridge: Cambridge University Press.

Halvorsen, T., Hauknes, J., Miles, I., & Røste, R. (2005). *On the differences between public and private sector innovation*. Oslo: NIFU STEP. Retrieved from https://www.researchgate.net/publication/309760722_Innovation_in_the_Public_Sector_On_the_differences_between_public_and_private_sector_innovation

Hartley, J., Sørensen, E., & Torfing, J. (2013). Collaborative Innovation: A Viable Alternative to Market Competition and Organizational Entrepreneurship. *Public administration review, 73*(6), 821–830. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/puar.12136

Hensher, D. A., Mulley, C., & Nelson, J. D. (2021). Mobility as a Service (MaaS) - Going Somewhere or Nowhere? (Vol. ITLS-WP-21-09). Sydney: Institute of Transport and Logistics Studies, The University of Sydney. Retrieved from https://ses.library.usyd.edu.au/bitstream/handle/2123/24890/ITLS-WP-21-09.pdf?sequence=1&isAllowed=y

Hirschhorn, F., Paulsson, A., Sørensen, C. H., & Veeneman, W. (2019). Public transport regimes and mobility as a service: Governance approaches in Amsterdam, Birmingham, and Helsinki. *Transportation Research Part A: Policy and Practice, 130*, 178–191. Retrieved from https://doi.org/10.1016/j.tra.2019.09.016

International Transport Forum (2020). *Integrating Public Transport into Mobility as a Service. Summary and Conclusions*. Paris: International Transport Forum. Retrieved from https://www.oecd-ilibrary.org/transport/integrating-public-transport-into-mobility-as-a-service_94052f32-en

Interview 3 Kolumbus (19 May 2022). *Interview to PTAs as MaaS Leaders/Interviewer: I. M. Ydersbond*.

Interview 3 Ruter (2021). *Interview to PTAs as MaaS Leaders/Interviewer: C. H. Sørensen*.

Interview Kolumbus (2020) *Interview to PTAs as MaaS Leaders/Interviewer: I. M. Ydersbond*.

Interview Kolumbus (2021). *Interview to PTAs as MaaS Leaders/Interviewer: C. H. Sørensen*.

Interview Oslo County (2021). *Interview to PTAs as MaaS Leaders/Interviewer: C. H. Sørensen*.

Interview UITP (2021, January 2021) *Interview to PTAs as MaaS Leaders/Interviewer: I. M. Ydersbond*.

Interview Viken County (2021). *Interview to PTAs as MaaS Leaders/Interviewer: C. H. Sørensen*.

Isaksson, K., Oldbury, K., Sørensen, C. H., Paulsson, A., Rignell, M., & Smith, G. (2019). Problembilder som formar framtidens mobilitet - exemplet "mobilitet som tjänst" i kollektivtrafikplanering. In J. Syssner (Ed.), *Ett nytt kontrakt för samhällsbyggande*. Boxholm: Linnefors forlag.

Jittrapirom, P., Caiati, V., Feneri, A.-M., Ebrahimigharehbaghi, S., González, M. J. A., & Narayan, J. (2017). Mobility as a Service: A Critical Review of Definitions, Assessments of Schemes, and Key Challenges. *Urban Planning, 2*(2), 13–25. Retrieved from https://repository.ubn.ru.nl/bitstream/handle/2066/174112/174112.pdf?sequence=1

Jørgenrud, M. G. (2020, 30 November). Abelia mener at offentlige inngrep gir ødelagte sjanser for IT-næringen. *Teknisk Ukeblad*. Retrieved from https://www.digi.no/artikler/intervju-abelia-mener-at-offentlige-inngrep-gir-odelagte-sjanser-for-it-naeringen/503427?key=01zehtW4

Kamargianni, M., Li, W., Matyas, M., & Schäfer, A. (2016). A Critical Review of New Mobility Services for Urban Transport. *Transportation Research Procedia, 14*(C), 3294–3303. Retrieved from https://core.ac.uk/download/pdf/82064899.pdf

Kamargianni, M., & Matyas, M. (2017). *The Business Ecosystem of Mobility-as-a-Service*. Paper presented at the Transportation Research Board Annual Meeting, Washington DC. Retrieved from https://www.researchgate.net/publication/314760234_The_Business_Ecosystem_of_Mobility-as-a-Service

KMD (2020). *Meld. St. 30. En innovativ offentlig sektor*. Oslo: Ministry of Local Government and Modernisation. Retrieved from https://www.regjeringen.no/contentassets/14fce122212d46668253087e6301cec9/no/pdfs/stm201920200030000dddpdfs.pdf

Kolumbus (2016). Strategi for Kolumbus 2016–2021. Rogaland: Kolumbus. Retrieved from https://www.kolumbus.no/globalassets/strategier/kolumbus-strategi-20162021_webversjon.pdf

Kolumbus (2019). About Kolumbus. Retrieved from https://www.kolumbus.no/en/about-kolumbus/about-the-company/

Kolumbus (2020). Dialogkonferanse om etablering av en bilflåte som en del av Kolumbus AS sitt mobilitetstilbud. Stavanger: Kolumbus. Retrieved from https://innovativeanskaffelser.no/wp-content/uploads/2020/11/kolumbus-invitasjon-til-dialogkonferanse-021220.pdf

Kolumbus (2021a, 19 October). Kolumbus bildeling. Retrieved from https://www.kolumbus.no/reise/bil/bildeling-i-kolumbus/

Kolumbus (2021b, 12 October). Mer om organisering. Retrieved from https://www.kolumbus.no/om-kolumbus/organisering/mer-om-organisering/

Kolumbus (2021c). *Årsrapport 2020*. Stavanger: Kolumbus. Retrieved from https://www.kolumbus.no/globalassets/aarsrapporter/arsrapport-2020.pdf

Kolumbus (2023). *Årsrapport 2022*. Stavanger: Kolumbus. Retrieved from https://www.kolumbus.no/globalassets/aarsrapporter/kolumbus-arsrapport-2022.pdf

Mazzucato, M. (2015). *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*. New York: PublicAffairs.

Medienorge. (2021). Andel med tilgang til smarttelefon. Retrieved 2 May 2021 from https://medienorge.uib.no/statistikk/aspekt/tilgang-og-bruk/388

Ministry of Transport. (2021). *Stortingsmelding 20 (2020-2021). Nasjonal transportplan 2022–2033*. Oslo: Ministry of Transport. Retrieved from https://www.regjeringen.no/no/dokumenter/meld.-st.-20-20202021/id2839503/

Mukhtar-Landgren, D., & Smith, G. (2019). Perceived action spaces for public actors in the development of Mobility as a Service. *European Transport Research Review, 11*(32), 1–12. Retrieved from https://link.springer.com/article/10.1186/s12544-019-0363-7

Mulgan, G., & Albury, D. (2003). *Innovation in the Public Sector*. London. Retrieved from An evolving, not finished piece of work (urban-response.org)

Nice (2021). AtB mobility platform. Designing mobility for the districts. Retrieved from https://www.wearenice.com/portfolio/atb/

Olsen, J. P. (2005). Maybe It Is Time to Rediscover Bureaucracy. *Journal of Public Administration Research and Theory, 16*(10). Retrieved from https://www.researchgate.net/publication/5014559_Maybe_It_Is_Time_to_Rediscover_Bureaucracy

Olsen, S. J., Tveit, A. K., Aarhaug, J., Wolday, F., Fernley, N., & Christiansen, P. (2022). *Fremtidig organisering av kollektivtransporten i Oslo og Viken*. TØI Report 1868/2022. Oslo: The Institute of Transport Economics. Retrieved from: https://www.toi.no/getfile.php?mmfileid=72256

Paulsson, A., & Aarhaug, J. (2021). *Frivillighet och konsekvensernas decentralisering*. K2 working paper 2021:18. Malmö: K2. Retrieved from https://www.k2centrum.se/sites/default/files/fields/field_uppladdad_rapport/k2_workingpaper_2021_18.pdf

Pedersen, L. H., Tveit, J. B. N., & Haualand, A. (2021, 6 September). Tester mobilbetaling på bussen uten soner og månedskort. *NRK*. Retrieved from https://www.nrk.no/norge/ny-betalingsmodell-kan-erstatte-manedskortet-1.15633174

Public Transport Norway (2020a, 28 September). Kolumbus nominert til kollektivprisen 2020! Retrieved from https://kollektivtrafikk.no/kollektivprisen2020-finalist1-kolumbus/

Public Transport Norway (2020b). Kolumbus vant kollektivprisen 2020. Retrieved from https://kollektivtrafikk.no/kollektivkonferansen/kollektivprisen/kolumbus-vant-kollektivprisen-2020/

Public Transport Norway (2020c, 30 September). Ruters el-bussprosjekt nominert til Kollektivprisen 2020! Retrieved from https://kollektivtrafikk.no/kollektivprisen2020-finalist3-ruters-elbussprosjekt/

Public Transport Norway (2021, 12 March). Innovasjon for bærekraftig mobilitet. Retrieved from https://kollektivtrafikk.no/innovasjon-for-baerekraftig-mobilitet/

Reyes García, J. R., Lenz, G., Havemann, S. P., & Bonnema, G. M. (2020). State of the Art of Mobility as a Service (MaaS) Ecosystems and Architectures—An Overview of, and a Definition, Ecosystem and System Architecture for Electric Mobility as a Service (eMaaS). *World Electric Vehicle Journal, 11*(1). Retrieved from https://www.mdpi.com/2032-6653/11/1/7/htm

Ruter (2015). *M2016: Fra dagens kollektivtrafikk til morgendagens mobilitetsløsninger*. Retrieved from Oslo: https://m2016.ruter.no/visjon-fremtidens-hovedstadsregion-gronn-mobilitet/

Ruter (2017). Presentasjoner frokotmøte kombinert mobilitet 01.03.2017. Oslo: Ruter.

Ruter (2020a, 28 November 2020) *Interview for Innovation through Collaboration/Interviewer: I. M. Ydersbond*.

Ruter (2020b). *Målbilde for bærekraftig bevegelsesfrihet*. Oslo: Ruter. Retrieved from https://www.mynewsdesk.com/no/ruter/events/ruters-nye-maalbilde-kan-baerekraftig-bevegelsesfrihet-bli-den-nye-normalen-97242

Ruter (2020c). *Årsrapport 2019*. Oslo: Ruter. Retrieved from https://aarsrapport2019.ruter.no/no/ruter-gjennom-aret/mobilitetstjenester

Ruter (2023). Årsrapport 2022. Oslo: Ruter. Retrieved from https://aarsrapport2022.ruter.no/okonomi/ruters-okonomi-og-nokkeltall/

Ruter Interviews (2020/2021) *Interviews for Innovation through collaboration /Interviewer: I. M. Ydersbond & C. H. Sørensen*.

Sarasini, S. (2019). How to support the development of MaaS: Implications for public governance. Shift Policy Brief 2019/2020. RISE Viktoria. https://www.nordicenergy.org/wp-content/uploads/2019/10/maas_web-1.pdf

Skoglund, J. (2019, 12 August). Stavanger er landets smarteste innen transport - fikk Mobilitetsprisen 2019. *Veier24*. Retrieved from https://www.veier24.no/artikler/stavanger-karet-til-landets-smarteste-innen-transport-fikk-mobilitetsprisen-2019/471361

Smith, G. (2020). Making Mobility-as-a-Service: Towards Governance Principles and Pathways. PhD dissertation. Gothenburg: Chalmers University of Technology. Retrieved from https://research.chalmers.se/publication/516812

Smith, G., Sochor, J., & Karlsson, I. C. M. (2018). Mobility as a Service: Development scenarios and implications for public transport. *Research in Transportation Economics, 69*(September), 592-599. Retrieved from https://doi.org/10.1016/j.retrec.2018.04.001

Spare. (2020). Spare and AtB bring electric on-demand transportation to senior citizens in Trondheim, Norway. Retrieved from https://sparelabs.com/en/blog/atb-launches-senior-transportation/

SSB (2022). Fakta om Internett og mobilitelefon. Retrieved from https://www.ssb.no/teknologi-og-innovasjon/faktaside/internett-og-mobil

Stenerud, D. (2018, 8 November). Billett-systemet Flexus: Oslo-skandalen som kostet skattebetalerne 600 millioner kroner. *Dagsavisen*. Retrieved from https://www.dagsavisen.no/oslo/nyheter/2018/11/08/billett-systemet-flexus-oslo-skandalen-som-kostet-skattebetalerne-600-millioner-kroner/

Sylta, O. (2015, 30 June 2015). Public transport in Norway must win the battle over cars. *Intelligent Transport*. Retrieved from https://www.intelligenttransport.com/transport-articles/16457/public-transport-in-norway-must-win-the-battle-over-cars/

Sørensen, C. H., Hansson, L., & Rye, T. (2023). The role of meta-governance in public transport systems: A comparison of major urban regions in Denmark and England. *Transport Policy, 130*, 37–45. https://doi.org/10.1016/j.tranpol.2022.10.018

Sørensen, C. H., Isaksson, K., Oldbury, K., Paulsson, A., Smith, G., & Rignell, M. (2020). *Kollektivtrafikmyndigheter och smart mobilitet*. Lund: K2. Retrieved from: http://www.k2centrum.se/en/node/1489

Sørensen, E. (2014). *The metagovernance of public innovation in governance networks*. Paper presented at the Policy & Politics conference, Bristol.

Sørensen, E., & Torfing, J. (2011). Enhancing Collaborative Innovation in the Public Sector. *Administration & society, 43*(8), 842–868. Retrieved from https://journals.sagepub.com/doi/10.1177/0095399711418768

Sørensen, E., & Torfing, J. (2018). Co-initiation of Collaborative Innovation in Urban Spaces. *Urban Affairs Review, 54*(2), 388–418. Retrieved from https://journals.sagepub.com/doi/abs/10.1177/1078087416651936

Torfing, J. (2018). Collaborative innovation in the public sector: the argument. *Public Management Review, 21*(1), 1–11. https://www.tandfonline.com/doi/full/10.1080/14719037.2018.1430248

Torfing, J., Sørensen, E., & Røiseland, A. (2016). Transforming the Public Sector Into an Arena for Co-Creation: Barriers, Drivers, Benefits, and Ways Forward. *Administration & Society, 51*(5), 795–825. Retrieved from https://journals.sagepub.com/doi/abs/10.1177/0095399716680057

Transportministeriet. Lov om trafikselskaber. Retrieved from Bekendtgørelse af lov om trafikselskaber (retsinformation.dk)

Tveit, J. B. N., Walmsness, T., Apall, K., & Norheim, H. J. (2021, 18 October). Kolumbus startar med bildeling – Ruter følger spent med. *NRK*. Retrieved from https://www.nrk.no/rogaland/kolumbus-startar-med-bildeling-_-ruter-folger-spent-med-1.15693835

Twin, A. (2020, 29 October). Risk Tolerance. Retrieved from https://www.investopedia.com/terms/r/risktolerance.asp

Valevatn, J. (2022). *Holdninger til ny transportteknologi*. Oslo: Norwegian Board of Technology. Retrieved from https://teknologiradet.no/wp-content/uploads/sites/105/2022/07/holdninger-til-ny-transportteknologi-teknologiradet.pdf

Vorotovic, V. (2020, 7 October). Defining MaaS and the parameters for its success in today's transport networks. *Intelligent Transport*. Retrieved from https://www.intelligenttransport.com/transport-articles/109222/defining-maas-and-the-parameters-for-its-success-in-todays-transport-networks/?utm_source=Email+marketing&utm_medium=email&utm_campaign=IT+-+Newsletter+41+-+15+October+2020+-+Spons%3a+Parifex&utm_term=Newsletter+%2341+2020+-+15+October+2020&utm_content=https%3a%2f%2femails.intelligenttransport.com%2frussellpublishinglz%2f&gator_td=%2bnr0hInrE7qPDGYcAwKo3f23mx3Mof%2bCI2uJRUm95QG1b8FgQ22dTw7apngxdDVhtHCWPEL2Bi8t7i5K3%2fbVm4ZhFzqIn1VYnUlSzzQoAGqSU6vU2U59WyXKnNGXq88ZGrMJhjODUpDADuR%2bqn0cn6KrRUQf6U0FS2Ew7shoAEQsCsVJJswzf6ewHuwYY%2f5MIxgdbbkWi1ryI5r1VFRoKw%3d%3d

Wong, Y. Z., Hensher, D. A., & Mulley, C. (2020). Mobility as a service (MaaS): Charting a future context. *Transportation Research Part A: Policy and Practice, 131*, 5–19. Retrieved from https://doi.org/10.1016/j.tra.2019.09.030

Waale, M. (2018, 23 October 2018). Forventet suksess, men endte med nedtur: Nå skal disse fjernes. *Aftenposten*. Retrieved from https://www.aftenposten.no/oslo/i/bKxq8B/forventet-suksess-men-endte-med-nedtur-naa-skal-disse-fjernes

Ydersbond, I. M. (2019). Smart, delt og elektrisk mobilitet: Fremtiden er her! *Samferdsel*. Retrieved from https://samferdsel.toi.no/forskning/smart-delt-og-elektrisk-mobilitet-fremtiden-er-her-article34349-2205.html

Ydersbond, I. M., Auvinen, H., Tuominen, A., Fearnley, N., & Aarhaug, J. (2020). Nordic Experiences with Smart Mobility: Emerging Services and Regulatory Frameworks. *Transportation Research Procedia* (49), 130–144. Retrieved from https://www.sciencedirect.com/science/article/pii/S235214652030733X?via%3Dihub

Ydersbond, I. M., & Veisten, K. (2019). *Klimaeffekten av elsykkel. Dokumentasjon av hva som fremmer og hemmer bruk av elsykkel i Norge og elsykkelens bidrag til kutt i utslipp av klimagasser i norske kommuner.* TØI Report 1691/2019. Oslo: Institute of Transport Economics. Retrieved from https://www.toi.no/getfile.php?mmfileid=49973

Yom, S. (2015). From Methodology to Practice: Inductive Iteration in Comparative Research. *Comparative Political Studies, 48*(05), 616–644. Retrieved from http://cps.sagepub.com/content/48/5/616.abstract

Aarhaug, J. (2017). *Bare Ma(a)S? – Morgendagens transportsystem i storbyregioner?* TØI Report 1578/2017. Oslo: Institute of Transport Economics. Retrieved from https://www.toi.no/publikasjoner/bare-ma-a-s-morgendagens-transportsystem-i-storbyregioner-article34504-8.html

Aarhaug, J., & Tveit, A. K. (2023). How “within-regime” tensions can create windows of opportunity for new mobility services. *Environmental Innovation and Societal Transitions, 49*, 100784. https://doi.org/10.1016/j.eist.2023.100784

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