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Mobility as a Service (MaaS): A Potential Economic, Social and Environmental Game Changer

Abstract. The paper explains the origins and development of MaaS in Scotland and Europe. It explains the formation of MaaS Scotland, a network of 71 companies and public sector agencies formed to develop and deliver MaaS in urban, rural and island communities. It then reports on the results to date including linkages with other MaaS networks across Europe and North America. The paper then highlights several key issues to be addressed for any MaaS system on a regional or national scale and discusses including interoperability, connectivity, data and API sharing, regulation and legislation, governance and the role of Government, skills and funding. Lastly, it links connected and autonomous vehicles to MaaS, arguing that a MaaS ecosystem can start with the private car.

Keywords: MaaS, MaaS Scotland, CAV, interoperability, connectivity

1 Introduction - The Origins and Development of Mobility as a Service

In 2006 I led a team, commissioned by Siemens, that produced the *Megacity Challenges Report* (1). I researched the global trends driving future mobility leading to what Siemens called *Complete Mobility*. The paper explains how these trends are developing and shows that future mobility is being driven by market forces and technological advances rather than policy or strategy.

From 2012 to 2015 I was commissioned by Scottish Enterprise, the economic development agency of the Scottish Government, as their Smart Mobility Network Integrator, to produce a report on MaaS showing how the public and private sectors in Scotland could develop and apply MaaS to support economic, social and environmental objectives (2).

In 2015 I was appointed Programme Manager for MaaS Scotland. My role was to build a network of public and private companies funded through membership fees, to establish links with other MaaS networks and to develop practical demonstration trials for MaaS in urban, rural and island communities. I achieved all three, exceeding the

targets set. This led to a positioning paper for the Scottish Government (3). The paper explains how this was done and its relevance to current mobility developments.

MaaS Scotland now has 71 Members and is partnering with Transport Scotland, the National Transport Agency, to deliver MaaS trials. The Scottish Government has set up a £2m MaaS Investment Fund to aid this process. Organisations in Barcelona/Catalonia, Australia, New Zealand, Canada and Finland are in discussions with MaaS Scotland about partnering and developing a similar model in their areas.

2 The Development and Delivery of MaaS in Scotland

Global interest in Mobility as a Service (MaaS) is growing as it emerges as the dominant force in mobility development. Driven by increased demand for personalised services and key technological developments, the concept has disrupted traditional transport thinking, capturing the attention of the private and public sectors alike and introducing new players into the mobility market.

Based around a central premise of a single point of delivery supplying a customer focused, seamless and valued mobility service, MaaS represents an important tool that could allow future transportation to be shaped to ensure positive benefits for the environment, social equity and inclusivity, and facilitate community building.

The economic opportunities in this area are substantial with estimates of the global market ranging from £900 billion to \$13tr by 2020 (Transport Catapult; Frost and Sullivan and ABI). The opportunity for Scotland has been estimated at up to £480m depending on market share assumptions (Hazel, Scottish Enterprise Report 2017) but this could be an underestimate depending on how the market evolves and how MaaS is defined.

The potential economic, social and environmental benefits available have ensured that MaaS enjoys a global profile with significant interest shown by the UK Government. There is a UK Parliamentary Committee examining the potential impact of MaaS and the Department of Transport is actively developing their response, organising workshops and a Foresight project.

This high profile is further illustrated by the inclusion of the Future of Mobility as one of four 'Grand Challenges' in the recent UK Industrial Strategy White Paper. This recognises the significant impact that mobility developments could have on the future of the UK, highlighting MaaS specifically as a disruptive concept that could 'challenge our assumptions about how we travel'.

Scotland finds itself in a strong position to exploit this transformational opportunity. With traditional strengths in the three key areas needed for MaaS development and delivery - energy, informatics & data analytics and transport – and the right geographic and demographic characteristics to provide attractive test beds for MaaS products and services, Scotland is aiming to become a global lead in future mobility, benefitting directly from the opportunities that this will bring.

3 Success to date

With initial support from Scottish Enterprise, MaaS Scotland was established in March 2017 to be the driving force for MaaS activities in Scotland, establishing a formal network for the vibrant MaaS eco-system in Scotland, and facilitating initiatives that will deliver the benefits of MaaS to Scotland. MaaS Scotland is a joint venture, operated by Technology Scotland and ScotlandIS, Scotland's foremost Technology Associations. The group has made rapid progress developing considerable interest both locally and internationally. Highlights include:

- Membership growth to 71 companies and public bodies, representing the entire MaaS supply chain. The MaaS Scotland network is now the largest of its kind in Europe, and possibly globally, and it has attracted international recognition – a list of current members is given in Appendix 1.
- Links have been established with MaaS companies and networks around the world, including high profile organisations such as MaaS Global and the European MaaS Alliance, providing opportunity for international collaboration as well as opening up new market opportunities for Scottish industry.
- Integration into the existing UK wide ecosystem, including key links to Innovate UK/KTN, Transport Systems Catapult, AESIN and the Satellite Applications Catapult. MaaS Scotland was approached by two UK professional institutions seeking advice on MaaS with respect to the UK Parliamentary Committee examining this area.
- Two MaaS Scotland Conferences and a number of MaaS Project Workshops.
- Development of a MaaS Project pipeline - multiple MaaS projects across Scotland that focus on the delivery of MaaS as a solution for a diverse range of transport challenges – urban, rural and island communities linking with such things as health and tourism.
- International recognition of the thought leadership that MaaS Scotland has shown through its network and leadership in the MaaS market.
- Global interest in the MaaS Scotland Model where MaaS Scotland facilitates the development of a strong cluster of companies who can supply products and services along the MaaS value chain in partnership with the public sector. The group then helps to identify potential Phase 1 trials, working with the leadership team of these trials to develop the business case and build consortia that have products and services that could contribute to the delivery of that project. This includes the key links between private and public sector organisations.

The MaaS Scotland model, as a way of delivering a public/private based MaaS, is attracting interest across the world and MaaS Scotland has been approached by groups in Canada, Spain, Finland, Slovakia, Australia and New Zealand, all of whom are interested in developing a similar cluster based model. MaaS Scotland is supporting these activities and seeks to build relations with clusters that will facilitate international collaboration, leveraging these opportunities with Scottish based reference sites, while providing key global opportunities for our members and attracting inward investment.

MaaS Scotland has made significant progress over the past 2 years, delivering a powerful network with an international profile and laying strong foundations for future MaaS exploitation through the project pipeline. We are now building on that progress to enable Scotland to maintain a leading role in MaaS development. Failure to do so could see Scotland missing out on a significant new export market, together with the high value job creation that would result from the growth of Scottish businesses.

In an increasingly competitive global market, MaaS Scotland is supporting the Scottish Government to ensure Scotland remains an attractive base for international investors to develop MaaS products and services. In order to achieve this, it is vital that Scotland creates the correct environment for the deployment and upscaling of MaaS Solutions, including attractive regulatory and legislative frameworks for delivery. This will require Government intervention and, in this context, it is important to note that current world leading nations in MaaS, such as Finland, have enjoyed significant Government support. This is a key lesson for any country seeking to develop MaaS solutions. Examples of international Government support for MaaS are given in Appendix 2.

Securing Government engagement also allows the Government to shape the benefits of MaaS to support economic, social and environmental objectives.

By providing a mechanism to personalise and incentivise transport users, MaaS can shape mobility use in a way that brings value to users and to the community while offering viable transport options to those who do not own a car or have restricted mobility through disability. For example, we have projects building personalised MaaS systems for 16 to 25 year olds, older people who can no longer drive and people who are living with dementia. A number of projects being generated within the MaaS Scotland network also address issues regarding rural mobility, offering new, more efficient, approaches to connectivity in semi-rural and remote areas.

In addition, by improving the efficiency of current services, and driving mobility use through incentivisation, MaaS offers the opportunity to improve operational performance and impact positively on environmental targets such as decarbonisation. By working in parallel with Low Emission Zone introductions, this would have an enormous health benefit lessening the load on key health services.

Projects are underway in Scotland that will provide an evidence base for the true impact of MaaS to cities and rural areas. By engaging with these projects, and supporting subsequent projects in the project pipeline, Government has the opportunity to shape outcomes and align project impacts with Government targets and future policy. Government engagement also gives confidence to project consortia that MaaS solutions are meeting local and national demand, offering sustainability beyond the project lifetime.

In this context MaaS Scotland has identified the following areas that will require Government intervention to ensure maximum benefit for the nation, its companies and its citizens:

3.1 Interoperability

As MaaS develops so various eco-systems and platforms are emerging, each vying for their place in the market through delivery of different products and services. It is my view that the next 5 years will see a number of MaaS systems coming to the market and these will need to be integrated to provide a national system of mobility that will allow users to travel freely, without needing to join several different systems. This requires interoperability between systems, akin to the roaming architecture already in use within the mobile phone industry. The ERTICO based European MaaS Alliance has already established a working party to look at a roaming type system based on a standardisation framework. This needs to be addressed at national level, led by Government whether national/ local/state/regional and industry.

3.2 Connectivity

Digital connectivity is an essential pre-requisite of MaaS. This includes not just overall connectivity, but connectivity matched to the availability needs and expectations of business and personal users. This in turn relates to demographics and geography. In Scotland, the Government has achieved a lot in this area and has an ambitious programme to deliver digital connectivity to every part of Scotland. The recent budget announcement, committing a further £100m to the programme, underlines this ambition. However, the Scottish Government must be engaged in MaaS activities to ensure that the quality and reliability of connectivity provision allows MaaS adoption across all regions and communities island, rural and urban.

3.3 Data and API sharing

One of the key essentials for MaaS is the ability of MaaS providers to get access to the data and Application Programming Interfaces (APIs) of companies along the value chain, including transport operators and product and service suppliers. This is a major area of concern for transport operators, many seeing MaaS as a threat rather than an opportunity to grow their market. It may be possible to develop a Government regime where companies are incentivised to do this but, if not, there will have to be legislation forcing companies to open their APIs and share data. The Finnish Parliament has already introduced legislation that requires all companies and agencies operating within the Finnish mobility system to open their APIs and their data to the market. This came into force in January 2018.

3.4 Regulation and Legislation

There is general agreement across the MaaS community that the role of Government should be to enable innovation and delivery of MaaS, not to act as the MaaS aggregator or provider. A major part of this role is ensuring that regulation and legislation support MaaS delivery. However, much of the current regulation and legislation does not help MaaS and needs to change. For example, transport services need to be bundled to enable

a seamless, fit for purpose product. This is difficult under current legislation in the UK. There are examples around the world where this type of bundling, matching type of service to need, can provide better value to the user and a more effective and efficient system for Government and operators. It is also important to use the potential of MaaS to address environmental, social equity and wider economic issues. If not, there is a danger that MaaS providers will concentrate on urban, high income areas.

The Finnish Ministry of Transport and Communications has led the way by developing a new Transport Code – a simplification of regulations and legislation related to transport into one code for all modes, including data and API access as mentioned above.

4 Skills needs and opportunities

MaaS brings together energy, ICT and transport into a new, integrated and user focussed mobility market. This presents a significant opportunity to create new job opportunities across multiple sectors. However, MaaS and the associated areas of connected and autonomous vehicles, will challenge some existing jobs and skills. This means that re-skilling will be required providing new opportunities. Support from Government may be needed to ensure the necessary skills are in place within both the private and public sectors.

5 Governance

MaaS cuts across modes and disciplines. It is mode neutral and brings together energy, ICT, transport and arguably other areas into one, integrated user-focused service. This challenges policy and strategy formulation and governance structures which tend to be departmental based in the various disciplines. Fundamental questions emerge relating to the role, structure and operation of Government at all levels.

6 MaaS Investment Fund

As a first step towards a National MaaS Framework the Scottish Government has established an Advisory Group, formed of a partnership between Transport Scotland and MaaS Scotland. In addition, Transport Scotland has established a MaaS Investment Fund of up to £2m over three years, starting in 2019. The bid and evaluation framework is being developed with a view to launching the fund at the 3rd Annual MaaS Scotland Conference in June. It is likely that the bids will be based on matched funding but this has not been decided as yet.

MaaS Scotland has been facilitating the development of a MaaS Project pipeline that will seek to deliver MaaS solutions in a range of different environments - urban, rural and island communities. This includes the development of business models that are commercially viable and will help deliver the Scottish Government's targets. Scotland's first MaaS project was launched in October 2017 through the ESP Group's

NaviGoGo scheme and the Dundee MILL initiative will provide a further MaaS pilot in 2019.

Three additional projects – Cairngorm National Park/Inverness Region, Isle of Arran and Orkney Islands – are generating particular international interest as most MaaS activity to date has been concentrated on urban areas. Scotland could be at the forefront of rural and island development, bringing MaaS benefits to isolated communities and providing outcomes that will be of interest across the world. MaaS Scotland will be advising Transport Scotland on the framework for the investment fund but will not be part of the evaluation process.

7 The Integration of Connected and Autonomous Vehicles (CAV) and MaaS

One of the most interesting aspects of future mobility is combining CAV and MaaS. MaaS is usually developed from transit however it can also be developed from the private car through CAV. The key point being that CAV must include vehicle to user/customer interface to enable interaction directly with the user. Once you have that link then other products can be built around the core. I am currently advising Cubic Transportation Systems (CTS) in partnership with other global companies regarding a proposed trial using CAV to provide real time interactive traffic management on the Scottish Strategic Road Network. The proposal is to use CAV technology and incentivisation to offer drivers real time information regarding alternative routes, to travel at alternative times, to work from home, to share journeys or to switch mode to bus or rail. We are currently in discussions with Transport Scotland, our industry partners and car OEMs to develop and deliver phase 1 of the project in 2019. This is of value to both Government and the private sector as it will show how MaaS eco-systems can be developed from the private car getting you to the same point in the end. This will be of interest to areas with little or no transit service.

8 Delivering CAV/MaaS – The Key Issues

What are the key issues to be resolved to enable CAV/MaaS to deliver its potential:

- What is the commercial model?
- What is the role of government, both local/regional and national?
- Who are the aggregators and where do others fit?
- How do we build an eco-system that addresses data sharing, protects USP and IP, shares profit, works with government, etc
- How do we build a data sharing platform that protects the user and each supplier?
- Does CAV/MaaS work in rural areas?
- How do we build in social equity and environmental objectives?
- How do we bundle services together - ie traditional transit, real time transit, ride hailing, car clubs, car hire, peer2peer car share, cycle share?

9 Concluding Remarks

The MaaS community in Scotland is vibrant, with a number of high profile ‘anchor’ companies supported by a hugely powerful network of SMEs providing innovative technologies and products. Representation across the supply chain is strong, from technology providers and systems integrators to transport operators and regional transport partnerships. With a willingness from private and public sector organisations, a strong pipeline of demonstrator projects, and a unique and attractive geography to deliver MaaS, Scotland stands in a great position to exploit this transformational and lucrative opportunity.

Mobility as a Service offers huge and exciting potential to suppliers and policy planners. The paper seeks to show how it is possible to provide value to the user as a customer and as a citizen. MaaS provides:

- The customer with a valued, personal, seamless, one account mobility system.
- Government with a system that helps them balance supply and demand, generate new revenue streams and incentivise users to travel less, more sustainably and at different times and places. It helps deliver economic, social and environmental objectives through giving the customer value and incentives.
- Companies along the value chain with new opportunities to sell existing products and services and develop new ones.
- Opportunities for transit operators to grow their market and create new revenue streams.

10 Appendix 1: MaaS Scotland Membership

							
							
							
							
							
							
							
							
							

11 Appendix 2: International Government Support for MaaS

11.1 Finland

TEKES, the economic development arm of the Finnish Government, invested around €2-3m from their innovation fund to support exploitation of the emerging MaaS market. When MaaS Global was formed in 2016, TEKES invested €2.2m in partnership with two private companies to begin development of the WHIM application, one the world's first MaaS provision platforms. This triggered a further €24m investment in MaaS Global from major investors such as Transdev, Toyota and Karsan.

The Finnish Government also offered a €16,000 grant for all mobility providers to implement MaaS products and services and they have launched a new National Transport Sector Growth Programme (2018-2022) aimed at translating MaaS into deliverable products and services to secure a percentage of the global MaaS market.

11.2 Sweden

Drive Sweden is leading the development of Combined Mobility/MaaS on behalf of the Swedish Government. This is under one of the five National Innovation Partnership Programmes – Next Generation Travel and Transport Programme. Drive Sweden comprises Volvo Cars, Volvo Buses, Nobina, RISE and the Royal Swedish Institute of Technology. They have funding of 50m SEK (£4.5m) over four years.

In addition, the Swedish Government's Collaboration Group has created the KOMPIS Programme to develop a Roadmap for MaaS delivery from 2018 to 2020. KOMPIS has €2.5m central funding plus €0.3m from Western Sweden Region, €1.2m from National calls and between €1.5m to €3m from the Swedish Energy Agency.

11.3 Netherlands

In late 2017, the Dutch Government conducted a comprehensive market consultation on MaaS, focussing on their ambitions for MaaS development around a series of Regional Pilot Projects.

The Dutch Ministry of Infrastructure and Water Management, working with decentralised authorities, has developed 7 regional pilots that were put out to tender in 2018. While these pilots have specific, distinguishing objectives, they will be built on a National Framework Agreement according to uniform rules and transparent preconditions.

The pilots will be experimental in nature, identifying what MaaS solutions work best in practice and generating an evidence base for future development and policy. It will also be a requirement that pilots are setup such that a rapid national upscaling is possible.

11.4 Other Areas

Other areas to look at with respect to MaaS development are Austria (Upstream and Fluidtime), Dubai, Germany (Siemens and Bosch), Barcelona, Australia (Sydney and Brisbane), Japan, Singapore and Hong Kong.

References

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2. Smart Mobility Network Integrator Report on Mobility as a Service for Scottish Enterprise, November 2016.
3. The Future Development of MaaS in Scotland – MaaS Scotland, January 2018.