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Urban (UMaaS) and rural (RMaaS) mobility as a service (MaaS): practical insights from international practitioners and experts

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Abstract

The concept and potential of Mobility as a Service (MaaS) has been the subject of significant debate in academia and industry for nearly a decade. There are several city-based Mobility as a Service (MaaS) pilots globally. There remains a significant lack of practitioner evidence of MaaS with the focus on city-based solutions rather than in rural and suburban areas. To that end, this paper asks four research questions to contribute to the gap in Rural MaaS (RMaaS) and Urban MaaS (UMaaS); firstly, is MaaS a mobility option for rural areas given the identified evidence in scientific literature? Secondly, how do practitioner experiences with MaaS (in all areas) differ considering factors like phraseology, geography, available modes, transportation, the origin and implementation stages? Thirdly, what practical learnings can be drawn from practitioners in the field? Fourthly, what is the future of MaaS for rural and urban areas. The research and findings are based upon grey literature and twenty semi-structured interviews with representatives from research or government organisations, public bodies, MaaS technology suppliers, transport operators and experts. Each participant discussed and contributed to the practicalities around real-world applications of MaaS in urban, regional, or rural areas. The analysis produced 2 applied tools which will be useful to practitioners interested in MaaS; a Thematic Map visualising the common matters emerging from the interviews revolving around 'People, Policy, Practice and Pilots (4Ps); a Practical Framework for Implementing MaaS tool, which can be used by any practitioner at any stage of a MaaS project.

Keywords Mobility as a service (MaaS), Rural MaaS, Urban MaaS, Practical learnings, MaaS framework

1 Introduction

The history of rural transport in developed countries such as the UK focuses primarily upon transport poverty [31], 'forced car ownership' Mattioli (2017, cited in Kutler et al. [28], p. 104]), lack of infrastructure [46] and the heavy reliance on bus subsidies [4]. This is reflected by Transport Systems Catapult [54], p. 5] observation that for "people living in Britain's rural communities, transport can be defined by choice, or rather the lack of it."This view is not unique to the developed world, with the UN goal of Sustainable Development number 11 focusing upon sustainable cities and communities and the interconnectivity with rural and is strongly focused on the delivery of affordable and sustainable transport systems. This is linked closely to the opportunity to improve productivity in rural areas [27]. In addition, the International Transport Forum (ITF) [23] published a report on rural mobility highlighting the common rural characteristics throughout the OECD countries.

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The concept and potential of Mobility as a Service (MaaS) has been the subject of significant debate in academia and industry for nearly a decade. This has created two problems; firstly, confusion and inconsistency in the terminology as the term MaaS is often interchangeably used alongside 'mobility management', 'customer orientated management', 'intelligent transport solutions (ITS)' or 'Mobility on Demand' [34, 49]; secondly, the focus has been upon densely populated areas and consequently there is a gap needing expanding on the significance of rural. This paper delves into the approach of two participant groups, namely international practitioners and international experts who all have practical experience of MaaS in a rural, regional and also urban context. For the purposes of this paper, experts are from organisations not actively delivering MaaS and practitioners work or are involved in projects/pilots in various capacities.

The MaaS literature often focuses upon business models, potential impacts [1], and theoretical applications [14]. Better documented projects include UBIGO in Sweden [26], or SMILE in Austria [53] are frequently drawn upon [19]. A few evaluation tools have been developed including KOMPIS which is a framework developed as part of a Combined Mobility as a Service project in Sweden, to analyse new transport or mobility solutions taking into consideration factors involving social, environmental, and economic impacts. This evidence gap curtails the direction and future of MaaS as without documented evidence, stakeholder involvement and financial commitment will be limited.

The literature is heavy on the MaaS conceptualisation stage [10] but light on the Design, Development and Marketing (DDM) stages. The journey of MaaS has all but stagnated at the first stage with the little DDM work undertaken being predominantly in cities. The question of why it has stagnated is a pressing one.

In this context, this paper explores four main research questions; firstly, is MaaS a mobility option for rural areas given the identified evidence in scientific literature? Secondly, how do practitioner experiences with MaaS (in all areas) differ considering factors like phraseology, geography, available modes, transportation, the origin of MaaS and implementation stages? Thirdly, what practical learnings can be drawn from practitioners in the field? Fourthly, what is the future of MaaS for rural and urban areas. The paper is organised as follows: a state-of-knowledge review (Sect. 2) is followed by a description of the methodology (Sect. 3) where the qualitative research process is described. The results in Sect. 4 focus on the ten key factors presented by the twenty participants whilst the discussions are explored in Sect. 5, concluding in Sect. 6.

2 State-of-knowledge review

A summary account of the State-of-Knowledge in the subject area of rural mobility and its relationship with MaaS is presented in this section.

2.1 The problem: rural mobility

The challenges of rural mobility not only centre around comparative low-density populations and investment compared to more densely populated area, but that citizen expectations have shifted. Figure 1 is based on my experience over 20 years, and information gathered working in the field (SMARTA, MAMBA, ITF, ARTS) and during this time ITS (Intelligent Transport Solution) applications have become commonplace in cities with solutions ranging from vehicle priority, real-time information systems through to ebike hire and digital tickets/wallets. The digitalisation process has changed the way consumers access information [9], be that information for journey planning or booking and paying for transport services. Many cities are familiar with contactless ticket integration, transport planning tools such as CityMapper and widespread new mobility services such as car clubs and Uber.

The reliance on digital connectivity as the backbone to solutions and offerings, is a significant factor when aligning transport choices and offerings to consumers in rural areas. Digital literacy and reluctance to engage with digital technologies is also a relevant factor which can be more prevalent in rural areas which may characterised by an older population. It cannot be assumed the whole population is digitally competent or comfortable [37]. This globalisation and use of digital services to deliver solutions possess challenges in some rural areas. For example, in the UK spatial coverage of data services in rural areas is weak [45] (Fig. 2—green depicts 3G coverage) contributing to the so-called "digital divide" [57], a situation not shared by rural areas in Finland, for example (Fig. 3—yellow depicts 3G coverage).

2.2 Solutions: rural mobility

Between 2017 and 2022, EU projects, namely SMARTA,[1] SMARTA2[2] and MAMBA[3] have trialled solutions such as hitchhiking [52], car sharing to Demand Response Transport in rural areas across Europe. Although the themes are similar to those published in the ARTS (Action on the Integration of Rural Transport Services (ARTS [2]) handbook in the early 2000s, the factors affecting rural

[1] https://ruralsharedmobility.eu/wp-content/uploads/2019/12/Smarta-Report-on-rural-good-practices-web-version.pdf.

[2] https://ruralsharedmobility.eu.

[3] https://www.mambaproject.eu.

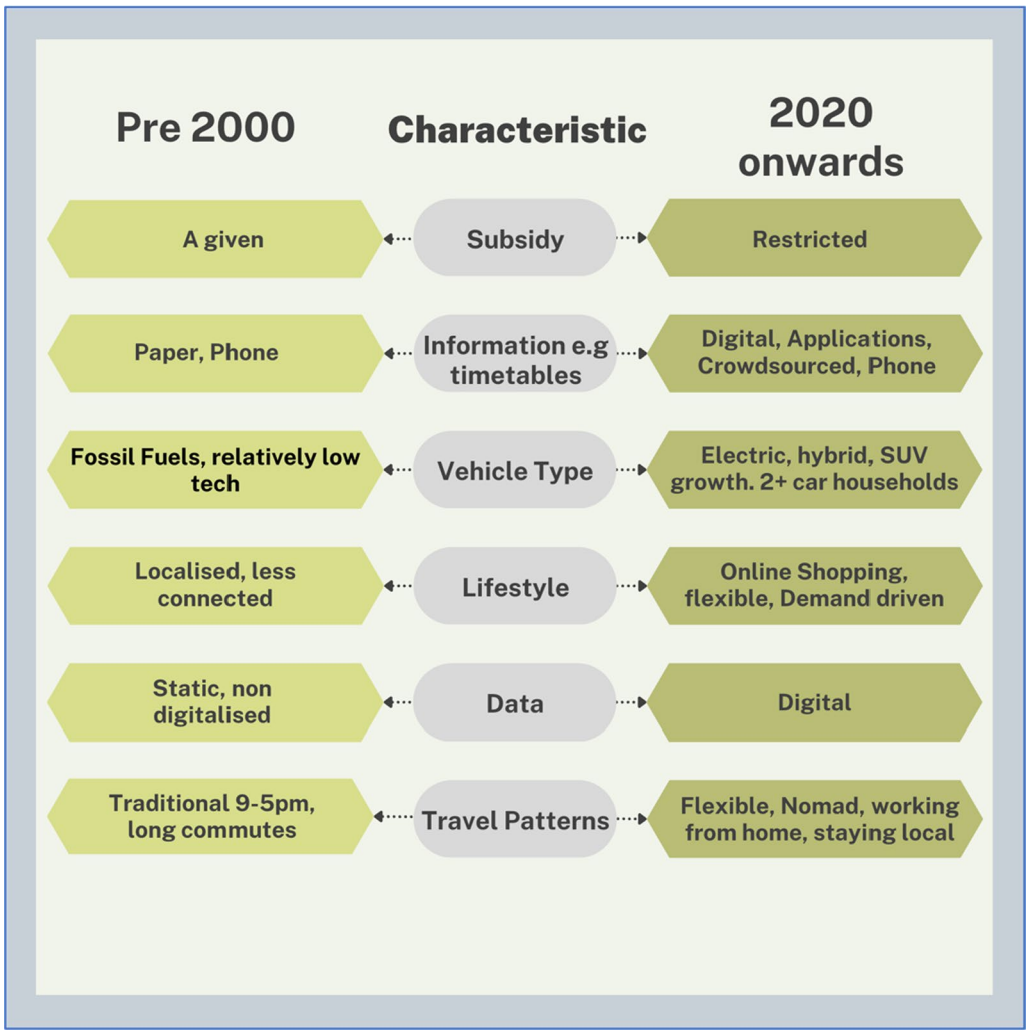

Fig. 1 Illustrative rural mobility; past and present (*Source*: Authors' Own)

transport have grown but the characteristics at the core, remain the same as Fig. 1 highlight.

In some European countries (Table 5) the school bus features heavily in rural areas. Public transport services revolve around the delivery of school bus contracts meaning fewer bus services exist for the customers during 07:00–09:30 and 14:30–16:00. This operating pattern affects the ability to generate revenue from an already weak farebox recovery. This is not a feature of transportation in city areas. Rural bus services have been in long-term decline [4] due to budgetary restraints and additionally the impacts of COVID-19 [35].

In the UK, for example, the choice of modes in rural areas has expanded in the last twenty years, but not at the same rate as its city counterpart. The role of the third sector to fill gaps cut by government has seen a growth in Community Transport and car share schemes [38] and more recently trials of ebike hire and Digital Demand Response Transport (DDRT) as captured in the ITF report on innovation in rural mobility [23] and the International Association of Public Transport [56].

As Gray [16] explains, the car is the most used form of transport in rural areas, either as a driver or passenger. Car reliance and ownership often marries transport poverty for many in rural areas [31] because of the cost of running and operating a car or indeed owning two or three. This implies that Rural Mobility as a Service (RMaaS) solutions must find a way of incorporating a role for the private car.

There are a range of mobility solutions emerging involving technology and innovation [18]. In cities, policy making, and solutions seek to deter car ownership, reduce congestion and consequently reduce emissions through offering choice in travel modes, congestion charging and

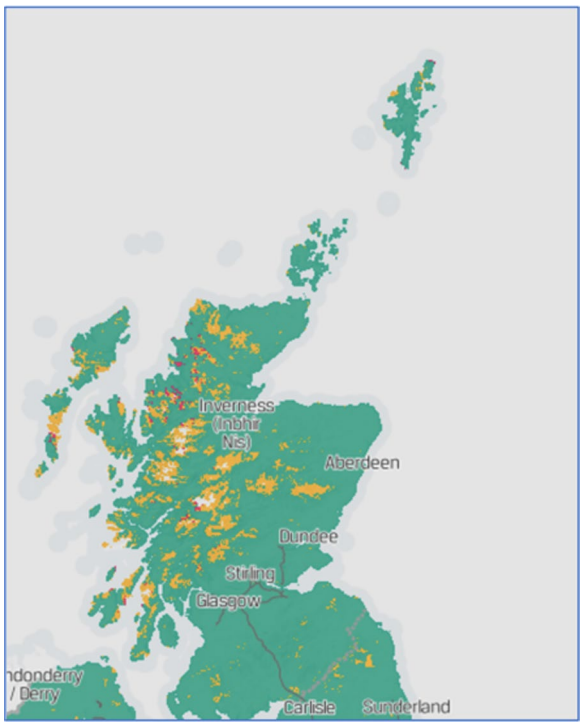

Fig. 2 Scotland spatial coverage map 2023 (*Source*: Ofcom)

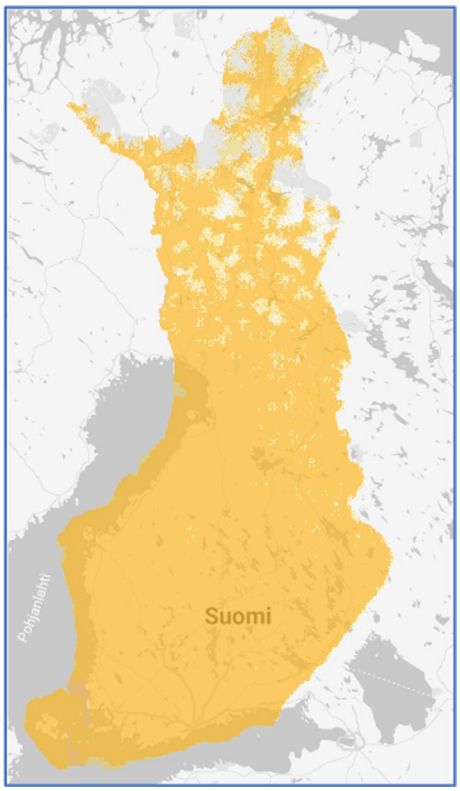

Fig. 3 Finland spatial coverage map 2022 (*Source*: https://elisa.fi/kuuluvuus/)

low emission zone [50, 51]. Urban communities provide critical mass for solutions can include hiring your car out when it is not in use, organised liftsharing and point-to-point transport services. In contrast, "innovation" in rural areas tends to focus on minor service improvements to public transport, active travel infrastructure and formalising informal networks. In the SMARTA project, for example, organised Hitchhiking was trialled in Herault, France. The concept was revamped digitally and offered a cost-effective solution at 50 cents per trip in the community with a wait time of less than 10 min. Other solutions becoming more prevalent in rural areas include mobility or community hubs such as those in the Netherlands [15] or Midlands Connect in the UK and combining goods and people with a transport service [29], similar to that of the PostBus [58] or by allowing Community Transport to offer a goods collection and delivery service which developed during COVID-19 [40]. This overview provide context for later discussion on modal availability and gaps when focusing on RMaaS.

The developments in technology have been a significant driver over the last twenty years and consequently, technology has been the founding driver of MaaS. Trials of Autonomous Vehicles [48] are also beginning to emerge in rural areas, notably in Japan and Australia, and more recently in Scotland [6]. Aviation mobility solutions are also evolving. In Scotland, the island of Iona is currently being serviced by drones for the last mile delivery of parcels [24]. All of these developments are contributing to the development of MaaS, one which seeks to offer the customer a unique, personalised multi-modal experience whilst offering added value.

International MaaS case studies are peppered across continents. Reports and any grey literature were also included in the knowledge review, some of which looked beyond the scope of this research and were not pursued for interviews. There is not scope for a full literature review and discussion in this paper, but Table 1 outlines the number of projects identified and academic papers published, using the database Science Direct on 7th March 2023. The advanced search undertaken used the key words 'mobility as a a service' and the areas in the title, abstract and keywords. Less prominent MaaS examples include Narupiti [39] exploring Thailand and presents a strong case for a 'product champion' based on research in Bangkok. In China Liu et al. [30] explore the relationship between MaaS and added value linked with consumer internet services such as accommodation or restaurant booking whilst Zang and Zang [59] use evidence from the UBIGO trial to identify success factors for China, namely collaboration of industry, the need for data sharing criteria and support in government. In Singapore [25] explore a living lab approach with the 'Jalan'

Table 1 Summary table of MaaS evidence base in selected countries

Location	Number of academic papers	Number of urban and rural MaaS projects identified	Example of relevant literature
Ithaca, America	0	1	Mengal [34]
Sweden	11	10	Smith et al. [53], Hult et al. [22]
Finland	14	12	Eckhardt et al. [11], Smith et al. [53]
The Netherlands	14	7	Hirschhorn et al. [13, 20]
Scotland	0	6	MaaS Scotland [33]
Japan	3	276	Smart Mobility Challenge 2019
New Zealand	1	2	NZTA [42], New Zealand Government [43]
Australia	0	0	Very little available at the time in 2021

MaaS application targeting commuters which involved a constant user engagement process. Chen and Chen [8] undertook an online survey in Taiwan with the users of the MenGo project in 2020 whilst Chang et al. [7] evaluated 2 projects, MenGO (Taipei UMAJI) and Taipei-Yilan, using 7 Key Performance Indicators.[4] Other urban based examples include SUPERHUB, a user centric open platform [5].

3 Methodology

3.1 Research approach and participants

This explanatory research is underpinned by the use of qualitative methods with in-depth, semi-structured interviews. Matyas [32], p. 3] states "while quantitative methods can provide insights into the relationships that emerge through the data, qualitative analysis can provide the reasons behind decisions and can include elements that the researcher may have not foreseen. Qualitative analyses are especially useful to examine new topics, as responses are not restricted by the question-and-answer frame". During the interviews, I was able to elicit access to grey literature from participants. This secondary data provided additional sources of information (Fig. 4).

Step one of the methodology (Fig. 5) involved an state-of-knowledge review of published and grey material to ascertain the evidence base (as discussed in Sect. 2).

Step two required a short-listing of international examples as the review and existing professional networks were used to identify potential MaaS projects in a range of contexts. To help with the narrowing, several mindmap were created using Coggle software (Fig. 6 as an example), to detail the key findings and observations from the knowledge review for each area included in this study.

Six factors were identified as the basis for determining whether to pursue semi-structured interviews in an area: how much experience an area had with MaaS; how extensive the knowledge and research base was on MaaS; what was the role of stakeholder engagement in the pilots; how did the area vary in procurement approaches?; what were, if any, the differences in the development and journey of MaaS; and finally, where the pilots were undertaken (regional, cities, suburban or rural). The areas which offered the best potential coverage of these factors were the Netherlands, Scotland, Sweden, Finland, Japan, New Zealand Australia, and America.

This research is part of on-going doctoral studies, and a Data Management Plan was developed alongside attaining ethical approval. Now the locations were selected, it was important that those selected for interview (step three) had lived and practical experience of MaaS, given the lack of such documented evidence. Interviewees were selected based upon five groups: Research and government funded organisations, public bodies e.g. municapalities, technology suppliers, transport operators and independent experts. These groups were chosen to provide a cross section of experience and insight. Ideally, one person from each group per area was desired, but this was not achievable for all areas as Table 2 highlights. The COVID-19 pandemic impacted with pressures on the workplace for participants, particularly on transport operators and research organisations. The participants are numbered to ensure confidentiality and experts (P18–20) aren't assigned to a particular area in the table given their wider knowledge. Finally, of the 20 interviewed, 18 were male participants and 2 were female which reflects the gender bias in transport.

3.2 The interviews (step four)

The semi-structured interviews were conducted by video and audio online via Zoom between April and September 2021. The interviews were conducted online not only due to the logistics and carbon footprint of in-person

[4] 1) Behaviour Change 2) Travel Satisfaction 3) Service Quality 4) Integration of Service Providers 5) Number of Horizontal Alliances 6) Economic Benefit and 7) Financial Benefit.

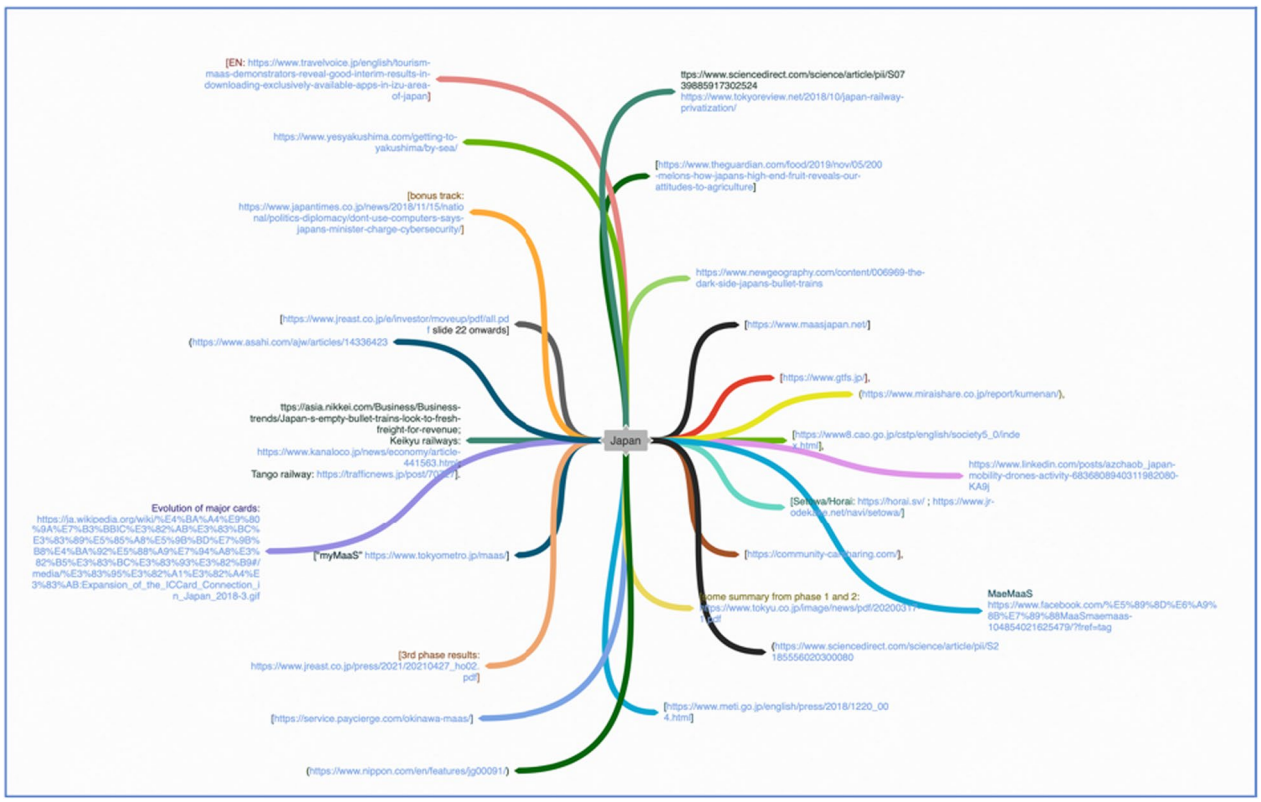

Fig. 4 Japan grey literature example

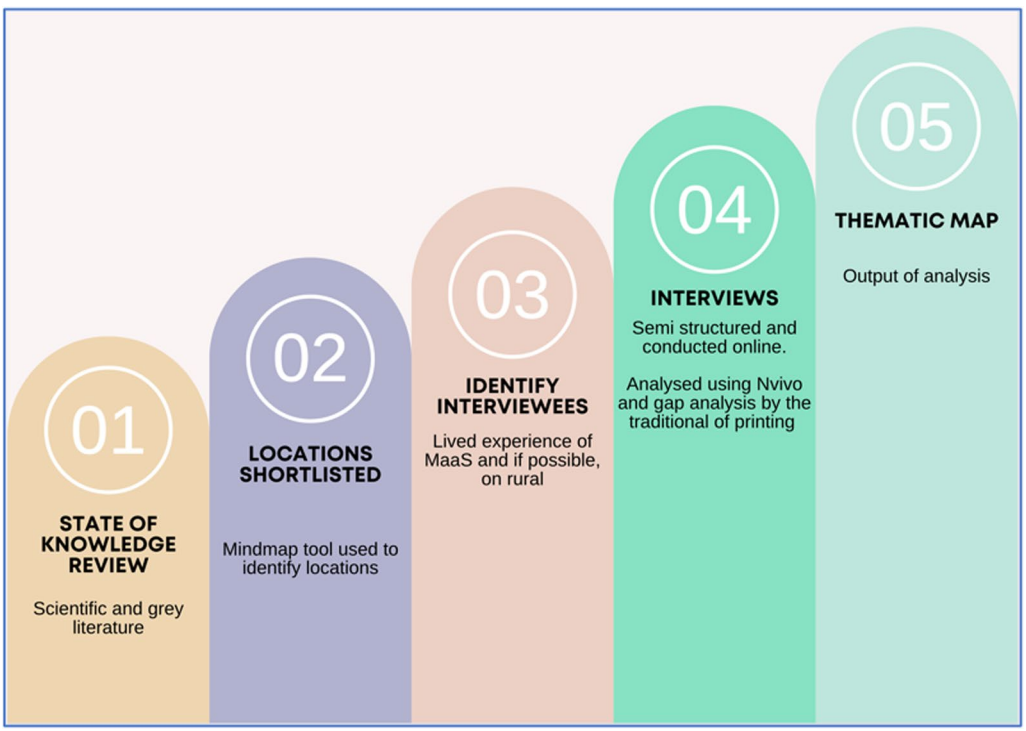

Fig. 5 Methodology process

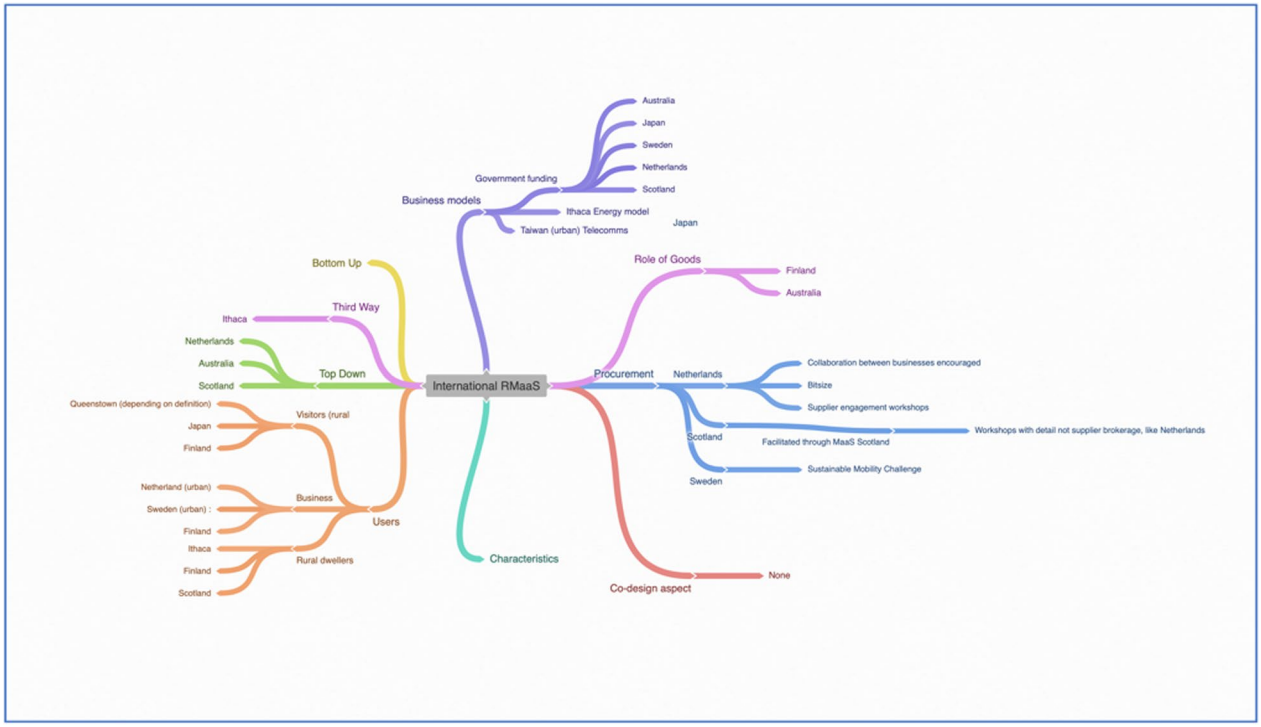

Fig. 6 Mindmap example

Table 2 Participants

Participant	Country	Research or governmental organisation	Public bodies	Technology supplier	Transport operator	Expert
P1	Scotland					✓
P2	Scotland			✓		
P3	Scotland		✓			
P4	Scotland		✓			
P5	Sweden		✓			
P6	Sweden	✓				
P7	Sweden					✓
P8	Sweden			✓		
P9	Finland	✓				
P10	Finland		✓			
P11	The Netherlands		✓			
P12	The Netherlands				✓	
P13	The Netherlands			✓		
P14	Japan			✓		
P15	New Zealand			✓		
P16	United States		✓			
P17	Victoria, Australia		✓			
P18	Not applicable					✓
P19	Not applicable					✓
P20	Not applicable					✓

Table 3 Research questions relationship to interview questions

Research question	Research question number	Interview topic area
1	Is MaaS a mobility option for rural areas?	2 and 3
2	How practitioner experiences with MaaS (in all areas) differ considering factors like phraseology, and available modes	1
3	What practical learnings and insights can be gathered	4
4	What is the future of MaaS for rural and urban areas	5

interviews but also due to the COVID-19 pandemic. Saunders et al. (2016 cited in Alyavina et al. [3]) recommends a non-random sample of between five and twenty-five for semi-structured interviews and in this instance, there were 20 participants. The sample provides perspectives from an area given the size of location/region and is thus not a direct country comparison.

The four research questions provide the basis for the semi-structured interviews as per Table 3.

The interview topic areas were as follows:

1. General area discussion including geography, demography, and the understanding of the terms 'rural, 'mobility' and 'transport'(RQ2).
2. Discussion on transport and mobility services in each area including any gaps, and the role of data, including understanding rural transport infrastructure and policy(RQ1).
3. The background and origin to MaaS/RMaaS in the area, including aspects such as stakeholder engagement, funding, and procurement(RQ1).
4. The implementation and operation of pilots (RQ3).
5. The Future of MaaS both in an urban and rural context (RQ4)

3.3 Data collection and analysis

Once the interviews were conducted and stored securely, they were transcribed using Descript software and then uploaded to NVivo, a Qualitative Data Analysis software. The transcripts were coded, identifying key themes. These themes were then cross referenced against the above five areas from the semi-structured interviews to undertake analysis. The early analysis also involved developing Word Clouds based on the most common words and Word trees, showed the frequency and connections to phrases/words identified during the first stage of analysis.

The analysis also grouped nodes by country as well as subject, for example the nodes 'stakeholder engagement' in Sweden. Given the number of locations and themes, the analysis reverted to more traditional methods. Each location's identified key phrases/words were printed on a A4, so for example, any information relating to procurement and Finland was printed on a sheet. A gap analysis was then able to be undertaken as the pieces of paper were placed on a floor, themed by location and code. This visually helped to identify gaps. An outcome of this thematic analysis was the development of a Thematic Map (Fig. 7) which depicts associated but clearly determined themes which represents related responses from all the participants.

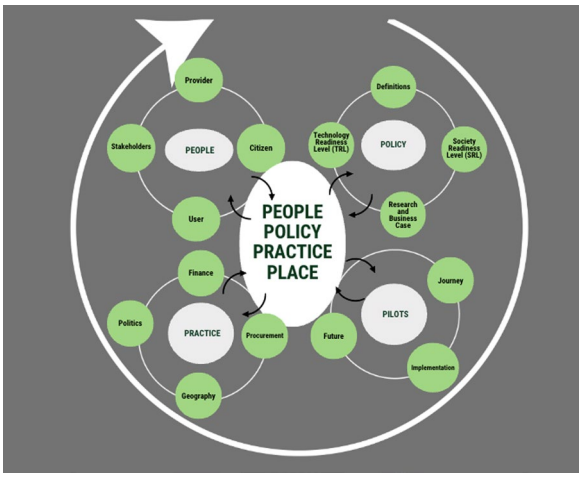

Fig. 7 Thematic map

4 Results

This section shares the findings from the interviews with initially a Thematic Map—Step Five—(Fig. 7) and then a Practical Framework for Implementing MaaS (Fig. 8). As we enter the results section, the structure constituted a framework for practical delivery.

4.1 Thematic map

The output from synthesising and analysing the interviews is a Thematic Map (Fig. 7) which helps "identify, analyse, organize and describe the themes and patterns that emerge" Nowell, et al. (2017 cited in Matyas [32], p. 3]). The maps origins lie in the question areas from the interviews (Table 4), which when analysed, four clear

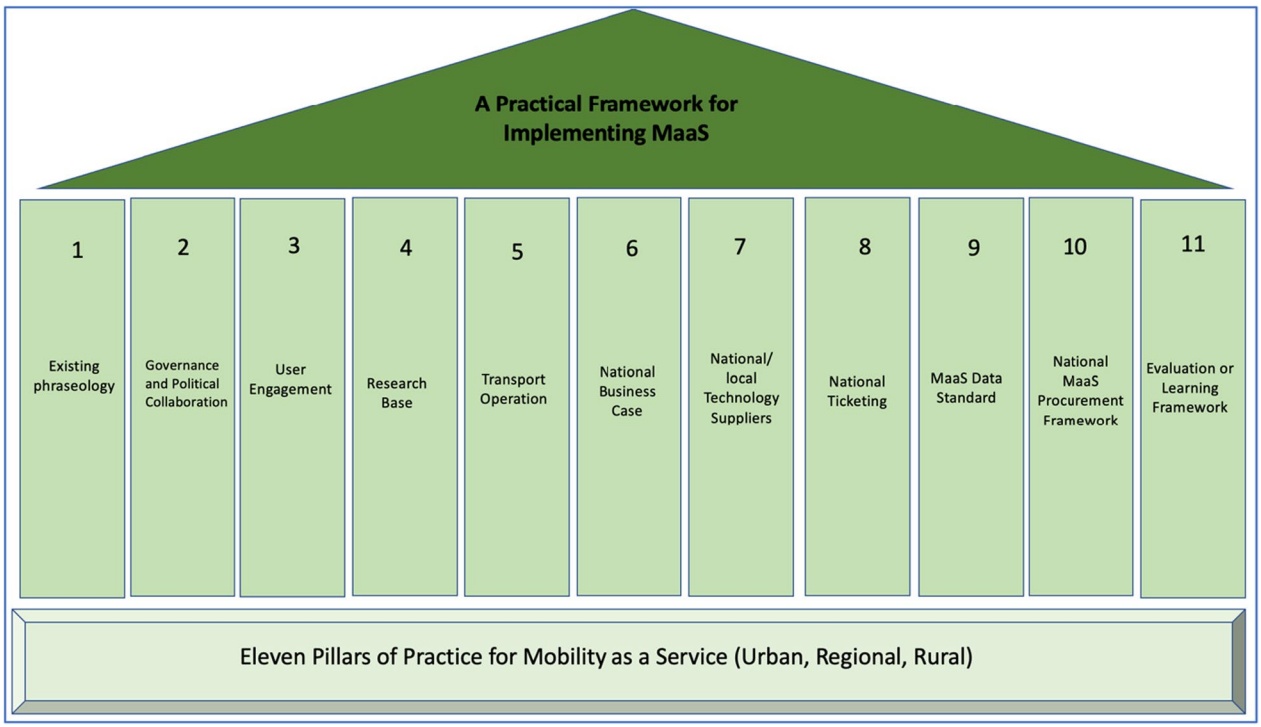

Fig. 8 Practical framework for Implementing MaaS

Table 4 Example interview questions

Theme	Example questions
People	Who (which actors) to involve, how and when?
	What does stakeholder/actor mean?
	How are citizens and or users engaged in the MaaS/RMaaS process
	What is the role of a provider?
Policy	What efforts had been undertaken to develop a research or business case for MaaS/RMaaS?
	How are terms such as 'transport''mobility' or 'rural' defined?
	What state of readiness is MaaS/RMaaS technology in your location?
Practice	What was your procurment process and journey?
	What role, if any, does politics both locally and nationally have on MaaS/RMaaS?
	How is MaaS/RMaaS financed/funded?
Place	The journey of pilots from implementation to their future success—the whole cycle (as visualled by the encompassing circular arrow)

themes emerged—People, Policy, Practice and Place (the 4Ps).

4.2 Practical framework for implementing MaaS

This framework (Fig. 8) has eleven individual but connected pillars. Each represents a key discovery from the interviews. Although each pillar is important in its own entity, they also cross-connect. In addition, the evidence from the interview analysis presented in the Thematic Map (4Ps—People, Policy, Practice and Place)—should be themes and discussion points considered for each pillar as a secondary tool. The pillars are all relevant at any stage of a pilot and do not need to be followed chronologically by a practitioner. For example, a pilot project could be in the concluding stages of operation and use the 11 Pillars as a framework for evaluation. Alternatively, during a MaaS journey, an area could use the eleven pillars to help provide a focus, or discussions points with relevant persons.

This framework is designed as a practical tool to be used by all MaaS practitioners.

4.2.1 Existing phraseology

The existing phraseology became an important finding as it shaped, or not, the MaaS journey.

Given the international spread of participants it was important not to assume definitions and how terms are understood are the same. As a direct result, all the participants were asked to define the following terms, 'rural', 'mobility', 'transport' and 'MaaS'. It is from these conversations that Pillar 1, 'existing phraseology' emerged.

The word 'rural' revealed some interesting differences. All the countries except the Netherlands had a formal definition for 'rural'. In Scotland and Australia, the definitions of 'rural' were both based upon the ability to travel by car. Australia's definition was wide with remote rural meaning over 400 km from a small regional centre whilst in Scotland it is an area where a greater than 30-min drive is required to reach a settlement with over 10,000 population. As one expert (P19) stated, "it is not a term or a concept that is really easy to grasp". Some organisations and countries "define rural as areas that are not urban beyond other areas, which are considered central. These areas are extremely diverse, so they are characterised by lower population density, more limited access to services and great distances to social and economic opportunities" (P19).

With regards to the term 'mobility' one described it as "a basic freedom. It is one of the most important freedoms that people have… strangely mobility has never been defined as a human right, yet it is one of the most important freedoms" (P18). Another highlighted "that there are different aspects as there is also social mobility, which is still very different" (P19). The term 'mobility' caused discussion as many participants hadn't consciously thought if a difference existed between 'mobility' and 'transport'. 'Mobility' was also viewed as a 'movement' or an entity that encompassed transport and activity whilst another thought 'mobility' and 'transport' are interchangeable.

Meanwhile 'transport' was viewed as a mode, public transport or vehicle that takes you from one point to another. 'Transport' was also seen as a "mechanism for one's mobility" (P18) or the "outcome of mobility" (P15) along with the transportation of goods, logistics and freight. One participant suggested that the definition of 'transport' also should acknowledge the new 'digitalisation of transport'.

One expert claimed MaaS "was confusing" (P16) whilst others viewed it as "things combined for the user, a one stop service point" (P20). Some thought MaaS was still an idea or described it as a technical solution. The word 'digital' repeatedly appeared combined with the notion of 'blending what [transport] exists' (P2). As the experts varied in their roles, it was unsurprising that the point was made "that it is different things to different people. It is not a single definition" (P8). This might indeed be one reason as to the lack of agreement in the transport and mobility sector on a definition. One expert stated that MaaS has evolved over the last ten years alongside technological, economic, and social developments, thus what we are now discussing and trying to define is the second iteration of MaaS, MaaS v0.2.

From the conversations on 'definitions', there was grounding in previously used transport terms. For example, in Sweden the term 'combined mobility' had been entrenched in policy, in Finland it was 'smart sustainable mobility' and in Ithaca in the United States 'customer-orientated management'.

4.2.2 Governance and political collaboration

Pillar Two naturally emerged as a practical challenge but also presented as an opportunity. The history associated with existing phraseology, directly impacted the collaboration aspect of pilots. For example, the Swedish Government created in 2016 a collaborative group on Next Generation Travel and Transport (NGTT) and committed to a RoadMap with 2027 [21] targets. This collaborative action generated a depth of knowledge from a wide range of stakeholders which brought a greater understanding to the idea of MaaS. However, in Sweden the collaboration does not extend to how pilots are funded. In comparison, Scotland has a membership organisation called MaaS Scotland[5] which formed due to the swell of interest by the private sector in MaaS. MaaS Scotland are a 'home' for those businesses, transport providers and operators or academia, interested in the subject. MaaS Scotland also provides a central contact point in Scotland.

MaaS Scotland [33] published a White Paper[6] to seek funding for pilots which resulted in the creation of the MaaS Investment Fund (MIF). In the Netherlands, a White Paper was also published but the lead came from the Ministry of Infrastructure and Water Management [ADD REF] rather than a membership organisation. These different approaches illustrate how the Netherlands was led by Government, whilst in Scotland the collaboration was at a tier below, in a broad-based membership, which had to break down barriers to gain government and political collaboration. Finland went a step further in 2017 with the Act of Transport Services

[5] https://maas-scotland.com/.

[6] On request through MaaS Scotland.

2017 which created a national framework for MaaS and required all transport operators to make their data available. Finally in Victoria, Australia, the focus is upon developing the MaaS narrative and understanding at government level instead of deploying pilots.

It is thus evident that political collaboration is not just a requirement at public policy level, but it is also a factor that should facilitate citizens/users' ability to interact, engage and collaborate in the process.

This 'bottom-up' approach (Pillar 3) to collaboration has not so far been the 'norm', instead it is a 'top down' approach which has been the focus. From analysing the evidence from Pillars One and Two, we can ascertain that countries could be categorised as either a 'Follower', those countries that are unaccustomed to collaborative working and lack that historical association with similar policy approaches and are thus further behind on the journey, or a 'Leader' of MaaS.

The start of the MaaS journey is not based solely on the two pillars, but they provide the foundations and insight into the potential MaaS story and journey. Given the lack of political commitment in Scotland, although MaaS is included in policies such as the National Transport Strategy 2, they would, at this stage, be classed as a 'follower' along with Victoria in Australia who are watching developments on the international stage. In contrast, Sweden, Finland, and the Netherlands, could be described, at this stage, as 'Leaders'. Sweden due to their use and legacy of existing phraseology (4.2.1); Finland due to their early political commitment (2018 Finnish Transport Service Act) and stance and finally, the Netherlands given the Ministry's' leading role and heavy commitment behind the White Paper.

4.2.3 User engagement

As will be evident, Pillar 3 has cross-cutting impact upon many Pillars because the MaaS users, also known as the citizen, organisations or indeed any stakeholder, are critical to the shape and success of a pilot. I developed a stakeholder map for RMaaS and throughout the interviews it quickly became apparent that 'people' i.e., users or the customer, were seldom part of the process. One expert, (P20) stated that the main issue is "finding the ground players [and keeping them] together to survive MaaS projects", whilst in contrast another "advocated this lean start-up approach where you really get nitty gritty with the users and understand their needs, preferences" (P6). One other expert stated that 'participatory innovation' (P5) was their aim, but that the COVID-19 pandemic affected this approach.

In Sweden KOMPIS, a group developed by NGTT, meets every three months to share information but the end-user is not included. In contrast, New Zealand's Transport Authority (NTZA) had commissioned end-user research prior to commencing a pilot, although the Netherlands did facilitate the bringing together of the public and private sector. In Ithaca, there is a history of a strong political culture of collaboration but again no formal research into end-users. MaaS Scotland hosts an annual conference and Special Interest Group meetings throughout the year, but similarly the user is not involved. The reason the user lacks involvement and that some stakeholders are missing from some projects, may relate to an observation made by one expert. "If one municipality is trying to propose something bottom up, the municipality often doesn't have the resources to involve this large network of actors that need to be brought together to organize something, that pools the different actors" (P18). One project in Sweden has identified this opportunity and has appointed a Project Consultant to undertake this role.

4.2.4 Research base

At present there is only limited published research in the countries include in this study, reported by the interviewees. In the UK there has been study of the West Midlands trial [20] along with DfT and UCL in 2015 exploring options for London [55]. To date, Scotland's knowledge and research relies on outputs from the Navigogo (2016–2017) pilot, although there are a number of pilots underway Go-Hi (2019–2023) ENABLE (2019–2023) and GoSEStran (2022–2023). In Sweden, the UBIGO trial has developed a strong research base with potential from current pilots including Linchurping and KomILand (2019–2023). In Finland, the research has focused mainly on the MaaSiFiE (2015–2017c [11]) and ALPIO (2018/2019) projects.

Given the strength of pilots in the Netherlands, there is the potential for the research base to be developed and to build upon the 'Beter Benutten' project. This covered twelve regions with pilots relating to traffic congestion and travel behaviour change,[7] providing the basis for MaaS pilots. In America, the research base is thin but again there is opportunity in Ithaca, the San Joaquin Valley [47], and Wisconsin [30] pilots to develop the base.

4.2.5 Transport operation

This Fifth Pillar, Transport Operation, is complex due to the differences between the locations so is not included in Table 3. When comparing countries, we had to consider the characteristics of each area, from geography, population, political frameworks, and the operational delivery of

[7] https://dutchmobilityinnovations.com/spaces/86/dutch-mobility-innovations/wiki/view/11711/platform-beter-benutten.

Table 5 Transport modes in rural areas

Mode in Rural Area	Sweden	Finland	Scotland	New Zealand	Japan	The Netherlands	Australia	America
School Bus*	✓	✓		✓	✓			
School Bus**		✓	✓		✓		✓	
Fixed Bus Route	✓	✓	✓	✓	✓	✓	✓	✓
Bike/Ebike			✓		✓	✓	✓	✓
Car Club	✓	✓	✓					
Car Share	✓	✓	✓	✓	✓			✓
Rail	✓		✓		✓	✓	✓	✓
Ferry		✓	✓		✓	✓		
Plane		✓	✓				✓	
Community Transport	✓		✓		✓			✓
Patient Transport		✓	✓					
Flexible Transport / DRT	✓	✓	✓	✓				✓
Peer to Peer	✓	✓						
Taxi		TAXI	TAXI					TAXI
Coach Tours	✓	✓	✓	✓				

transport services. The Nordic states, Finland and Sweden have similarities with Scotland regarding sparse populations, islands, and geography and although Japan has similar mountainous terrain and islands the population density in rural areas is much higher. In addition, Japan has natural disasters and risk of volcanic eruptions, all of which need to be considered when building and implementing transport projects. New Zealand again is similar to Scotland, with population and geography but like the UK is an island. The extreme is Australia which has the largest land mass with very sparse rural areas, while the Netherlands which is predominantly flat.

Knowing the geography of an area can help understand existing transport services and what gaps exist. Table 5 illustrates is based upon evidence provided by the interviewees on the availability of a mode in their rural locations. Scotland, Japan, and Sweden appear to offer a

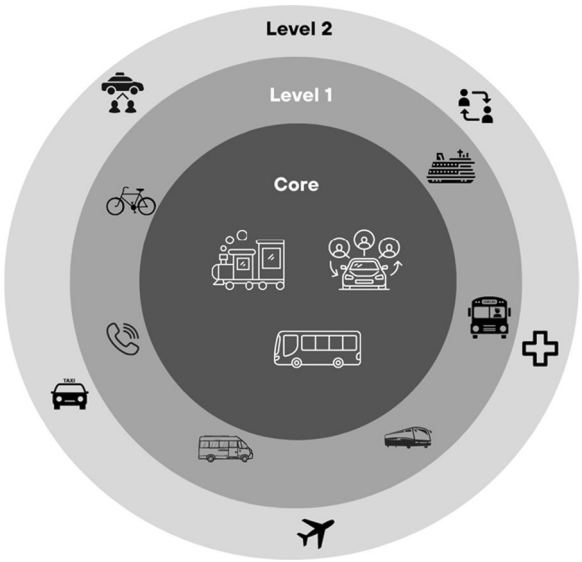

Fig. 9 Hierarchy of rural transport modes for RMaaS (*Source*: Authors' own)

larger range of solutions, but this does not always mean there is quantity or quality.

Shared mobility has evolved over the last ten years, but Sweden and the Netherlands have had challenges encouraging car clubs to rural areas and Japan simply doesn't have any. The notion of 'shared ownership' has been city-centric with the sharing of your car or bike/ebikes through formalised peer to peer. This revolution has yet to take hold in rural areas in many of the countries. As one expert stated "this obsession with shared mobility that it is not sharing, it is a false word. Mostly the sharing is renting. You're renting a bike; you're renting a car. You're not sharing it" (P18). However, peer to peer sharing does happen in rural communities, but historically this has been based on informal rather than formal arrangements.

To conclude, no matter the ownership model of the service, there are clearly a wide range of modes which can be considered for MaaS. Using Table 5 as the basis, the three core and most common modes found in rural areas across the locations included Fixed Bus Route, Rail and car share whilst bike/e-bike, buses (dedicated school bus * and combined public transport and school bus **; fixed line buses), Community Transport, coaches and bikes (including ebikes) are level 1 (Fig. 9). Thus, the importance of Pillar 5 is not only in the necessary review of current services in an area but identifying any mobility gaps which can be filled and utilised by the user (Table 6).

4.2.6 National business case

Pillar six emerged because of participants discussing the 'economic case' for MaaS/RMaaS and the steps some locations had taken to support investment into MaaS/RMaaS. Although it appeared a concern, only New Zealand and Finland had developed either a Strategic Business (SBC) Case or a National Business Case (NBC). However, Ithaca, located in Tomkins County had developed a Business Case as part of a bid for Federal Funds which was based upon robust 'customer-orientated' mobility management strategies. All other countries in this study had not taken this step to develop documentation to support investment.

At this point, New Zealand could be described as a 'leader' rather than a follower as the National Strategic Case for MaaS [41] and accompanying papers [43] outlining the role of government in mobility services published between 2017 and 2018 are detailed. The documents also led to the creation of the National Mobility Marketplace [12]. The 'Connected Journeys: MobilityOS Programme' also included an Investment Logic Map (Fig. 10) and key performance indicators as part of a wider benefit measurement approach. The work of the NZTA also considered the 'what if' question, i.e. 'what if we did nothing' (Fig. 11) scenario.

Table 6 Participant quotes on ticketing

Participant	Quote
P7	*Everyone wants to own the customer ……*
P8	*It is the money chain*
P8	*If you can't find the business case, nothing will happen …*
P14	*It is not profitable to transport people …*
P9	*Need knowledge …*
P20	*Need to be connected to all layers of complication ……*
P1	*Ticketing is just a nightmare. If I could do everything through single source on a single mobile ticket, or even at pay per ticket then I think people would be for other*

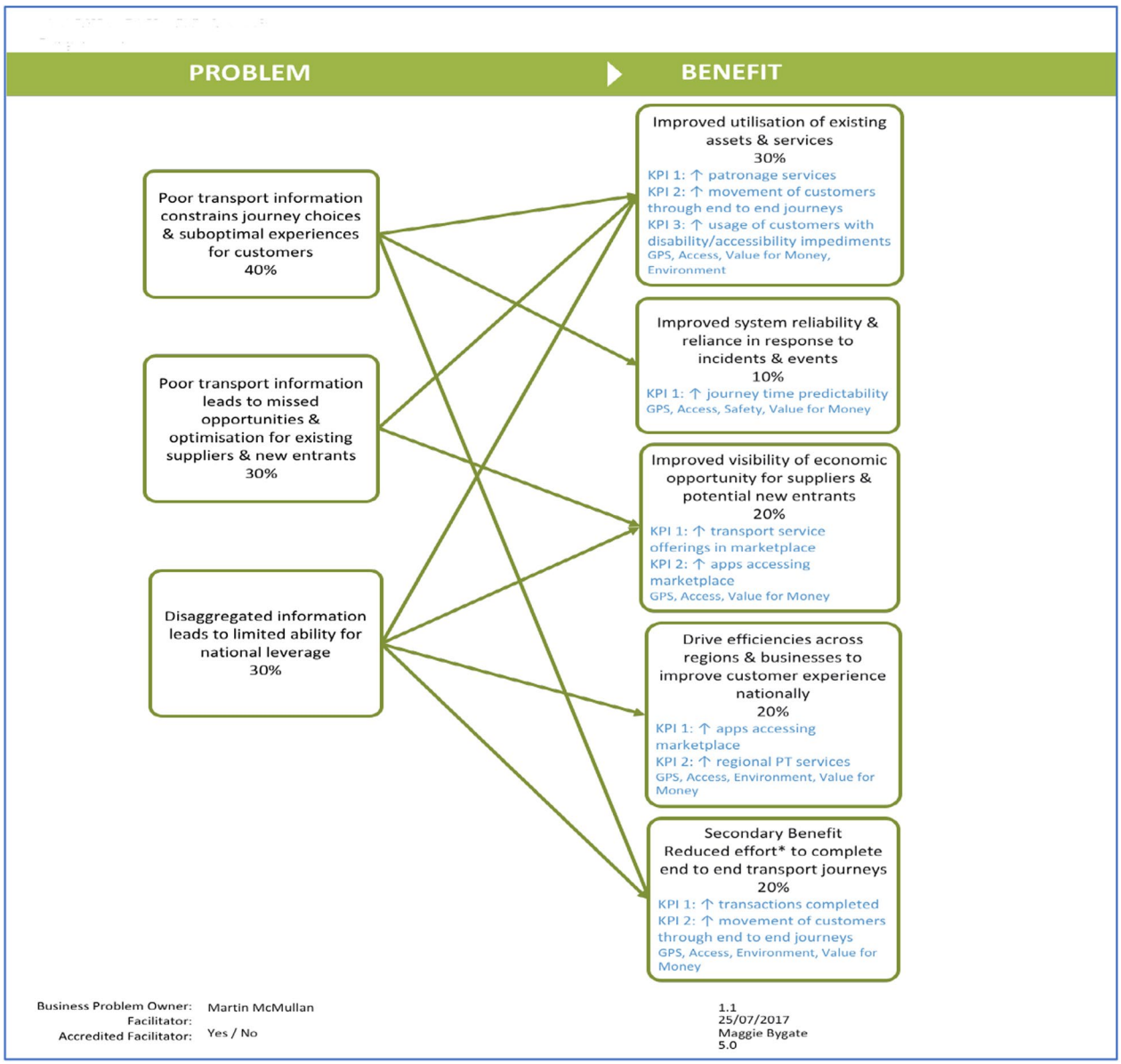

Fig. 10 NZTA investment logic map (*Source*: NZTA 2017)

4.2.7 National/local technology suppliers

This pillar was an unexpected finding but as Fig. 12a, b shows, national or local technology suppliers are an important unique feature for certain countries. Figure 12a, b showcase the wide variety of distinguished features, and as such does not read horiztontally nor vertically and if information was limited, a space if represented.

During the interviews it emerged that some countries had deliberately nurtured the development of an 'in-house' supply chain to deliver MaaS and RMaaS solutions. In Ithaca, local technology companies were commissioned to design the mobility package. In Sweden, Finland, and Japan again the majority of companies working in the MaaS pilots were 'home grown'. Suppliers in New Zealand and Scotland, in the main were from outside their countries.

It may have been a conscious decision by a area to support and nurture growth in this field, to provide employment and future skills development. It is also worth noting, that very few suppliers have yet to fully export their products to other countries.

The importance of this finding is not to be dismissed for the simple reason that when planning, designing,

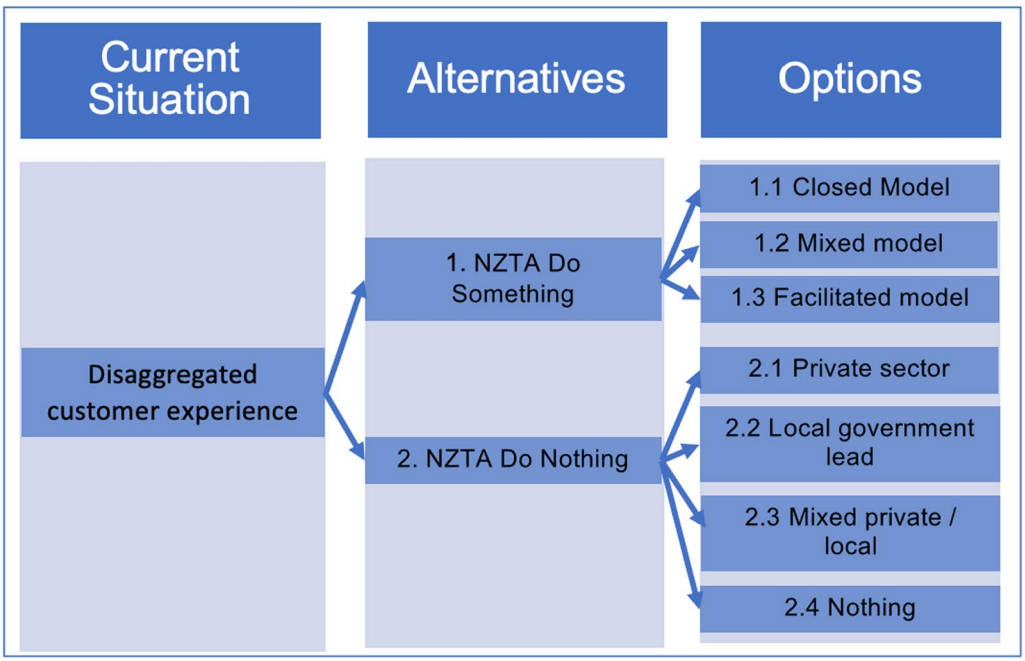

Fig. 11 NZTA 'What if' scenarios from NZTA 2018

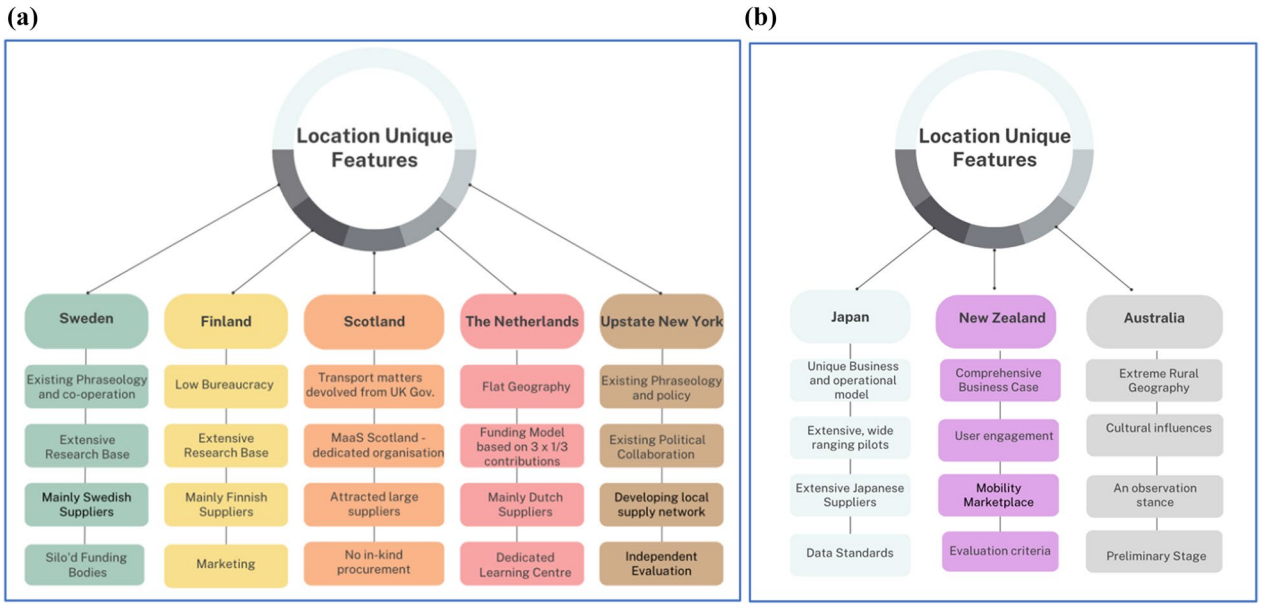

Fig. 12 **A** and **B** Conditions for delivery

or implementing a pilot, the question of where the supply chain originates needs discussed with the stakeholders, hence the inclusion as Pillar 7 in the Practical Framework.

4.2.8 National ticketing

Some of the challenges have already been outlined such as the lack of transport choice, the existing phraseology and research base and all of these shape the MaaS

Table 7 Comparative MaaS foundations

Feature	Scotland	Japan	The Netherlands	Finland	Sweden	New Zealand	Ithaca, America	Australia
Funding organisation	National Government Agency, Transport Scotland	Central and local Government	Co-financed Regions and Ministry	Research Organisations and Government	Research Organisations and Government	National Government Agency, NZTA	National Government	National Government
Budgets	2m Euro's MaaS Investment Fund	21m € Smart Mobility Challenge (1)	16m €	Unknown	1.7m €	2m €	1.6m €	Unknown
Priority areas	3 Themes, including rural	Rural, City, Regional	Rural, Regional, City	Rural, Regional, City	Rural, Regional, City	City and Town/rural	Town/rural	City and Region
Timescales	6 pilots, 2019–2023	276 Pilots 2018–2023	7 pilots 2019–2023	Pilots 2017–2024	10 pilots 2014–2023	2 pilots 2017–2018	2 pilots 2010–2023	2 pilots 2020–2023

operational model. The practitioners focused on three key challenges when implementing MaaS, including when discussing ticketing: consumer, data, and privacy. The below quotes provide a wider flavour of the practitioner concerns.

Many referred to the level of effort and co-ordination required along with the challenge to formalise agreements and assign roles. These, it was stated, are the 'challenges of a co-operation' and none more so than gaining agreement on branding or how ticketing might operate.

A few participants viewed ticketing as a complex component of MaaS. Not only do areas offer different solutions, but the challenge also remains that special offers for transport can be cheaper by directly booking with the relevant transport operator rather than through an application. One participant shared the example of package holidays where the purchaser is not aware of the prices for flights, food, hotel but they know the bundled amount.

Sweden has tried repeatedly to have a national ticketing system, instead it has developed a national standard. However, the journey for the National Ticketing Strategy (NTS) in New Zealand started back in 2009, a timeframe similar to Scotland. New Zealand currently have four public transport cards available and will be launching the NTS in 2024. Scotland has some regional smart ticketing solutions, but nothing nationally.

4.2.9 MaaS data

MaaS can appear to be mostly about data. Not dissimilar to the earlier analogy regarding UTMC's, MaaS requires at its core an aggregator to process and distribute data. Data was identified as an 'enabler' but also a barrier due to challenges around quality, accessibility, interoperability, and the cost associated with developing an API standard.

The Japanese government are on to a second version of a Data Standard and in the Netherlands the TOMP (Transport Operator MaaS Provider) API has been developed. This was never an intended action in the Netherland but became necessary as the market and suppliers hadn't developed consensus on how to align APIs. In Sweden the national Ticket Standard (BoB) has been used, but this is primarily for tickets and payments. In New Zealand, there is a framework but no standard using the Open Government Information and Data and Open Access Licensing Cabinet Directives. Several participants requested the creation of data frameworks and or standards, due to the variety of existing booking and ticketing interfaces that need to be integrated.

Participants raised questions around how data was stored and who had access to the data. Was it a third-party data monitoring company or is it a public service and the data should be kept in-house?

In one area privacy law and data protection became a technical hinderance as government bodies are not accustomed to working with consumer data. In other pilots, the organising and collecting of revenue from third parties and apportioning the distribution of monies, slowed implementation. It was regularly remarked by the interviewees from their experience, that administration and project management costs, absorbed a high proportion of funds.

4.2.10 National MaaS procurement framework

How services are funded and procured is often overlooked, but the differences discovered, highlight the diversity in funding models. In Scotland, a minimum of 30% commitment in cash was required from the private sector with no 'in-kind' allowed for pilots. Equally the funding applications were prohibited from any significant research phases and were required to be a Minimum Viable Product (MVP), equating to Technology

Ready Level (TRL) 6 or above. In comparison, Sweden and Finland have been heavily reliant on research funding which is evident in their plentiful publications. In Sweden, it was not unusual for pilots to be funded from a variety of different Government organisations and to have 70% in-kind funding and 40% from the private sector. Meanwhile, the Netherlands co-financed the pilots through the Regions and Ministry bodies. In Ithaca the project received combined funding from the state (10%), local (10%) and 80% from federal reserves. Table 7 summarises the differences in funding requirements, budgets, approach and timescales, noting that for a few countries these are an estimated budget. It was clear that in Finland and Japan that the numerous organisations involved in the delivery of pilots has meant it is difficult to accurately provide a total budget cost and thus these are estimated.

Another finding concerns the design of pilots and the procurement of services. The processes varied from a 'Marketplace' designed by the New Zealand Transport Agency (NZTA) which brought together international technology suppliers, to that of the Netherlands which hosted several workshops and openly encouraged consortiums. At the beginning forty-one organisations submitted to join the Dutch MaaS framework [36], with the final number finalised around twenty. The Ministry also requested regions to propose and design pilots, whereas the Scottish Government's Transport Scotland body prescribed the themes ('rural', 'tourism', 'accessibility' and then laterally 'urban').

In 2019 Japan opened the 'Smart Mobility Challenge (1)', which is now in its third phase with 276, past and present projects included.[8] 60% of these projects are in rural, regional, or sub-urban areas and as explained earlier one of the uniqueness in Japan is the commitment from the private sector, with a model not seen elsewhere. Finally, the duration of pilots varied with the word 'pilot' not considered in Japan since the approach is that the project is not short-lived but here to stay.

4.2.11 Evaluation or learning framework

Each person was asked a series of questions relating to the future of MaaS both in a rural and urban context, but the primary interest lay in the ability to learn from what had gone before. For all the pilots outlined, only a handful had considered the importance of evaluation throughout the process.

One participant openly stated, "you can't really measure what is MaaS (P9)" and another "how to measure impact is a tricky question" (P17). UBIGO is the most analysed pilot [22, 53]. A 'pre-measure' or baseline is required and nearly all the other countries have failed to undertake this activity. Thus, the collecting of evidence is very challenging particularly when, "no premeasure or baseline data [exists]to compare or rate success" (P8).

The KOMPIS tool provides a series of questionnaires for pre, during and after any pilot and acts as a third-party evaluation. This is critical as evaluation requires approval and authenticity. In the Netherlands a Learning Community Database is established to 'understand what is happening'. Ithaca took a similar stance with third parties commissioned to audit the programme to help maintain validity. There may be many informal lessons learnt, including this research, but the collective evidence is thin. When asking the evaluation questions behaviour change and the role of decarbonisation were often referenced. New Zealand was the only area to consider pre-evaluation work, commissioning a local organisation to survey the 'appeal' of MaaS. Over one thousand respondents replied with "58% of respondents [finding] the idea to be either Very Appealing or Quite Appealing [and] 24% indicated that the tool would likely change their travel behaviour" [42]. The evidence from global pilots on how MaaS can change behaviour is severally limited, in the main due to the lack of evaluation.

The idea that MaaS can help with policy goals relating to decarbonisation was again repeated, but again evidence was lacking. One participant even stated, 'climate has been on the back-burner' (P17) for MaaS. The role for evaluating a change in behaviour or emissions is crucial for MaaS, yet it is uncaptured at present. Ultimately as one participant argued, the "customer is tied to the regional transport authority/provider and it is these organisations that have the role to reach the goals set by Government, for example the Paris Agreement, not the customer" (P5). However, there are travellers who are conscious of their carbon footprint and will make transport choices based upon that ideal. Thus, the future requires more effort and motivation to undertake evaluation at all stages of pilots, to help progress the product development cycle.

5 Discussion

This section focuses upon three key areas 1) the customer and value proposition,2) The public sector, including 2 key Pillars (Fig. 8) Ticketing and Business Case and finally, the future of MaaS.

5.1 The customer and value

During the interviews, when the customer was mentioned, it was in the context that often the MaaS/RMaaS solutions were not customer or person focused. The customer is likely part of a household and solutions have

[8] https://www.linkedin.com/feed/update/urn:lia:activity:7005497060686798848/.

been tailored towards certain segments in society, for example tourists, young people or those with disabilities or living in a particular area. There was a consensus that the household as a customer was ignored. Many participants acknowledged that the model is driven by the desire to commercialise the concept rather than customer focused, and therein lies a contradiction to the many MaaS definitions that discuss MaaS as a 'personalisation' of services. Without customers there is no opportunity to commercialise the concept and take revenue.

So where does value lie? In America insurance companies are offering grants to integrate health care transport into the tailored offering whilst in Ithaca 'value' is attached to roles such as volunteer driving. The mobility package here recognises that 'value' is not only for a customer but for those providing a service. Those who volunteer drive or offer car share qualify for a discount on transport services contained in the package. Ithaca also acknowledges that the value of disruption or the uncertainty in reliable services can be a deterrent to customers. Consequently, a guaranteed ride features in the mobility package. This guarantees a mode of transport home if for example the bus is late, and a connection is missed. This will be a critical component for RMaaS where transport services are sparse coupled with customer uncertainty and anxiety over transport modes as supported by (P3) who stated [it is a] *"Great model but it doesn't relate to on the ground, daily changes need to plan and be reliable….."*

One finding shown in Table 5, is the lack of school bus for the Netherlands and Ithaca. In Scotland, the school bus (school bus **) is integrated with the fixed bus service. Although this maximises the vehicle use (and potential value), as highlighted earlier, this does limit peak use by the public. At present Sweden operates a separate school bus (school bus*) and fixed route service but is currently investigating the possibility of merging the two. In the Netherlands, pupils are expected to walk or cycle to school but if the weather is not desirable, the fixed route bus service still makes it possible for pupils to travel to school.

Rail is a difficult mode in rural areas as lines exist, but they don't always interconnect to service communities in the same way as DRT or taxis. In Japan, the railway network is extensive in rural areas and is a core part to any mobility package. The inclusion of ferries and planes is clear for those with island geography or long-distance travel such as Sweden, Scotland, Finland, and Japan. In Finland, air mobility is vital for connecting areas such as Lapland, to healthcare or for transporting supplies or blood tests. Here there is also a culture to own a summer home and "these are often in places where you simply cannot get by a bus" (P10) so planes are a link, when the car is not possible due to the distances involved. In Australia, planes provide a quicker way to travel and deliver due to the expanse of the country. "I remember going to some communities in 2015, which were about 800kms away from Alice Springs, in the desert and some of the parents were sending their children to Perth, over 2500 km away, by plane" (P17).

Understanding the transport modes available for inclusion in a MaaS offering must be a key feature as the modes are not the backbone. RMaaS is therefore different to other areas, due to the diverse range of modes, for example ferries and planes are not considered in city offerings, nor are the roles of Community and or Patient Transport. The list of modes in rural and regional areas differs from that of cities. In addition, to operate RMaaS, the mobility gaps or scarce services, need to be identified, particularly as the modes form part of Goulding and Kamargianni [17], five characteristics of a MaaS Maturity Index. Examples of mobility gaps being filled in rural areas include the use of taxis in Ithaca for health care or the transportation of goods or the deployment of e-bikes, DRT, or car clubs in Scotland.

Herein lies another value of the concept of RMaaS; even though a technology solution may not have been deployed, steps are being taken to fill mobiity gaps. These developments can be described as step one of a RMaaS project but also of avalue chain. The examples from Ithaca, gaurenteed ride and valuing volunteers, could be described as the 'untapped potential' of a RMaaS model and could therefore feature in MaaS/RMaaS v0.2. There should be focus upon social value rather than just economic value.

5.2 Public sector, including ticketing and business case

The role of the public and private sector in the delivery of transport in the countries, was highly complex. In the majority of locations, transport services were in the main nationalised, thus making it easier, relatively, for government to facilitate collaboration and harness a partnership ethos. However, in Scotland, there exists a combination of private sector involvement with modes such as the bus as well as community responsibility for car share or bike schemes. In Japan, the operation model was again different. The businesses operating the railways also own property or indeed commercial businesses such as a restaurant. This operational model allows for profit and loss to be split over the portfolio whilst also the opportunity to embrace other markets, such as hospitality, into a MaaS offering. It is not uncommon in parts of Asia for regular traveller benefits to be tied to a grocery store or coffee shop to provide 'value'.

The basis for operating any company requires preparation, planning and consideration which usually takes the form of a strategic or business case. As outlined earlier,

Table 8 Participant quotes on the future of MaaS/RMaaS

Participant	Quote
P6	*My phone will say, you've got a meeting across town now in three seconds your transportation will be at your door*
P8	*With a new house you are given 3 months free mobility…*
P11	*Incentives introduced will focus on sustainability not economic growth*
P12	*Meeting rooms will be built into the app*
P13	*Lots of competition in city areas but less in rural…*
P15	*MaaS will be built into social media and transaction rates will be lower*
P17	*Drones will be used and incorporated…*

Ithaca has developed robust 'customer-orientated' mobility management strategies, but the depth and width of the scope does not match the gold standard of New Zealand which is recommended reading. New Zealand was at that time a 'Leader' in the field, but since, due to external challenges, the programme became dormant and other locations progressed resulting in our revised classification of New Zealand as a 'Follower'.

When considering any business case, ticketing and booking facilitates are part of the criteria. Aapoja et al. [1] agrees that there are only a small handful of locations operating integrated ticketing, most notably for the last decade in Japan. Here the ticketing packages have unlocked the demand and in turn offer value by providing additional collaborations. This is mainly due to the the Japanese business model, previously mentioned, that makes it easier for transport operators to collaborate with the hospitality sector or indeed grocery stores.

5.3 The future of MaaS

So, what does the future look like for MaaS and RMaaS by the participants? Given the interviews were undertaken during 2021, during the time of the COVID-19 pandemic, the answers were influenced by developments and pilots that occurred during that time. For instance, Demand Responsive Transport (DRT) pivoted away from transporting people and instead delivered prescriptions and food. One participant sighted this as a 'good' development for MaaS (P2) whilst another said, 'if you asked me this question, [what does the future for MaaS/RMaaS hold] …before the pandemic, I would have given you probably, a different answer' (P6).

In the final part of the interview, participants were asked to consider the next 5–10 years for MaaS in rural and urban areas. The quotations (Table 8) provide a flavour of the future which could also be interpreted as opportunities or potential value for MaaS.

There was agreement that there will be more digitalisation but at the same time "we don't know what we want yet" (P6). It was hoped that school transport will be integrated but that it was acknowledged that we "don't need MaaS for every purpose (P9)".

When asked about the future role of transporting goods, not just people, this was expected to be a rural rather than a city solution as there is a 'more stable flow of goods and deliveries in rural areas'(P18). In Australia the low-tech Bush Bus already covers an extensive area for passenger transport, whilst offering people the opportunity to transport equipment, medication or indeed move location. In Japan there are 'vegetable buses' which are trains transporting goods from rural areas into the cities. There are also cargo ferries for people and goods to be transported to islands.

6 Summary and conclusion

This paper has presented evidence from twenty practitioners involved in MaaS from eight different international locations. Not only has this research contributed to the existing knowledge gap on the practicalities of MaaS and RMaaS pilots such as the challenges, opportunities, or evaluation aspect but it has asked and answered four research questions which were previously identified research gaps.

The first question asked if MaaS is a mobility option for rural areas given the identified evidence in scientific literature? The evidence suggests that RMaaS is being actively pursued and there are examples to support this statement but that, similar to urban pilots, financial commitment is required. Secondly, how do practitioner experiences with MaaS (in all areas) differ considering factors like phraseology, geography, available modes, transportation, the origin and implementation stages? Table 5 (modes) and Fig. 12a, b (characteristics) highlight just some of the differences between the locations including the amount invested, the various procurement approaches and the difference in the role of the national government. Thirdly, what practical learnings can be drawn from practitioners in the field? This was possibly the most interesting as it became evident that 'no one size fits all' and although there are different governance structures and policy

perspectives there were similar challenges. Furthermore, practitioners admitted that evaluation was lacking at all stages of pilots and that despite the desire to gather more evidence, pilots encountered various challenges to evaluation. This ranged from the procurement process lacking the requirement or indeed the ability to access knowledge on how and what to evaluate. The evidence and participants both agree that UMaaS can't be implemented in the same manner in rural areas and that a different approach is required. The emphasis was not upon low-density and distribution of customers but on travel purposes (and distance), the geography of an area and the choice of modes.

Through the evidence gathered from the participants' I was able to design and develop the 11 pillar Practical Framework Tool. This tool, along with the Thematic Map are designed to be used by MaaS/RMaaS practitioners to help guide them through the journey, no matter the starting point. As identified in the introduction, research has focused upon the conceptulisation stage rather than embracing Design, Development and Marketing, but the evidence presented provides practical learnings to assist practioners with DDM. As for the future of MaaS for rural and urban areas, question 4, although there are common areas for progressing, eg. Improvement in not only user involvement in the full cycle of a pilot but also evaluation; a Collaboration mindset is required by all actors and stakeholders; the role MaaS can play in decarbonising rural and urban areas needs serious consideration and absorption into all levels from policy, evaluation through to user requirements. These areas also provide part of the solution to unlocking the stagnation and opening up learnings and opportunities to progress past mere conceptulisation. That said, the future for both areas looks different as the characteristics of rural and urban areas vary due to factors such as population density, demography, geography, industry, and workplaces through to policy and financing. These attributes bring different strengths and weakness to each area and in turn require different approaches. However, as observed by Nylund and Belloni [44] "the transport sector is demonstrating a transition from a 'hardware-centred' approach (vehicles, roads, general infrastructure, etc.) to a user need-driven 'mobility as a service' approach". This transition is the common attribute to any geographical area, how this is interpreted "on the ground" remains the difference as an urban solution won't and doesn't work in a rural area.

6.1 Limitations

There were two main limitations to this research. Firstly, the sample size from each location could have been higher to allow a stronger comparison, however during the COVID-19 pandemic it was extremely challenging to recruit. Secondly, the scientific literature is lacking in the field of Rural MaaS and thus reliance on grey literature and secondary literature provided by participants was relied upon.

6.2 Future work

As the world emerges from a global pandemic, it would relevant to revisit these locations to see what mobility gaps have been filled and how travel patterns have changed. Furthermore, it is expected that some of the pilots will have completed and maybe even terminated. In turn what lessons can be learnt from the last two years.

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Author contributions
JM, JN, CC contributed to data collection. JM wrote the draft of the paper with MB. JN, PG, and SW all contributed to the paper. All authors read and approved the final manuscript.

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The authors declare that they have no competing interests.

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