Workshop 3: Emerging Business Models and Implications for the Transport Ecosystem

Factors of successful implementation and diffusion of services based on autonomous vehicles: users' acceptance and operators' profitability
Jaafar Berrada and Zoi Christoforou

potential to reduce energy consumption, to avoid accidents, to cut driving costs, and to optimize parking utilization. As a result, they could provide lower-cost services to public transport users and, eventually, replace an important part of private cars. However, several researchers and analysts are sceptical about AVs capacity to gain user's acceptance in the midterm, and then to achieve profitability for providers.

The present study explores factors of a successful implementation and diffusion of taxi services based on AVs (known as robotaxis).

From users' perspective, our study is based on Stated-Preferences Surveys. We interviewed more than 500 of persons commuting in Palaiseau, a city located on the south of Paris. Results stated that robotaxis will likely be used for short-distance (2 to 5 km) commuting trips by two user profiles: (1) non-motorized young users (less than 30 years old) and (2) motorized active population between 30 and 50 years old. The evaluation of users' preferences regarding fares, waiting times, travel times and transfer times is performed considering all existing modes. It suggests that the trip fare should be less than 6 euros and the waiting and travel times from 4 to 8 minutes. From operators' perspective, key performance indicators (KPI) are defined to assess technical and economic performances in different contexts: urban vs. rural area, last-mile vs. door-to-door service, taxi vs. fixed schedule, and so on. KPI values are indicated based on existing literature.

Finally, the analysis is extended to predict the most likely evolution of AVs penetration and diffusion.

Understanding the Ridership Decline on a Disaggregated Spatial and Temporal Level in Five Cities
Simon Berrebi, Taylor Gibbs, Sanskruti Joshi and Kari Watkins

In 2017, following five consecutive years of decline, bus ridership in the United States reached its lowest point since APTA started collecting the metric in 1965. For transit agencies across the country, this ridership crisis coincides with large scale urban migration, sweeping service changes, and the advent of private transportation services. Understanding the effect of these trends on ridership is necessary to plan for mobility in a dynamic, connected, and autonomous world. The effects of these emerging trends on transit ridership, however, have only been studied a regional level, and their underlying dynamics are still misunderstood.

Our research analyses the change in ridership in Portland, Miami, Minneapolis, Atlanta, and Pittsburgh at 50,000 stops using Automated Passenger Count data. Changes in ridership are explained with service levels, population, jobs, and demographic data at a disaggregated level from multiple sources. In addition, trip density data were obtained from a leading ride-hailing company on a highly specific spatial and temporal scale. Panel regression models are used to explain where, how, and why ridership is changing between 2012 and 2017. Internal and external factors are separated in two analyses. In the first part, only bus stops that were neither added nor removed in the five-year period are analysed in a fixed-effect model. In the second part, the effects of service changes in time and space are considered in a pooled model.

This study investigates the complex relationship between transit and ride-hailing usage while controlling for shifts in access to transit and population demographics. The impact of gentrification, network redesigns, mode cannibalism, and service allocation policies on ridership are identified. The research then assesses the competitive advantages and natural complementarity between transit and ride-hailing based on density, land-use, and demographics. This research provides an important tool to help policy makers to plan for optimal public-private integration frameworks and make long-term plans for our transit future.

Transport within the bigger business picture
David Brown

We have, thankfully, moved beyond the concept of 'competition' in transport services as the one-dimensional consideration of productive efficiency of minimising the cost of service. Thredbo conferences, among other avenues, have presented an evolving approach to transport competition to include the optimum combination

of services and fares and the need for a social cost-benefit evaluation including social inclusion and environmental outcomes.

Adding to the breadth and complexity of community issues, however, we now see new technologies that are allowing businesses to use transport services as just one part of a broader relationship with customers.

So, as we have had to move our consideration of travel choice beyond the parameters of time, distance and cost to include personal and life style situations, so we will have to grasp the concept of 'competition' beyond just making a profit out of the specific mobility or freight carrying activity.

Mining personal information, cross promoting products (including subsidies) and establishing loyalty programs will have a big impact of the type of mobility services that will be offered. We must not fail to consider how modern companies will use mobility and freight transport as a component of much broader strategies.

We have seen public and political cheering when commercial opportunities provide new services that reduce upfront costs to government, and possibly customers, but unintended consequences (perhaps good, perhaps not so good) are inevitable and providing more transport services will not necessarily produce trickle down benefits such as social inclusion for the disadvantaged.

The paper will briefly look at historic examples of some new transport technologies that led to aggressive and dominating business activities beyond just mobility.

The main focus of the presentation will be based on recent interviews with car manufacturers, mobility service companies, freight vehicle manufactures, academics and business analysts to identify what they want to get from transport service provision, examples of how incentives are already affecting transport provision and the impacts (perhaps in a positive or negative way) on community activities.

This will include how the "profit" from the transport service will not just come from the fare box and/or a government subsidy. It will also include how large companies that were not originally involved in transport will make the transport function a stepping stone/competitive advantage to their other business activities.

Consumer preferences for coordination: the value of institutional integration of public transport ecosystems

James Bushell, Matthew Beck and Rico Merkert

Integration occurs in many dimensions, including physical, network, transfer, informational, operational, payment, ticketing and fare, and underneath all of these, institutional integration. Smart ticketing systems (STS) have become the dominant ticketing mechanism used by public transport operators across the world and perhaps represent a first step towards forming consolidated views of the public transport ecosystem in the minds of consumers. Integration of information systems through STS platforms can be used to facilitate operator cooperation which is delivered to consumers through pricing and operational integration mechanisms. In other sectors, consumers value this cooperation, which is anecdotally replicated in public transport systems, though not yet quantified. In this study of consumer preferences, we apply stated preference experiments and mixed logit utility models to determine preferences for both operational and fare integration across modes, geographies and firms and study their role in providing services that consumers value. In understanding the values for this coordination, we look to glean useful insight into how STS may be deployed to allow further collaboration opportunities between transport operators to deliver journey options to consumers and their potential use in developing a more operator focussed Mobility as a Service (MaaS) environment. Additionally, we aim to understand how marketisation of an STS brand may be a viable management strategy to enhance the usage of public transport.

Distilling actionable insights from big travel demand datasets for land use planning

Alvin Chua, Serene Ow and Kevin Hsu

As a city state with limited land to meet the growing needs of its people and economy, Singapore has adopted a series of innovations to optimise its use of space. Working towards a more data-informed land use, amenities and infrastructure planning process, the city's Urban Redevelopment Authority (URA) leverages big data and spatial analytics to deepen its understanding of urban activity and mobility. Big travel

demand datasets from public transport and ride-hailing services allow planners to observe mobility patterns at an unprecedented level of detail, accounting for large numbers of users, trips, and trip types. Since August 2018, the URA has been working with regional ride-hailing operator Grab to understand how daily commute patterns in Singapore vary between new and existing transport modes, and how the nature of activities (including work, school, and recreation) varies depending on the time of day. This paper describes the novel dataset and analytical techniques utilised to study the relationship between urban activity and mobility. It will also report how spatial-temporal characteristics of the urban environment, such as land-use mix, location accessibility, and peak-hour travel demand, can influence commute by different modes. By studying mobility over an extensive range of travel modes, this analysis will provide land-use planners with valuable insights to better assess infrastructure requirements for new developments. The findings are also useful for emerging transport providers, who can improve service delivery across short- and medium-term time scales.

Diffusion of start-ups in the mobility ecosystem
Marc Hasselwander and Joao Bigotte

The transportation sector is currently experiencing a major transformation that is triggered by digital technologies and societal changes. In many, if not most, cities around the globe, novel mobility solutions have changed the way how people move and loosened car dependencies. This development is best represented by the emerge of new start-up companies. They have improved existing (e.g. carpooling) and developed new (e.g. ride hailing, car-, bike- and scooter-sharing) mobility solutions and made their services available to a broad mass of customers through the use of smartphones. In relatively short time, the most successful mobility start-ups have experienced exponential growth and achieved instant global recognition. Among them, we analysed a comprehensive group of 48 start-ups in order to understand the diffusion pattern of new mobility solutions. Our main findings include the following. First, most start-ups that are based on a platform business model (PBM) and follow VC-backed growth strategies, seeking for rapid international expansion. Characteristic for the PBM is the creation of two-sided markets and network effects, ingredients that especially start-ups providing ride hailing (Uber, Cabify, etc.), carpooling (BlaBlaCar, Zimride, etc.), and P2P car sharing (Drivy, Snappcar, etc.) services can benefit from.

Second, we found that new mobility solutions typically originate from the developed world and diffuse to developing countries through either start-up's international expansion or the emergence of so-called "copycats". It appears that particularly first mover companies and market leaders tend to expand to the developing world. This includes, for example, the cases of Uber and BlaBlaCar. On the other hand, they are facing new competition from local start-ups such as DiDi Chuxing (China), Easy Taxi (Latin America) or Ridely (India).

With regard to emerging mobility solutions, such as Mobility as a Service (MaaS), we show that our research provides evidence about potential paths for diffusion in developing countries and insights on which stakeholders may be responsible for it.

Public Preferences for Mobility as a Service: Insights from Stated Preference Surveys
Chinh Ho, Corinne Mulley and David Hensher

Mobility as a Service (MaaS) is a fast-emerging concept that aims to redefine transport markets with flexible, efficient, user-focused, and personalised services. It unites existing transport options, deploying the most appropriate mode for each journey, recognising customer preferences and real-time conditions of the transport network when the trip is requested. MaaS relies on a digital platform to integrate various forms of transport into a single, on demand service in which mobility is considered as a service to be delivered as opposed to being acquired via asset ownership such as private cars or seasonal tickets. Best described as a one-stop shop for mobility services, MaaS offers an opportunity for individuals to improve the efficiency of the urban transport network through their collaborative consumption and mitigate potential risks associated with the rise of point-to-point and on-demand services powered by disruptive transport technologies including ride-sourcing (e.g., Uber) and in due course, self-driving vehicles.

The MaaS concept has been trialled in various forms in Europe with Finland being the pioneer in commercialising mobility plans under the MaaS framework. Since 2016, Helsinki residents have been able to use the Whim app to plan and pay for their everyday travel, either with a pre-pay option as part of a monthly mobility subscription or with a pay-as-they-go option. Other countries such as Sweden, Austria, Germany, France, the UK, Singapore, Canada, and the US have tested more limited mobility bundles on real people

and real networks with real mobility plans. Notwithstanding these active engagements of many jurisdictions and their enthusiasm for this emerging mobility paradigm, MaaS is still in its infancy with much development, innovation, adaptation, and experimentation still to be undertaken.

This paper investigates the potential uptake of MaaS by identifying public preferences for mobility packages within the stated choice experiment environment. Economic and social factors that make MaaS offers more attractive than conventional unimodal transport options (e.g., private car and/or public transport service as it currently exists) are identified to inform MaaS providers how best to package, cost and market mobility plans to different segments of the population based on their travel needs and willingness to pay for new mobility services. To do so, state-of-the-art discrete choice models are developed using behavioural data recently collected in Sydney, Australia and Tyneside, England using computer-assisted personal interview (CAPI) surveys administered via face-to-face method. These two datasets, collected with a similar design and survey method, provide a unique opportunity to inform the potential impact of MaaS on private car and public transport use, including point to point travel and first/last mile of public transport journeys, as well as providing a comparative assessment of public preferences in different institutional settings (regulated with integrated ticketing system in Sydney vs. deregulated in Tyneside) showing how MaaS offerings might be more (or less) attractive to users.

Incentive Schemes for Sustainable Urban Mobility: Generic Business Models
Gustaf Juell-Skielse

Recently, there have been much interest in “nudging” individuals away from using conventionally fuelled vehicles to using more sustainable modes of transportation when travelling in urban areas. Operators, governments and employers use resources provided by multiple stakeholders to build business models to deliver value to travellers. The value offered to the travellers include for example points that can be redeemed for discounts and vouchers, rewards and digital games. In return the customers change their mobility behaviour and provide digital information about their trips. However, the understanding of business models for incentive-based schemes is rather low. For example, government organisations rarely use the concept of business model and employers rarely encourage employees to travel more environmentally friendly. Therefore, in this article, we present three generic business models for sustainable urban mobility using incentive-based schemes: Public Programme, Operator and Employer. A mixed methods approach has been used in order to collect data. The result shows that organizations implementing a business model for “nudging” individuals to change travel behaviour have to develop new capabilities in terms of knowledge and skills, organization, management and technology.

Transport Industry Adapting to Change: An Australian Case Study
Christopher Lowe, Janet Stanley and John Stanley

Growing governmental reluctance to fund local bus services is leading to increased interest in demand responsive transport (DRT). At the same time, the use of technology to facilitate access to DRT is creating circumstances for significant disruption of the way bus services are planned, contracted, delivered and regulated. This disruption creates uncertainty for bus operators but also presents an opportunity for operators to proactively adapt to better meet passenger needs. This could involve diversifying their businesses, becoming total local transport providers and/or brokers, along Mobility-as-a-Service (MaaS) type lines, where the passenger is of central importance, rather than the mode of transport.

The bus industry in Victoria, Australia, has, until recently, comprised a cohort of almost exclusively trans-generational family businesses. Since the end of the Second World War, bus operators have had contracts with the State Government, commonly negotiated via their voluntary professional association (VPA) (or industry representative body), to deliver scheduled (timetabled) fixed route and school bus services throughout the state. The emerging disruption to bus service delivery provides an opportunity for the operators’ VPA to take a leadership role in supporting and enabling the current route service operators to augment their capabilities and deliver DRT services. The provision of a new transport business model, and the technological platform that supports it, will enable bus operators to compete in the growing DRT realm and passenger services levels to improve, also supporting better social and environmental outcomes.

After describing the current state of bus operating environment in Victoria, this paper will discuss the disruption and uncertainty that is occurring around public transport and the need for the bus industry and the regulatory environment to respond. Market opportunities that arise from this disruption are discussed, including the development of a new software system that supports operator involvement in integrated local service provision. The results of a pilot study in regional Victoria will be presented. The role the bus industry

VPA can play in facilitating the development of local mobility services, and the associated diversification of bus operators' business, is discussed, as are the implications for the regulatory environment within which services operate and the evolving nature of public transport.

Issues and challenges in formalising the jeepney industry in the Philippines – developing a research agenda

Derlie Mateo-Babiano, Redento Recio, Marie Danielle Guillen, Sandy Mae Gaspay and David Ashmore

Jeepneys – paratransit vehicles consisting of sixteen-seater buses – constitute the bulk of urban transport in many of the cities in the Philippines. The Philippines Department of Transportation estimates that there are 178,000 jeepneys across the nation. Yet 90% of these are at least fifteen years old and are producing significant air pollution. As such, the Government has committed to, by 2020, removing all these older polluting vehicles from the road and replacing them with cleaner diesel or electronic propulsion. This is to be achieved by means of a voluntary area franchising arrangement by which a primary operator will contract with the government; all operators within an area franchise will be eligible for loans for newer, cleaner, propulsion technologies. Operators opting for this model will be salaried; routes will be consolidated to form integrated networks operating under a single ticketing portal. This is, however, an ambitious undertaking, not merely because of its scale, but the current, relatively informal model by which jeepneys are regulated. Whilst the vast majority operate on fixed routes with set tariffs, they remain driver owned, with the market entry requirement consisting of a permit to operate. The sector continues therefore to be characterised by lack of integration and some informal illegal operators also competing on the road. Most drivers are organised under powerful political unions and operator groups possess the ability, through industrial unrest, to bring cities to a standstill. The bulk of the driver unions oppose the proposed regulatory model, seeing it as a means by which they will not only lose control of their industry and autonomy, but something which will force many smaller drivers out of business. Furthermore, there are plans for high capacity bus rapid transit (BRT) systems in cities such as Manila with the jeepneys constituting the proposed feeder mode into the trunk routes. It seems that many operators may therefore elect not to become part of an area franchise and choose instead to compete 'on road' retaining their self-governance. Yet at this point nothing is certain, and if lessons from elsewhere in terms of paratransit are to be brought to bear, the process of industry consolidation is likely to be drawn out and eventuate in a hybridised model with a strong degree of informality remaining. This paper explores these issues by presenting the finding of qualitative interviews, with key sector participants, so as to develop a research agenda, placing the findings within a global context. The paper's focus is applied, and whilst key issues will emerge inductively from interview transcripts examined through thematic analysis, these are likely to revolve around social equity, risk transfer, the differing incentives within the sector, how a dual model may function, and the business case for change to achieve environmental targets. In eliciting these themes, the authors seek to development a constructive research agenda to inform the debate and assist the sector in moving forward.

Utilizing Virtual Singapore Platform to Quantify Autonomous Vehicles' Benefits

Priyanka Mehta, Anuj Abraham, Pranjal Vyas, Usman Muhammad, Rajashree Sundaram Agatheswaran and Justin Dauwels

Autonomous Vehicles (AVs) are a highly anticipated innovation in the intelligent transportation industry and we are seeing a significant surge in its growth. Scientists, engineers and policy-makers around the world are working together in reducing the gap where AV becomes a reality. The transportation and infrastructure industries are collaborating and defining their investment priorities in order to adapt to the upcoming advancements of AVs. We are also seeing AVs as an upcoming option for improving first mile and last mile connectivity. The micro transportation model such as shared e-scooters and e-bikes has received mixed reviews in terms of safety and comfort from both users and non-users of the service. As all these involved industries race to make AVs a reality, we will witness major infrastructure changes in urban cities adapting to driverless future. Hence, it is crucial that the stakeholders get a realistic view of changes to enable informed decisions.

The Virtual Singapore project is a NRF (National Research Foundation) initiative and a dynamic 3D model of Singapore bringing together all the urban elements in a virtual platform. It is a collaborative data platform that enables different sectors to test and develop tools for planning and decision making using virtual simulation techniques. This also opens up an opportunity to simulate scenarios, estimate the changes required for making AV a reality and quantifying the benefits of the technology.
This study discusses on methods of measuring the benefits of using AVs in the urban city of Singapore. The

study has exploited AV modelling and simulation techniques in a virtual environment. The team has made use of AV simulation software in conjunction with traffic simulation and architecture design software. The AV simulation software provides the capability of deploying different sensors such as virtual LIDAR with physics-based rendering, vision sensors, Inertial Measurement Unit (IMU) etc. These sensor measurements help the vehicles to interpret surrounding environment used for localization, perception, path planning, and collision avoidance etc. For a realistic environment, we have integrated the simulation software with a real-time traffic simulator. This traffic simulator is able to populate vehicles based on real-traffic conditions. The real traffic data is collected with help of our research collaborator, Land Transport Authority (LTA), Singapore. The integration of traffic data and simulator together helps to test and analyse different use cases to quantify the benefits like area saving, transit time etc. and express the challenges involved in adapting Singapore to an AV environment. The results will be finally integrated to Virtual Singapore platform for visualization and dynamic rendering of AV simulation. This paper presents a perspective of utilizing Virtual Singapore platform for testing and validating AV deployment in Singapore road network through a combined interface of different software.

Policy frameworks for higher education mobility management: a focus on public transport provision
Ofentse Hlulani Mokwena and Mark Zuidgeest

Transport demand management (TDM) measures are widely regarded as essential tools to deal with traffic issues. Their effectiveness has been under scrutiny. Packaging of TDM measures has recently received much attention from researchers and governments, because it can achieve more complex policy goals and resolve the negative effects of single TDM measures. Many studies have examined the concept of policy packaging, the ideal packaging process and potential barriers at the theoretical level, and even the effectiveness and acceptance of several specific combinations of TDM measures. However, the way TDM packaging as a concept works in a real-world context has received little attention.

This study regards TDM packaging as a generalized concept rather than the simple combination of measures. We propose a TDM packaging framework including three levels as a whole: the integration of perceptions and visions, the integration of institution and organization, and the integration of specific TDM measures. An effective and feasible TDM packaging process should achieve the integration of these three levels.

Next, we examine the TDM packaging framework in one Chinese city, Jingmen, which locates in the centre of China. It is a typical Chinese prefecture-level city with the population of 3 million and the urban district area of 273 square kilometres. Compared to super large cities like Beijing and Shanghai, most Chinese cities are just like Jingmen, which reach the similar level of transport development and face the similar transport problems.

We conduct semi-structured interview to the officers from several different transport-related bureaus in the local government to collect their perceptions of sustainable transport in order to detect whether different bureaus share the similar visions and perceptions in transport management; to record the cooperative activities among them in order to know the degree to which the organizations are integrated; and to ask them assess the effectiveness and feasibility of a bunch of TDM measures in order to form the possible packaging of TDM measures.

The result shows that firstly the perceptions of different bureaus are distinct, especially between the plan-oriented bureaus and the executive-oriented ones; secondly, the cooperation is lack and only happens under the formal institutional arrangement and temporary orders from municipal government; at last, the bureaus that share the similar perceptions tend to have similar evaluation of effectiveness of TDM measures, and the bureaus assess one TDM is highly feasible when its design and implementation involve the other bureaus which they have built good partnership.

Therefore, this study concludes that the clear consensus and the formal or informal institutional cooperation are essential for an effective and applicable TDM packaging.

A Business model perspective to understand inter-firm transitions: From traditional public transport to MaaS
Fariya Sharmeen and Henk Meurs

Implementing Mobility as a Service (MaaS) essentially means adding a third party 'intermediary', often referred to as MaaS provider, within the traditional public transport system who would offer real time service alternatives to the end user. The end user will buy their services through the MaaS provider and would get flexible travel advice catered to personal preferences, including any adjustments caused by disruptions to allow seamless service provision. One of the major motivations to move towards such flexible systems is to address the gaps in both service delivery and market share. However, it is yet unknown how the advent of a new actor would affect the traditional public transit system? How would the stakes and revenues be re-arranged? General conjecture is that the public transport providers would be at the losing end of the bargain and end users would have to pay up – to what extent are these true? Insights on these questions related to the transition of traditional public transport system to these new forms of shared services has been largely missing. While transition theories lack bearing to study such firm dynamics, a business model (BM) perspective can be used as a source of this change and inertia to understand the socio-technological transitions.

A BM is "the set of which activities a firm performs, how it performs them, and when it performs them as it uses its resources to perform activities, given its industry, to create superior customer value (low-cost or differentiated products) and put itself in a position to appropriate the value"*. By using BMs to understand firm transitions one can track the diffusion of innovation and the progress of entrepreneurial experimentations providing an opportunity to refine before commercialization. Therefore, it is particularly advantageous at an early (pilot) stage. Another specific advantage of this approach is that it can inform the governance and the complexities of transitioning to a multi-stakeholder shared system. As a tool to understand transition management, BM can be seen as an activity system based around four types of activities–strategic (collaborative processes), tactical (long-term visions), operational(management) and reflexive(monitoring/evaluation). Following this approach, in this paper, we study the evolution of BMs of public transport operators joining MaaS pilots in the Netherlands. We identify the differences and similarities among traditional and new BMs in public transport regime. In doing so we shed light on the co-existence and co-evolving aspects of the new MaaS service providers with traditional network operators.

This study will contribute to understanding transition and governance of MaaS from a firm perspective. It follows a case-study approach using the Dutch MaaS start-up built in close collaboration with academic research clusters, who act as incubators for niche developments of new technologies. They serve as central points of knowledge ecosystems, also in terms of value creation and eventually feeds back to the overall business ecosystem around the regime through addressing the aforementioned gaps and systematizations. This research would therefore, also extend our understanding to these synergies fostered through knowledge ecosystems.
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MaaS 101: making mobility as a service work in a city near you
Andy Taylor

As global demand for Mobility as a Service (MaaS) grows, it's becoming increasingly clear that when it comes to MaaS, one size does not fit all. Helsinki, Gothenburg, and Vienna – cities that have successfully integrated MaaS services into their transit environments, have otherwise little in common – they differ in size, population, and traffic patterns. Yet, they have become the prime examples of MaaS best-practice, while others, such as Birmingham and Brisbane experienced significant teething problems. What conditions did they meet and what obstacles have they avoided in their journey towards MaaS?

By providing a global overview of Mobility as a Service (MaaS) best-practice delivered through major partnerships between government agencies and technology companies around the globe, where MaaS solutions were properly implemented, responsibly managed and well executed, this speech will serve as a practical guide for cities contemplating the introduction of MaaS services but unsure where to start or how to prepare. It will identify common attributes of cities where MaaS solutions were introduced successfully, consider various approaches to MaaS implementation (led by both, city authorities, and third-party providers or a mix thereof), look at teething problems in cities where integration of MaaS proved to be complicated, and discuss common operational, economic, and regulatory issues related to MaaS implementation, offering

a helpful overview of prerequisites necessary for MaaS success.

While each city faces unique urban challenges, identifying common traits of effective MaaS implementations can help us better understand the conditions necessary for delivering MaaS solutions that serve the public good, asses the best scenarios for implementation taking into consideration factors including the market, specific region- or city-wide needs and goals, and varying levels of government regulation, and better prepare us for complex MaaS challenges, such as improving integration, encouraging responsible, secure data sharing, solving issues related to the ownership of the customer, and, most importantly, finding a common language in what's likely to be a difficult task of agreeing on the right economic and pricing model for MaaS.

Carpooling Business Models in Rural Switzerland: Suitable Geographical Areas and Potential Impacts on the Public Transport System
Thao Vu, Sebastian Imhof, Widar von Arx and Timo Ohnmacht

Like elsewhere, conventional public transport in rural Switzerland faces major problems of low efficiency and poor accessibility partly due to low population density. Carpooling, a kind of 'on-demand' ridesharing, appears to be an alternative mobility solution that enables more efficient transport systems for rural areas, for instance by complementing public transport. Moreover, carpooling helps reduce private car trips due to higher occupancy rates, thus decreasing emissions and fossil fuel consumption. Although carpooling is nothing new but with current mobile technologies coupled with governmental support via transport policy, we are witnessing a revitalization of carpooling with new business models.

While research on carpooling has been paid much attention to the demand side, in particularly users' behaviour, users' preferences and motivations, knowledge on the supply side is still fragmented. Against this backdrop, in this current paper we seek to identify the suitable geographical areas and their socio-spatial attributes for successful implementation of carpooling. Furthermore, we investigate impacts of different carpooling business models on the overall public transport system. The analysis will be based on a case study of nine carpooling pilot projects in rural Switzerland where carpooling operators attempt to integrate their services into existing public transport system. Most of these pilot projects involve the public and private actors. We will use geographical information data (spatial, socio-demographical, accessibility quality of public transport, and carpooling stops/frequency) with the help of GIS tools to analyse the characteristics of carpooling operating areas and benchmark them with those of successful carpooling cases.

Our paper provides managerial implications for carpooling operators and local transport authorities in better exploiting the potentials of carpooling mobility solutions with a special focus on rural areas. Furthermore, based on these findings, we will develop hypotheses on the success of carpooling business models that will be tested by using the data from the demand side in our future study.

The coming disruption — Competition from new service models and the implications for government
Anna Wilson

The transportation service offerings emerging from the private sector— such as ride-sharing, car-sharing and Mobility-as-a-Service MaaS — create both opportunities and challenges for governments in respect to public transportation.

The prospect of competition in segments of the transport market and supply chain is becoming very real. MaaS providers could be considered 'retailers' who complement and compete with public transport authorities in offering pricing and service bundles to customers. In addition, some ride sharing providers' business models are evolving to resemble small on-demand buses that could, and in some cases do, compete against timetabled, fixed route bus services.

Competition drives efficiency and innovation; however, history shows us that government decisions can easily hinder competition in markets where they have a significant role in planning, delivery and regulation. This paper draws from experiences in other network industries, which have been opened for competition, namely energy and telecoms. It draws parallels between these industries and the public transport sector and looks at how government policy and legacy governance arrangements will need to evolve to ensure competition flourishes where efficient.

So what lessons are identified?

Across the globe, introducing competition in these comparator industries required restructuring to separate out the potentially competitive segments from the non-competitive segments. It is also necessary to provide rivals with reasonable commercial access to, and the ability to integrate with, the non-competitive portions. For example, to compete with buses, ridesharing competitors will ideally be able to access dedicated bus lanes (and potentially bus stops) which are currently only for use by buses and taxis.

In a bid to "kick start" the market, there is also the risk that governments may inadvertently close off the market by signing exclusive arrangements with a single provider. There are already examples of this in Australia, particularly through standard procurement arrangements. For example, bus franchising contracts typically focus on defining the route and timetabling of the services required rather than the outcome desired which could prevent the provision of the service by on-demand providers.

Finally, the way governments support and provide public transport will also have a direct impact on the ability of different service offerings to compete. In a competitive market, subsidising one provider or mode but not another, will distort market outcomes and potentially stifle competition altogether. Hence, the government should investigate moving to more competitively neutral arrangements. Rather than subsidising uncommercial activities, consumers could be funded directly to reflect higher costs of service (i.e. disabled passengers) and/or subsidising rides taken in certain regions (rather than by specific providers). The effect of this would be that even on notionally uncommercial routes, providers can compete on their merits.

Whenever the prospect of competition emerges in a previously constrained market, existing policies and regulations come under pressure. This has already occurred in the taxi market. However, the regulatory changes that have occurred so far are likely to represent only the beginning of the market disruption.

Mode-agnostic mobility contracts: Identifying broker/aggregator models for delivering mobility as a service (MaaS)
Yale Wong, David Hensher and Corinne Mulley

Mobility as a service (MaaS) promises a bold new future where bundled public transport and shared mobility options (carsharing, ridesharing and bikesharing) will provide consumers with seamless mobility on par with and exceeding that of private vehicle ownership. Whilst there is a growing body of work examining the market and end user demand for MaaS, there remains a limited understanding of the supply-side around new business models for delivering these integrated mobility services. Mobility broker/aggregator models have been proposed, but to date there exists no quantitative evidence to empirically test the conditions around which interested businesses might invest or supply in this new entrepreneurial model. In this paper, we propose the idea of mode-agnostic mobility contracts as the interface for bringing together specialised businesses as part of the new MaaS ecosystem. We identify the relevant attributes and attribute levels defining these contracts through an extensive interview and participatory research program with key stakeholders including MaaS operators, conventional transport operators, public transport authorities and consultancies, with a focus in the Nordic countries where such schemes are presently well advanced. These mobility contracts were then incorporated as part of a stated choice survey, and we document the face-to-face pilot used to finesse the survey instrument prior to the main survey. A number of advanced mixed logit choice models (including willingness-to-pay estimates) based on collected data (n=202) is presented to showcase the potential of our stated preference survey to reveal what the market is willing to deliver in terms of MaaS and how the future service delivery ecosystem might look.

Mobility-as-a-Service (MaaS) Business Model and Role in A Smart City
Jian Xing Lee, Xian Wu and Jimmy Lee

In the current digital world, many industries are leveraging on big data to improve their businesses such as providing seamless and convenient experience, consumer centric and improving productivity etc. In the transport sector, big data can play a huge role such as Mobility-as-a-Service (MaaS), in Autonomous Vehicle deployment, Electric Vehicle deployment, Electronic Road Pricing, On-Demand Public Transportation, Asset Management, etc. This paper investigates how big data in MaaS can shed light in commuters' travel behaviour and even influence the pattern. Of particular interest, what are the roles of the different actors in this ecosystem such as from the government, operators and service providers.

The objective of urban mobility is to encourage commuting via public transport because it helps to be more environmentally friendly and reduce congestion on roads and is of particular interest for the government and operators. However, to realise this vision, more initiatives need to be created such as a comprehensive MaaS application to help commuters plan their journey seamlessly in terms of time saving, cost saving or improved comfort level. Taking Grab and Uber as examples, they have penetrated the MaaS market successfully, but commuters are expecting more such as competitive prices and shorter waiting time. Are there any examples that MaaS can integrate nicely into a commuter's daily journey under a Smart City initiative?

Road congestion is a common problem faced in every city, regardless whether in a developed or developing city. MaaS can help to influence commuters to take public transport or even shift the transport mode if it can demonstrate value add in the daily commute. Proper MaaS business model should be created suitable for that particular market, depending on the maturity of the public transport system in the city, and MaaS can be treated as one of the initiatives under the transport sector in a Smart City. In 2018, ASEAN had set up a collaborative platform which aims to synergise Smart city development efforts to develop 26 cities under the ASEAN Smart City Network (ASCN) program. This platform can pose a potential local market for MaaS opportunity, or even cross-territory opportunity which can be similar to the success story in the European market.

Finally, this paper will also discuss how from a technology viewpoint, transport disruptors such as Next Generation Electronic Road Pricing or Autonomous Vehicle can integrate with MaaS, and whether it can help to shift more towards public transport mode share.