Showcasing ITLS: Shining the spotlight on our MaaS research

Institute of Transport and Logistics Studies
University of Sydney Business School
http://sydney.edu.au/business/itls
http://sydney.edu.au/business/itls/research/showcase

18 July 2018

THE UNIVERSITY OF SYDNEY

ITLS

BRT+ CENTRE OF EXCELLENCE

WHAT IS MAAS?

Mobility as a Service is a combination of public and private transport services within a given regional environment that
provides holistic, optimal and people centred travel options, to enable end-to- end journeys paid for by the user as a single charge, and which aims to achieve key public equity objectives. (Cubic definition)

Transport Modes integrated - SkedGo

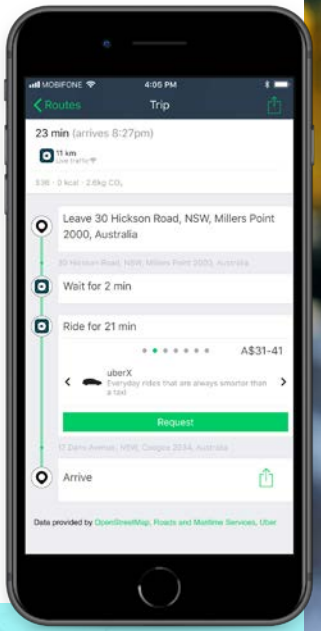
Walking	+	+	+	+
Driving	+	+	+	+
Cycling	+	+	beta	+
Public transportation	+	+	beta	-
Ride-hailing	+	+	beta	-
Car pooling	+	+	-	-
Taxis and limousines	+	-	beta	-
Shuttle services	+	-	beta	-
Pod-based car sharing	+	-	beta	-
Pod-based bike sharing	+	-	beta	-
Car rental	+	-	-	-
Demand-responsive transit	+	-	-	-
Free-floating car sharing	+	-	-	-
Free-floating bike sharing	soon	-	-	-

TripGo, Google maps, HERE maps, Open street maps

Book Uber in TripGo

TRIPGO

- All public & private transport modes
- Multi and mixed modal trip planner
- Agenda, calendar
- Personalise
- Real-time
- Booking & tickets
- POIs & events



Download on AppStore | Download on PlayStore | Launch Web App

We need to take a step back - Pre-Conditions for MaaS

THE UNIVERSITY OF SYDNEY

Some Pre-Conditions for MaaS

- What has now made the difference?
- Smart Transition (ST) is already occurring
- Digital Technology delivering better information in real time
- Enabled by
  - Digital platforms
  - Journey planners
  - Integrated ticketing
  - The internet of things
- Not essential for MaaS, but SIGNIFICANTLY value adding in a non-marginal way:
  - Driverless road-based vehicles (car and bus)
  - Sharing culture
- Crucial to separate out these pre-conditions which in many ways are likely to be far more important to managing the transport network than the appeal of MaaS (time will tell!)

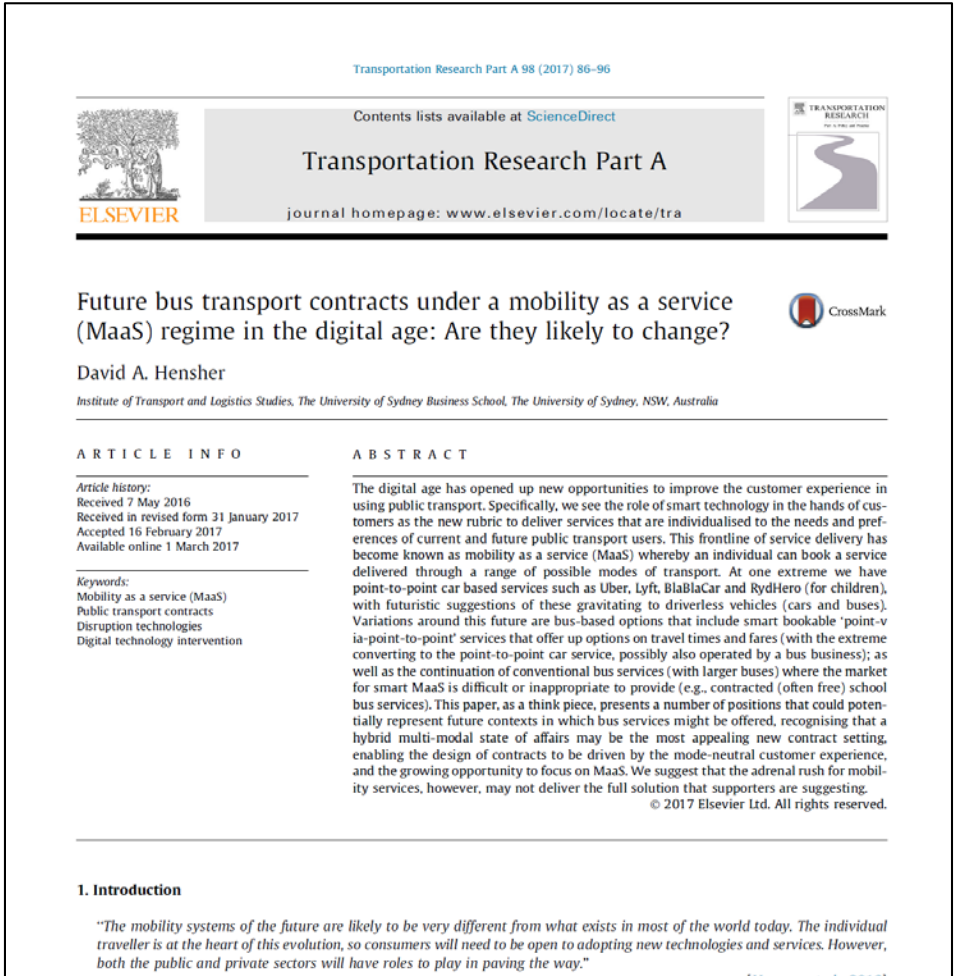
What Does MaaS (Potentially)Add?

- MaaS is not new as an idea and construct
  - Uni modal offerings existed for a long time
    - Dial a ride
    - Taxis
    - Community transport
- It must be multi-modal to recognise diversity of needs and delivery capability mindful also of societal goals
  - We expect PT to be at the centre, especially in high density settings
- It offers an integrated pricing scheme across all (or many) modes (one stop payment)
- It is very adaptable to matching the needs of actual and potential users (through flexible packaging and pricing)
- It delivers greater choice than we have at present in an almost seamless way with ease of participating
- It opens up the real possibility of a shift to the sharing economy where asset ownership (i.e., the car) is increasingly not necessary, provided in guarantees access to preferred modes when required.

Hensher (Part 1)

- Starts the narrative: transport futures in the digital era (MaaS)

- **Bundles:** mobility packages representing bundles of mobility
- **Budgets:** end user preferences and service provision possibilities
- **Brokers:** new contracting models and business interest



Transportation Research Part A 98 (2017) 86–96

Contents lists available at ScienceDirect

Transportation Research Part A

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

Future bus transport contracts under a mobility as a service (MaaS) regime in the digital age: Are they likely to change?

David A. Hensher

Institute of Transport and Logistics Studies, The University of Sydney Business School, The University of Sydney, NSW, Australia

ARTICLE INFO

Article history:
Received 7 May 2016
Received in revised form 31 January 2017
Accepted 16 February 2017
Available online 1 March 2017

Keywords:
Mobility as a service (MaaS)
Public transport contracts
Disruption technologies
Digital technology intervention

ABSTRACT

The digital age has opened up new opportunities to improve the customer experience in using public transport. Specifically, we see the role of smart technology in the hands of customers as the new rubric to deliver services that are individualised to the needs and preferences of current and future public transport users. This frontline of service delivery has become known as mobility as a service (MaaS) whereby an individual can book a service delivered through a range of possible modes of transport. At one extreme we have point-to-point car based services such as Uber, Lyft, BlaBlaCar and RydHero (for children), with futuristic suggestions of these gravitating to driverless vehicles (cars and buses). Variations around this future are bus-based options that include smart bookable 'point-via-point-to-point' services that offer up options on travel times and fares (with the extreme converting to the point-to-point car service, possibly also operated by a bus business); as well as the continuation of conventional bus services (with larger buses) where the market for smart MaaS is difficult or inappropriate to provide (e.g., contracted (often free) school bus services). This paper, as a think piece, presents a number of positions that could potentially represent future contexts in which bus services might be offered, recognising that a hybrid multi-modal state of affairs may be the most appealing new contract setting, enabling the design of contracts to be driven by the mode-neutral customer experience, and the growing opportunity to focus on MaaS. We suggest that the adrenal rush for mobility services, however, may not deliver the full solution that supporters are suggesting.

1. Introduction

"The mobility systems of the future are likely to be very different from what exists in most of the world today. The individual traveller is at the heart of this evolution, so consumers will need to be open to adopting new technologies and services. However, both the public and private sectors will have roles to play in paving the way."

ARTICLE IN PRESS

Transport Policy xxx (2017) 1–8

Contents lists available at ScienceDirect

Transport Policy

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

Tackling road congestion – What might it look like in the future under a collaborative and connected mobility model?

David A. Hensher

Institute of Transport and Logistics Studies (ITLS), The Business School, The University of Sydney, NSW 2006 Australia

ARTICLE INFO

Keywords:
Congestion
Pricing and funding reform
Intelligent mobility
Governance
Data ownership
Smart cities
Business models
Public transport futures

ABSTRACT

Traffic congestion continues to be the bane of many metropolitan areas and has exercised the minds of experts for at least the last 60 years. With the advent of smart (intelligent) mobility, aligned with digital disruption and future connected and collaborative transport including extensions to autonomous vehicles, the question of whether we have a new window of opportunity to tame congestion is now high on the list of possibilities. It is however very unclear what the future will look like in respect of congestion on the roads, especially if we rely on 'smart' technology and continue to reject reform of road user charging and new opportunities to fund the sharing model. This paper looks at a number of themes as a way of highlighting possibilities and challenges and promotes a position that congestion may not be reduced, especially without a significant switch to the sharing economy and relinquishing of private car ownership; the urgent need for government to define the institutional setting within which smart mobility can deliver reductions in congestion; and the crucial role that road pricing reform must play to ensure that those who benefit (suppliers and travellers) contribute to pay for the infrastructure (in particular) that they gain benefit from.

1. Introduction

The growing interest in smart[1] cities and the role of digital-based technology in driving new agendas for how our cities will perform in the near and far future has opened up commentary on what this might mean for curbing road traffic congestion. Will, for example, autonomous vehicles (at levels 3 and 4 in particular[2]) contribute to reducing if not eliminating or better manage traffic congestion, and when might this occur? How might a move to a sharing culture with less private car ownership affect levels of congestion even without autonomous cars? What will all this mean for future investment in infrastructure, especially major highways, and might the design of such roads change in recognition of the safety outcomes associated with computer-controlled cars that can travel in platoons? Will lanes be narrower,[3] with possibly autonomous intersection management? Under the sharing model, car-based movements might start to take on the feel of conventional bus public transport, albeit with smaller vehicles, offering improved public transport-like services that can stretch throughout suburbia under a point to point initiative, or as a first and last mile (almost seamless) connection with conventional line-haul high capacity public transport. These speculative assertions are eroding daily as we come to grips with the real possibilities of technology-enhanced mobility opportunities, driverless or otherwise. What this will mean for the changing landscape of service provision under the adage 'the customer comes first', and the implications for the governance of cities, are rapidly becoming priority agenda items.

With a focus on what this might mean for future levels of traffic congestion, this paper looks closely at a number of themes that might throw up clues as to the implications for future congestion and what conditions are likely to have to be in place to support taming traffic congestion. We have selected four themes: smart mobility, governance reform, ownership of information, and road pricing reform. In one sense the arguments presented below are speculative (although almost daily we acquire further factual evidence); but then so is the future. To recognise that the digitally disrupted future and its interface with autonomous vehicle technology may have significant downsides, once

Hensher (Part 2)

- Autonomous vehicles, MaaS and links to traffic congestion
- Role of road pricing reform in MaaS contracts/packages
  - Occupancy pricing (like PT)
- Modal mix within MaaS bundles
  - Demand Side (user preferences)
  - Supply Side (supplier side preferences)

Mulley

- Technology does not drive change, but rather only *enables* it
- Links to mobility management form a bygone era
- Challenges in changing cultural practices and attitudes

TRANSPORT REVIEWS, 2017
VOL. 37, NO. 3, 247–251
http://dx.doi.org/10.1080/01441647.2017.1280932

Routledge
Taylor & Francis Group

EDITORIAL

Mobility as a Services (MaaS) – does it have critical mass?

Cities are the powerhouses of nations. Dense concentrations of households and businesses increase accessibility and productivity, which ultimately deliver agglomeration economies. As cities grow, and globally the urban population is set to grow, cities become more spatially dispersed, and travel becomes a necessity. Left unchecked, congestion continues and this eventually dilutes the benefits of agglomeration (Graham, 2007). With urban area growth forecast to continue into the future, how can congestion be curtailed and the benefits of agglomeration maintained?

Transport contributes significant negative externalities – noise, air pollution and congestion. Contemporary transport practices increasingly compromise the well-being of existing populations. Perhaps more importantly, the way we travel today is constraining and compromising the environment of generations still to come. Climate change is largely (or entirely?) driven by human activity, and transport is hugely implicated. The transport sector in Australia, for example, accounts for 16% of Australia's greenhouse gas emissions, with light vehicles creating the lion's share at 10% (Climate Change Authority, 2014, p. 17). Australia's performance may be worse than other developed countries because of the greater share of road traffic, very low share of rail freight and the relative inefficiency of the vehicles (Climate Change Authority, 2014, p. 18). The transport sectors of other nations, however, make similar negative contributions to sustainability outcomes.

Most cities have moved from the predict-and-provide mentality, whereby the cycle of congestion is met by an expansion of the road network, which then fills up with extra traffic "excited" by any promise of reduced congestion. Providing new roads in most developed countries is now met with some cynicism, particularly when the motivation is to reduce congestion. The cycle of growth – congestion – dealing with congestion, is unlikely to be cured by road building for many cities. In time we will surely run out of space, if not resources, political imperative and cultural appreciations. Putting an end to the downward spiral of congestion diluting agglomeration requires new ways of thinking about access in cities.

A step change in technology promises much to sponsor new transport paradigms. Whilst many argue technology is driving change, this editorial argues that technology enables change. Sometimes this is rapid, and sometimes slow, but often it is dramatic when the right technologies come together at the right time. Gao, Kaas, Moh, and Wee (2016), for

Wong, Hensher & Mulley

Emerging transport technologies and the modal efficiency framework: A case for mobility as a service (MaaS)

Yale Z Wong[a*], David A Hensher[a] and Corinne Mulley[a]

[a] *Institute of Transport and Logistics Studies, The University of Sydney Business School, NSW 2006, Australia*

* Corresponding author: Institute of Transport and Logistics Studies (H73), The University of Sydney Business School, NSW 2006, Australia +61 432 919 272 yale.wong@sydney.edu.au

Keywords:
mobility as a service (MaaS); transport futures; digital disruption; modal efficiency; shared mobility; road pricing

Classification codes:
R410, R49

ABSTRACT

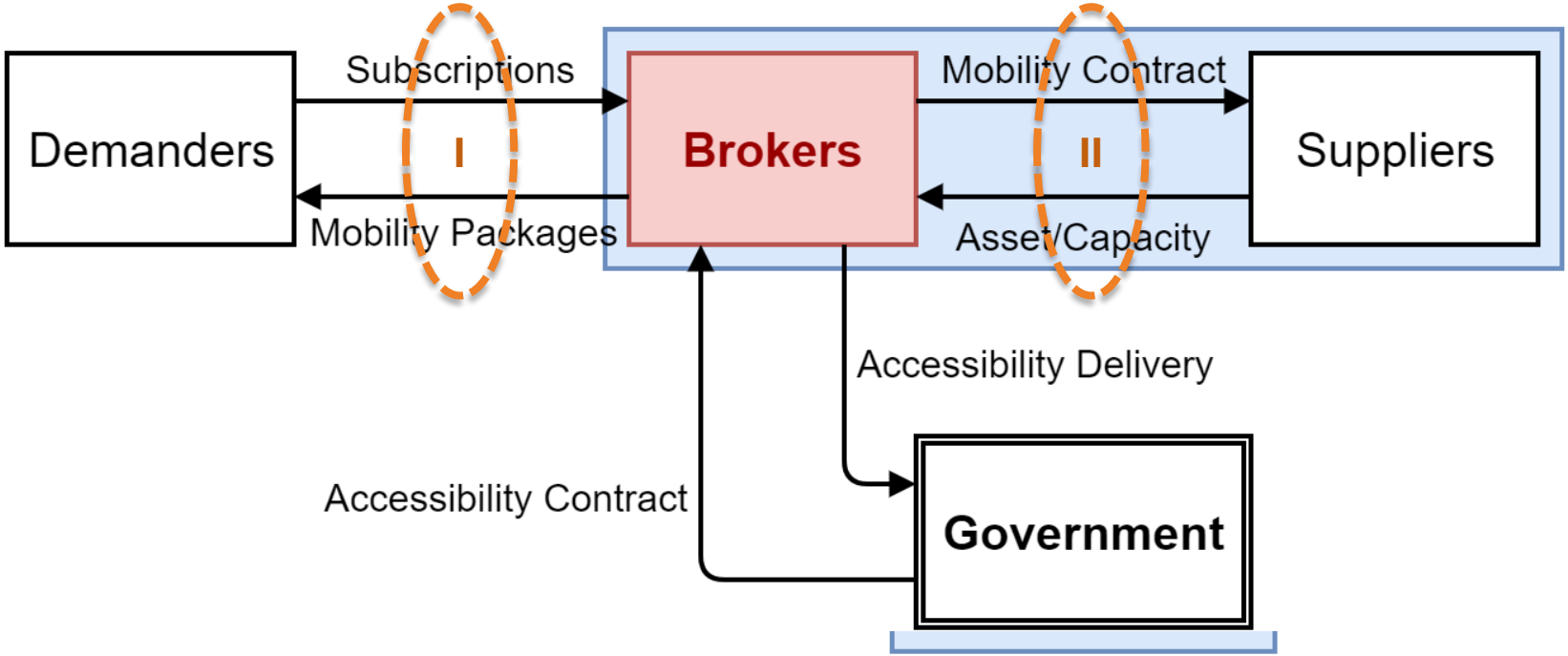
The land passenger transport sector lies on the cusp of a major transformation, guided by collaborative consumption, next generation vehicles, demographic change and digital technologies. Whilst there is widespread enthusiasm across the community for this nexus of disruptors, the wholescale implications on road capacity, traffic congestion, land use and the urban form remains unclear, and by extension, whether this emerging transport paradigm will bring a net benefit to the transport system and our communities. Some issues include the proliferation of point-to-point transportation, a continuation of universal vehicle ownership, and the demise of fixed route public transport—all envisaged by various industry leaders in technology and transportation. In this paper, we develop the *modal efficiency framework*, with axes representing spatial and temporal efficiency to illustrate why some of these developments may be geometrically incompatible with dense urban environments. We then investigate three potential scenarios likely to emerge and explain why they may be problematic with reference to this framework. Mobility as a service (MaaS) based on shared mobility and modal integration is then introduced as a sustainable alternative which accounts for the realities of spatial and temporal efficiency. Various models for implementing MaaS are evaluated including the distinction between commercially-motivated models (presently well advanced in research and development), and systems which incorporate an institutional overlay. The latter, government-led MaaS, is recommended for implementation given the opportunity for incorporating road pricing as an input into package price, defined by time of

- Collaborative consumption
- Next generation vehicles
- Demographic change
- Digital technologies

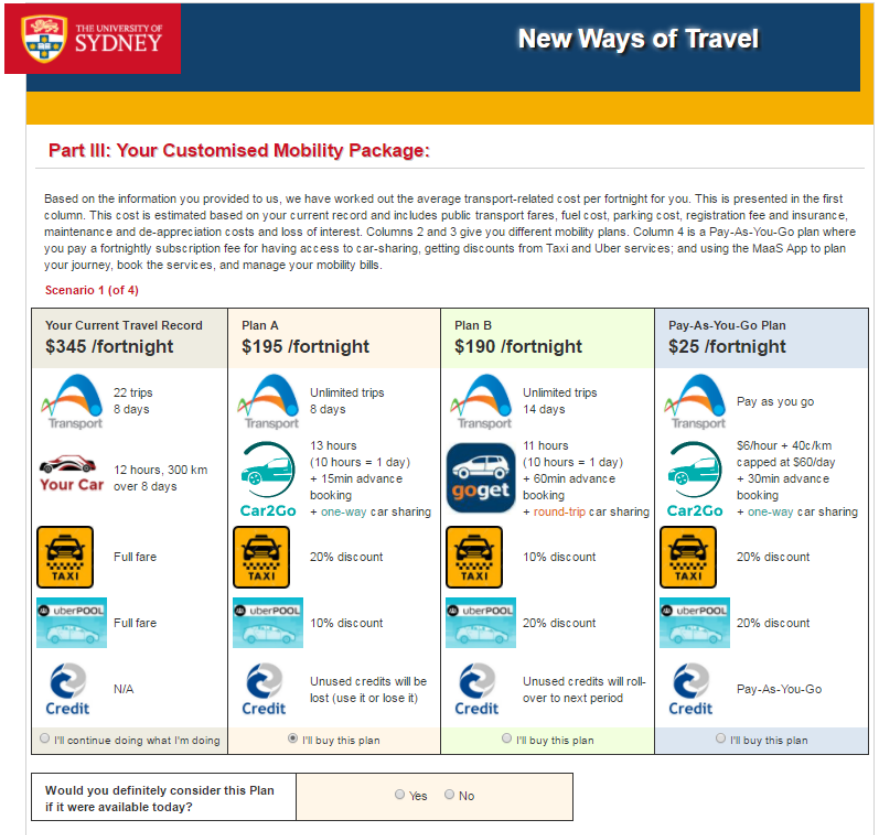
- **Modal efficiency framework**
- **Service delivery models**

Service Delivery Models

C: Mobility as a service under government contracting



Ho, Hensher, Mulley & Wong



THE UNIVERSITY OF SYDNEY

New Ways of Travel

Part III: Your Customised Mobility Package:

Based on the information you provided to us, we have worked out the average transport-related cost per fortnight for you. This is presented in the first column. This cost is estimated based on your current record and includes public transport fares, fuel cost, parking cost, registration fee and insurance, maintenance and de-appreciation costs and loss of interest. Columns 2 and 3 give you different mobility plans. Column 4 is a Pay-As-You-Go plan where you pay a fortnightly subscription fee for having access to car-sharing, getting discounts from Taxi and Uber services; and using the MaaS App to plan your journey, book the services, and manage your mobility bills.

Scenario 1 (of 4)

Your Current Travel Record **$345 /fortnight**	Plan A **$195 /fortnight**	Plan B **$190 /fortnight**	Pay-As-You-Go Plan **$25 /fortnight**
Transport: 22 trips, 8 days	Transport: Unlimited trips, 8 days	Transport: Unlimited trips, 14 days	Transport: Pay as you go
Your Car: 12 hours, 300 km over 8 days	Car2Go: 13 hours (10 hours = 1 day) + 15min advance booking + one-way car sharing	goget: 11 hours (10 hours = 1 day) + 60min advance booking + round-trip car sharing	Car2Go: $6/hour + 40c/km capped at $60/day + 30min advance booking + one-way car sharing
TAXI: Full fare	TAXI: 20% discount	TAXI: 10% discount	TAXI: 20% discount
uberPOOL: Full fare	uberPOOL: 10% discount	uberPOOL: 20% discount	uberPOOL: 20% discount
Credit: N/A	Credit: Unused credits will be lost (use it or lose it)	Credit: Unused credits will roll-over to next period	Credit: Pay-As-You-Go
○ I'll continue doing what I'm doing	◉ I'll buy this plan	○ I'll buy this plan	○ I'll buy this plan

Would you definitely consider this Plan if it were available today?	○ Yes ○ No

Prospects for switching out of conventional transport services to mobility as a service subscription plans – A stated choice study

Chinh Ho[a,b], David Hensher[b], Corinne Mulley[b] and Yale Wong[b]

[a] *Corresponding author*
[b] *Institute of Transport and Logistics Studies, The University of Sydney Business School, NSW 2006, Australia; +61 418 992 227; chinh.ho@sydney.edu.au, david.hensher@sydney.edu.au, corinne.mulley@sydney.edu.au, yale.wong@sydney.edu.au*

Classification codes:

R410, R49

Keywords

Mobility as a Service (MaaS), choice experiment, service bundles, willingness to pay, nonlinear choice model

Abstract

Mobility as a Service (MaaS), which develops plans that brings all modes of travel into a single mobility package, has received great attention from interested parties, including transport authorities, transport providers (public transport, car-sharing, bike-sharing, taxi, car rental), software developers, brokers, engineers, academics and environmental groups. Different business models have emerged in which it is planned for interested parties work together to provide integrated mobility services to MaaS subscribers, who in turn pay a subscription fee for the use of mobility services packaged into the MaaS plan. With such a smorgasbord of potential offerings, it is necessary to understand how large the market of MaaS would be if travellers are offered this one-stop access to a range of mobility services, and how much potential users might value each item included in a MaaS plan. To this end, this paper reviews the literature on the various MaaS models and synthesises their features into a choice experiment in which different mobility services are

WTP for Mobility Entitlements

MaaS component	WTP ($/fortnight)
An hour access to car-share	$6.39
A full day access to car-share (10 hours)	$63.85
One-way car-share	$7.27
Round trip car-share	$0.00
Every 15 minutes increase in advance booking time	−$1.06
A day of unlimited PT use	$5.92
10% discount to every taxi bill	$3.68
10% discount to every ride-sharing bill	$7.18

Entitlement per fortnight	Plan 1	Plan 2
Car days	2	2
Car hours	10	15
Car-sharing scheme	one way	round trip
Advance notice	60 mins	30 mins
Taxi discount	10%	20%
Ridesharing discount	10%	10%
PT days	4	6
Average WTP	$185	$231

THE UNIVERSITY OF SYDNEY

Business Opportunities in Future Mobility

Introduction

New technologies and business models are rapidly transforming the way in which passenger transport services are being provided. In a number of countries, we are seeing new types of services being offered, such as Uber, and packaging through a smart application the opportunity to access a range of transport modes. An important feature of the way in which the future will deliver transport services is identifying new business models where organisations can either invest in or run multimodal services. This survey is designed to elicit your views on how businesses may or may not participate in these future entrepreneurial opportunities.

This study is being undertaken by researchers at the University of Sydney's Institute of Transport and Logistics Studies (ITLS). The survey should take approximately 15-20 minutes to complete. Information collected is strictly confidential and the results of the survey will be reported in such a way that you *will not* be individually identifiable. You can withdraw from the study at any time by simply closing your internet browser.

If you would like further information about the survey, please consult the Participant Information Statement or contact Yale Wong. If you have any concerns or complaints about the conduct of this research study, please contact the Human Ethics Manager at the University of Sydney. Please quote the study title and protocol number (2017/1020).

By clicking on the button below to begin the survey you acknowledge that you have read this page and agree to participate in this voluntary survey.

Next

The role of autonomous taxis
in future urban transport systems worldwide

Henrik Becker[a,*], Felix Becker[a], Ryosuke Abe[b], Tim Becker, Prawira F. Belgiawan[c], Junia Compostella[c], Emilio Frazzoli[e], Lewis M. Fulton[c], Norman Garrick[f], Davi Guggisberg Bicudo[a], David A. Hensher[g], Scott Le Vine[h], Jai Malik[c], Katarzyna Marczuk[i], Reza Ashari Nasution[c], Danqi Shen[j], Alejandro Tirachini[k], David Verdis[f], Yale Wong[g], Mengmeng Zhang[a], Patrick Bösch[a], Kay W. Axhausen[a]

[a]*Institute for Transport Planning and Systems, ETH Zurich, Zurich, Switzerland*
[b]*Japan Transport Research Institute, Tokyo, Japan*
[c]*School of Business and Management, Bandung Institute of Technology, Bandung, Indonesia*
[d]*STEPS (Sustainable Transportation Energy Pathways), UC Davis, Davis, CA, United States*
[e]*Institute for Dynamic Systems and Control, ETH Zurich, Zurich, Switzerland*
[f]*Department of Civil and Environmental Engineering, University of Connecticut, Storrs, CT, United States*
[g]*The University of Sydney Business School, University of Sydney, Syndey, NSW, Australia*
[h]*Department of Geography, SUNY New Paltz, New Paltz, NY, United States*
[i]*nuTonomy Asia, Singapore*
[j]*School of Transportation and Logistics, Southwest Jiaotong University, Chengdu, China*
[k]*Transport Engineering Division, Civil Engineering Department, Universidad de Chile, Santiago, Chile*

Abstract

TODO: tbd

Keywords: autonomous vehicles, driverless vehicles, taxi, cost structures, international, competition

Wong & Hensher (et al.)

- Cost estimates for autonomous private vehicles, individual taxis, pooled taxis and line-based public transport
- Up to 80% cost reduction in US/Europe but much smaller in other countries (30% reduction in Chile, even cost increase in India)

Competition and Ownership: Thredbo 15

- **Mulley & Kronsell:** Workshop report on ‘uberisation’ of public transport and MaaS
- **Mulley, Nelson & Wright:** MaaS for the elderly and links to land use changes
- **Mulley, Hensher & Nelson:** Potential for MaaS in community transport sector

Ongoing Projects and Publications

- **Ho, Mulley & Hensher:** Demander stated choice study in Newcastle upon Tyne, UK
- **Stanley, Hensher & Wong:** New technologies, links to social inclusion and bus service subsidies
- **Merkert & Bushell:** *Macro* integration context, future smart ticketing platforms
- **Hensher and Mulley:** TR A Special Issue on MaaS and Intelligent Mobility
- **Wong, Hensher & Mulley:** Identifying mobility broker/aggregator models
- **Hensher:** Shared (Smart) Mobility, MaaS and Public Transport – A new Future! (OECD)

On-going projects - John Nelson (Joining ITLS end of2018)

- Founder Member of **MaaS Scotland,** a formal network for the MaaS eco-system, facilitating initiatives that will deliver the benefits of this transformational opportunity to Scotland
  - https://maas-scotland.com/

- **Rural MaaS studentship** (with the Highlands and Islands Transport Partnership)
  - This project is examining the requirements for delivering MaaS as part of a low carbon transport strategy in a rural setting.
- **"Cairngorm Connected"**
  - Multi-stakeholder feasibility project to support the implementation of MaaS solutions in the Inverness City Region

IMAGE THE FUTURE …

Small baby steps ?

MaaS skeptic ?

MaaS supporter ?

THE UNIVERSITY OF SYDNEY

IMAGINE THE FUTURE …

Final Comments

- We see the growth of MaaS Mobility Contracts (linked to Digital mobility apps)
- Conventional PT will be folded into the Mobility Contract
  - With possibility of a single mode initially (giving future proofing on contract)
- Multi-modal Contract Brokers will play an increasing role
- PT operators may become providers of all modes, ensuring matching of vehicle to user need
- Geographical contract boundaries will disappear (they create inefficiency and poor services)
- New mobility regulations will replace mode specific service contracts
- The autonomous car and the autonomous bus (of varying sizes) will act as essentially the same 'mobility mode' but with differing passenger capacities
- Pricing will be market driven with a community service obligation built in as appropriate for specific users (it will be a user side and not provider side subsidy)

Mode-specific operators

Non-mobility suppliers

Australian

Transport State Transit

busways

Transport Canberra

FOREST

BUSLINES GROUP

METRO

maas|aus

SKEDGO

MBB Group

Routematch

Trapeze®

BIC Bus Industry Confederation moving people

International

KMB 九巴服務 日日進步

DGM Coach Tours Taking you places...

SHENZHEN BUS 深圳巴士集团

BRIDGESTONE

BEL Since 1978 Beyond Excellence

TRANS-CONSULT

TERALYTICS

Partners in Industry and Government

busnsw
Bus & Coach Association NSW

BusVic
Proud Member of the Bus Australia Network

BIC
Bus Industry Confederation
moving people

VREF
VOLVO RESEARCH & EDUCATIONAL FOUNDATIONS

whim

SKEDGO

BRT+
CENTRE OF EXCELLENCE

THE UNIVERSITY OF SYDNEY
BUSINESS SCHOOL

NSW GOVERNMENT
Transport for NSW

Australian Government
Australian Research Council

busways

Edmonton

future transport 2056

CATAPULT
Transport Systems

METRO

ITLS MaaS Research Team

Program

2.00 Professor David Hensher – welcome and brief overview
2.20 Yale Wong, Doctoral researcher – The MaaS journey and MaaS Contracts
2.45 Corinne Mulley, Professor Emerita - Community Transport and MaaS
3.10. Dr Chinh Ho, Senior Research Fellow – The market for MaaS
3.40 Break
4.00 Professor John Nelson, Honorary Professor at ITLS (incoming Chair in PT) update on some of the UK developments
4.25 Dr Tim Cooper, co-founder and Head of Algorithms of SkedGo
4.50 Professor David Hensher close
5.00 Networking – drinks and canapes

Showcasing ITLS: Shining the spotlight on our MaaS research

Institute of Transport and Logistics Studies
University of Sydney Business School

18 July 2018

THE UNIVERSITY OF SYDNEY

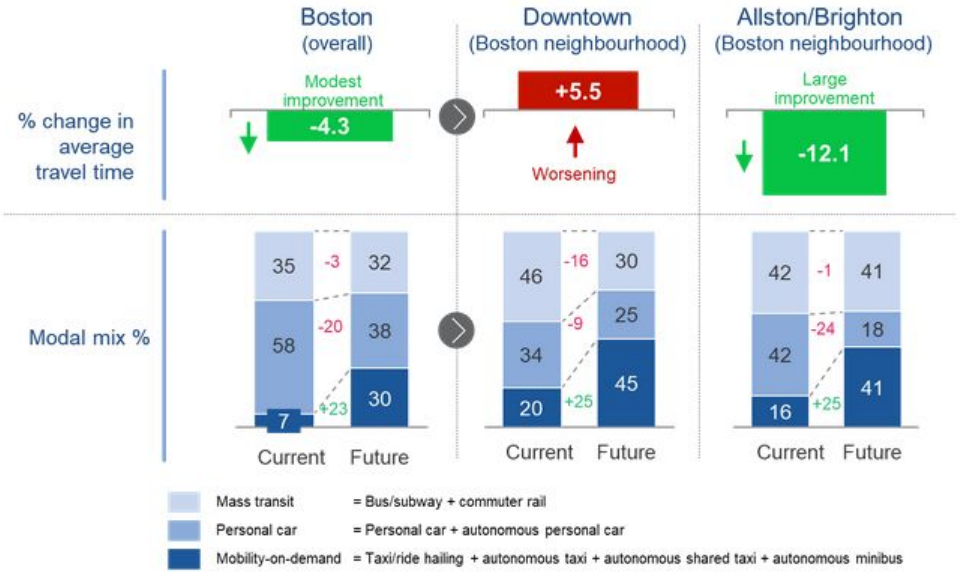
ITLS

Autonomous Cars - Congestion Busting or Myth and Implications for Conventional PT?

THE UNIVERSITY OF SYDNEY

A WARNING: City and state governments MUST intervene to encourage higher sharing of AVs and avoid a significant move away from mass transit (PT) systems, which remain essential for urban mobility and liveable cities.

"Cities need to actively explore policies and incentives, such as dynamic pricing, dedicated lanes and redesign of the kerb to ensure that autonomous vehicles will achieve the full value for society that they promise. If such choices are not made, cities risk losing more than they will gain from autonomous vehicles."
John Moavenzadeh, member of the Executive Committee of the World Economic Forum



Big Risks for Conventional PT and Traffic in presence of Autonomous Vehicles and the Boston Assessment

- Mobility-on-demand is likely to account for a significant share of all trips (at least >30%)
  - Driven by the cost-competitive nature of robo-taxis and robo-shuttles – especially on shorter trips – and the added convenience and comfort compared with mass transit.
- In suburban and other areas outside the city proper, mobility-on-demand is likely to mainly replace personal-car usage.
- In urban areas, it will most likely replace the use of both personal cars and PT, to equal degrees, with the shift creating a risk of increased congestion.
- Shared AVs are likely to reduce the number of vehicles on the streets and reduce overall travel times across the city.
  - The number of vehicles on the road will decrease by 15% while the total number of miles travelled will increase by 16%.
  - However, travel time will improve by just 4% on average – not as dramatic as other studies have forecast, but still an improvement.
- Introducing shared AVs will worsen congestion in the downtown area, mostly because these vehicles will be chosen as substitutes for short public transportation trips.
  - Travel time will increase by 5.5% in downtown Boston.
- Governments hold the key to influencing these results because they have the power to implement the right policies and incentives. The greatest effects are likely to come from **occupancy-based pricing schemes,** in which financial incentives discourage single-occupancy rides.
  - **This measure could improve citywide travel time by 15%.**