Creation of a MaaS Readiness Index with local features

Domokos Esztergár-Kiss*[1], Attila Aba[2]

[1] senior research fellow, Budapest University of Technology and Economics, Hungary

[2] research fellow, Budapest University of Technology and Economics, Hungary

SHORT SUMMARY

In this research smart mobility solutions are examined in the perspective of a Mobility-as-a-Service (MaaS) scheme. The main foundation behind the elaborated MaaS Readiness Indexes (MRI) is that there are specific features on which a MaaS framework could be based. It serves as a local index focusing on the mobility opportunities, the stakeholders, and the environment. The features included in the index can be divided into three areas: technical features, coopetition features, and added value features. To have comparable datasets, local partner and mobility service provider surveys are created. The MRI values are calculated for every pilot region and related to the outcomes of the pilot activities. As a result, the performance of the pilot activities is quantified. In most cases, the pilots support extensively the development of smart mobility solutions as justified by the positive change of the index values.

Keywords: framework, features, indicators, MaaS Readiness Index, Mobility as a Service, smart mobility

1. INTRODUCTION

The MaaS scheme provides a framework for a one-stop-shop mobility service with various transport mode alternatives providing routing, booking, payment, and ticketing in one application based on Hietanen (2014). MaaS can be considered as an ultimate, seamless mobility solution, where in an ideal case, all mobility services can be accessed through one application. This application is run by a MaaS operator, who has a central role in the MaaS ecosystem based on Kamargianni and Matyas (2017). The MaaS operator has many unique selling propositions (e.g., multimodal journey planner, advanced ticketing platform), but it depends on the technological level and availability of the service providers as defined by Esztergár-Kiss et al. (2020). In addition, the required technological advancements of the service providers are usually realized independently from the MaaS schemes since the digitalization of the operations and sales processes has many benefits for the service providers. Therefore, the examination of the readiness regarding the MaaS schemes is useful to have with an overview on the current circumstances, the future opportunities, and the potential risks a MaaS operator may face when developing new mobility services. Moreover, such assessment can effectively describe the status of the available smart mobility solutions.

Research and development projects aim to test and introduce smart mobility solutions for travellers. The question arises to what extent these pilots contribute to achieving these strategic goals. In this research, we developed and tested a unified data collection method and indicator system to evaluate pilots and to enable the opportunity of comparing results of other pilots.

Only a few studies developed indexes in connection with MaaS, for example by Aaltonen (2017). The two relevant studies are discussed. In CIVITAS Eccentric project, a MaaS Readiness Level (MRL) was developed with eight indicators: strategic focus, parking policies, internal travelling,

use of shared mobility, shared economy, public transport, integration platform, and visibility. Each indicator is evaluated on a one to five scale by experts, and this index uses one final single value, which could hide meaningful insights. The indicators are not weighted, and the selected eight indicator are too much to provide comprehensive insights.

Another solution by Kamargianni and Goulding (2018) is the MaaS Maturity Index (MMI), which is organized into five groups of indexes, covering 32 indicators. MMI uses weights and aggregates the results on a 0 to 1 scale, therefore ordering the cities based on one single value is possible. Input data are surveys or internet sources. Although some details are not available about this approach, but it is stated that MMI is applicable for larger cities with mature mobility and ICT background. While this is a more comprehensive set of indicators, some business aspects are missing, such as the market volume or the representation of wealthiness. These aspects should be considered, when a MaaS operator selects a new service area.

2. METHODOLOGY

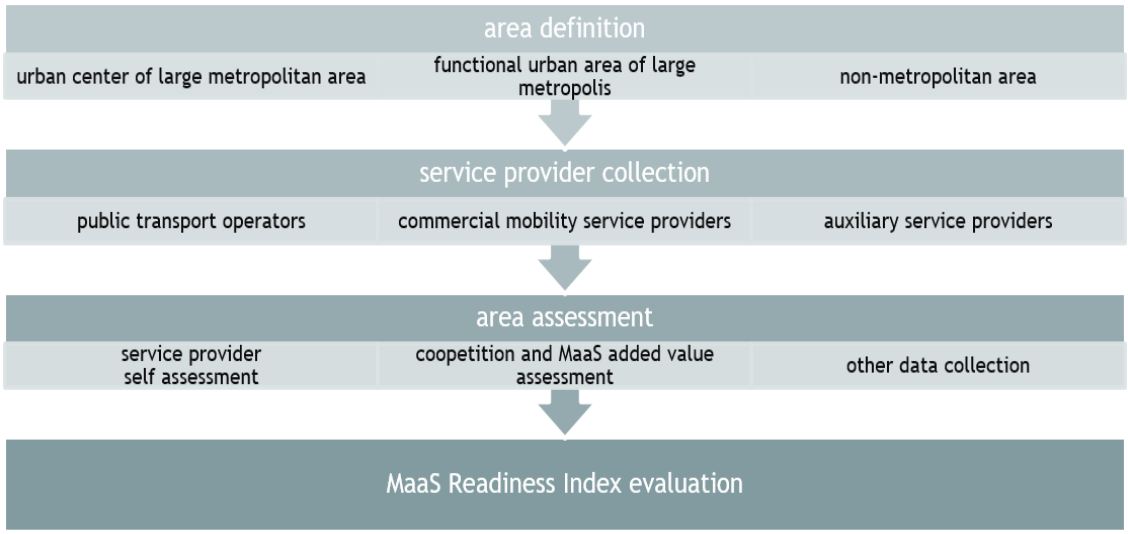
Feature definition

The MaaS readiness index (MRI) is an indicator, which describes the readiness of a specific area for introducing MaaS solutions and highlights the missing parts. The main foundation behind this index is that there are local features on which a MaaS operator can build a service. Practically, there are a couple of features which is considered as needed on the local context, and a couple of features which is considered as an added value for the MaaS operator. Thus, the MRI serves as a local index focusing on the local mobility opportunities, stakeholders, and environment. The features can be divided into three areas: technical features, coopetition features and MaaS added value features.

- Technical features: Is the local area technically mature enough to introduce a MaaS scheme? Are the technical solutions developed to provide advanced mobility services?
- Coopetition features: Does the local area have a vivid ecosystem of competing and cooperating stakeholders? Do these stakeholders provide mobility services, which can be well integrated?
- MaaS added value features: Does the local area have any experience with four MaaS elements: routing, booking, ticketing and payment?

The pilots and their readiness towards smart mobility solutions will be evaluated by this indicator among other outputs and KPIs. Figure 1 shows the overview of the process, which contains four consecutive phases. The first phase of the evaluation process is the area definition. The second phase is a collection of the mobility and mobility related service providers in the area. This phase is entirely delivered by local pilot partner. The third phase is the areas assessment, which is practically a data collection from local pilot partners and local mobility service providers. The fourth phase is the evaluation of index based on the collected information done by the local partner. The result of the evaluation process is a MaaS level, where the pilot area is assigned based on the defined index.

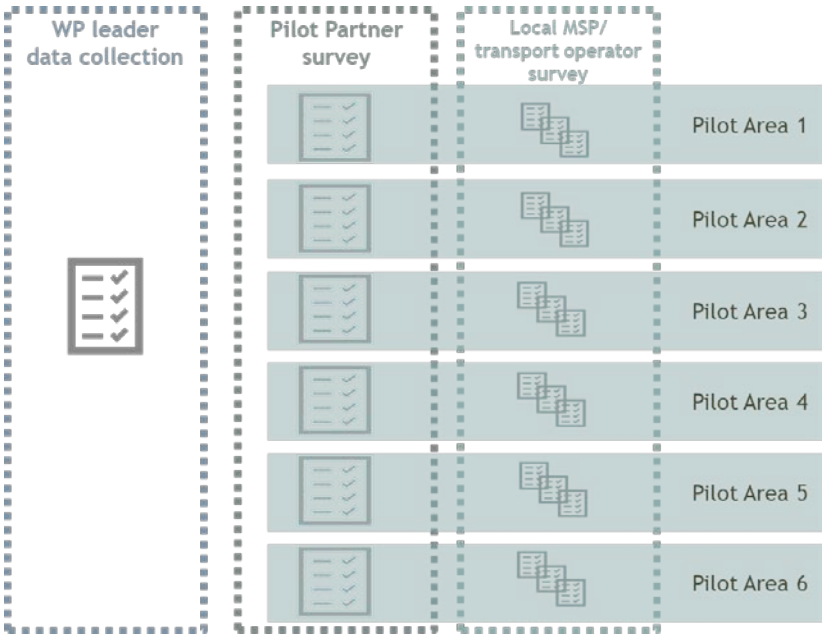
Figure 1 - Phases of the evaluation process



Data collection

The data collection is set up to collect all relevant data, which could possibly define how a smart mobility solution can be realized in a specific region. Online datasets, the representatives of service providers, and local experts are available as data sources. The local experts are represented by the project partners (PPs), who act as general professionals from the region, while the representatives of mobility service providers (MSPs) are mobility officers, who are employed at the local transport operator company. In these cases, short surveys are created to obtain the necessary information. Since the statistical data collection does not require local expertise, this task is done by the work package (WP) leader, where online datasets (e.g. the Eurostat database) are explored. Figure 2 describes the data collection method.

Figure 2 - Data collection method



The expert data collection is organized into surveys, where both PPs and MSPs describe the local situation and the implemented features based on a predefined list of answers. To each question, an ID is assigned, which represents its index and group it belongs to. In addition, a free text box is available for every question in the survey to express a more distinguished opinion in case of any local speciality.

The indicators of the technical index connect to the main components of a MaaS scheme: routing, booking, payment, and ticketing, where the additional category navigation is included to cover the supplementary services. All these indicators are collected through the survey distributed to the MSPs because they can provide these technical details about their services. The final indicator set is shown in Table 1.

Table 1 - Technical index indicators

Index	Group	ID	Name	Data source
Technical	Routing	TR01	Routing availability	MSP survey
Technical	Routing	TR02	Vehicle position	MSP survey
Technical	Routing	TR03	Dynamic information	MSP survey
Technical	Routing	TR04	Dynamic planning	MSP survey
Technical	Routing	TR05	Comfort services	MSP survey
Technical	Booking	TB01	Booking availability	MSP survey
Technical	Booking	TB02	Registration	MSP survey
Technical	Booking	TB03	Price information	MSP survey
Technical	Booking	TB04	Reservation	MSP survey
Technical	Payment	TP01	Payment availability	MSP survey
Technical	Payment	TP02	Payment types	MSP survey
Technical	Payment	TP03	Payment options	MSP survey
Technical	Payment	TP04	Discounts	MSP survey
Technical	Ticketing	TT01	Ticketing availability	MSP survey
Technical	Ticketing	TT02	E-ticketing	MSP survey
Technical	Ticketing	TT03	Validation	MSP survey
Technical	Navigation	TN01	Position	MSP survey
Technical	Navigation	TN02	Alerts	MSP survey

The indicators of the coopetition index describe the region's coopetition circumstances and cooperation opportunities, as shown in Table 2. The business and data group represents the stakeholder's approach to collaboration opportunities and to the establishment of a smart mobility framework, while the infrastructure and supply group describes the non-private mobility opportunities in the region. Information about the first two groups is collected by the experts. The market readiness and market volume groups collect general indicators and describe the potential user basis of a smart mobility solution; therefore, they can be collected by the WP leader while using online databases.

Table 2 - Coopetition index indicators

Index	Group	ID	Name	Source of data
Coopetition	Business and data	CB01	Willingness to collaborate	MSP survey
Coopetition	Business and data	CD01	Willingness to share data (MSP)	MSP survey
Coopetition	Business and data	CD02	Willingness to share data (MSO)	MSP survey
Coopetition	Infrastructure and supply	CI01	Mode availability	PP survey
Coopetition	Infrastructure and supply	CI02	Coverage	MSP survey
Coopetition	Infrastructure and supply	CI03	Frequency and reliability	PP & MSP survey
Coopetition	Infrastructure and supply	CI04	Quality	PP & MSP survey
Coopetition	Infrastructure and supply	CM01	Modal share	MSP survey
Coopetition	Market readiness	CM02	Mobile Internet access penetration	Eurostat
Coopetition	Market readiness	CM03	Willingness to pay online	Eurostat
Coopetition	Market readiness	CM07	GDP	Eurostat
Coopetition	Market volume	CM04	Total population	Eurostat
Coopetition	Market volume	CM05	Early bird population ratio	Eurostat
Coopetition	Market volume	CM06	Population density	Eurostat

The last index describes to what extent the region enables the development of smart mobility solutions with additional support (Table 3). The administration group describes how the local authorities, practitioners, and decision-makers prepare for advanced transport schemes. The experience group examines how much experience the stakeholders of the mobility market have in working together since in a MaaS scheme the routine of cooperation can speed up the processes. The data for these groups are collected both by the PPs and the available MSPs.

Table 3 - Added value index indicators

Index	Group	ID	Name	Source of data
Added value	Administration	MR01	Strategic documents	PP & MSP survey
Added value	Administration	MR02	Action plan	PP & MSP survey
Added value	Administration	MR03	Legislation and regulation	PP & MSP survey
Added value	Experience	CI01	Multimodal experience	PP & MSP survey
Added value	Experience	CI02	Experience in cooperation	PP & MSP survey
Added value	Experience	CI03	Cross-border experience	PP & MSP survey

Index creation

Based on some calculations, the MRI can be created in the following way:

- Technical index: All features are based on a Likert scale; therefore, the final results have a ready-short-long scale, as well. Although the AHP methodology could result in one final outcome, in this research, the weighted shares of the ready-short-long options are represented in the technical index.
- Added value: The majority of the features are based on a Likert scale without a numerical representation of the indicators. Other features can be transformed to this scale so the final outcome of the added value index is represented on a ready-short-long scale.
- Coopetition index: The majority of the features are quantitative indicators; therefore, the final outcome of the coopetition index is a value between 0 and 100.

The coopetition index is different from the other indexes by two aspects. In case of the technical and the added value indexes, an absolute readiness can be reached (i.e., 100% of the realized features are 'ready'), and any development is supposed to be realized without setbacks (i.e., the decrease of a technical level is highly unlikely). Meanwhile, in case of the coopetition index, the maximal value cannot be reached, which means that achieving the best results in every collected statistical data is highly unlikely, and a possible setback is rational. These considerations result in different final outcomes for the three indexes.

3. RESULTS AND DISCUSSION

Saxony

Saxony's pilot activity is a bus line optimization with better rail connections in Boxberg. The results of the Saxony pilot location are presented in Table 4. The Saxony pilot involves several transport modes; thus, both the coopetition index and the added value index are developed through the willingness to collaborate and the multimodal experience indicators. The changes in the added value index are quite significant; however, it has to be noted that the basis is relatively weak.

Table 4 - Saxony MRI results

Saxony		before the pilot	after the pilot
Technical	ready	16%	16%
	short	51%	51%
	long	33%	33%
Added value	ready	29%	49%
	short	29%	8%
	long	43%	43%
Coopetition		53,1%	57,4%

Rottal-Inn

The Rottal-Inn region plans to test a cross-border on-demand bus as a pilot activity. The effects of the pilot are shown in Table 5. While no technical development is achieved, both the added value and the coopetition indexes develop by the cross-border cooperation and the willingness to collaborate indicators. After this pilot, the added value index does not require any long process to reach smart mobility solutions.

Table 5 - Rottal-Inn MRI results

Rottal-Inn		before the pilot	after the pilot
Technical	ready	19%	19%
	short	40%	40%
	long	41%	41%
Added value	ready	85%	85%
	short	7%	15%
	long	8%	0%
Coopetition		51,9%	54,8%

South Bohemia

South Bohemia plans to offer new innovative bus services; therefore, mode availability, mode, as well as frequency and reliability develop, as shown in Table 6. Both of these indicators affect the coopetition index; thus, an increase in this term can be observed.

Table 6 - South Bohemia MRI results

South Bohemia		before the pilot	after the pilot
Technical	ready	28%	28%
	short	38%	38%
	long	34%	34%
Added value	ready	85%	85%
	short	15%	15%
	long	0%	0%
Coopetition		54,5%	58,8%

Wiekopolska

Wiekopolska aims to develop an IT transport platform to collect, store, and open up public transport data. The Wiekopolska region realizes primarily technological developments, which might reduce the long-term technical developments (Table 7), where the dynamic information, the position, and the alerts' indicators are easier to be integrated in a smart mobility solution. Additionally, the experience in cooperation indicator affects the added value index, so that the MaaS schemes could be more easily realized because of the established cooperation between the stakeholders.

Table 7 - Wiekopolska MRI results

Wiekopolska		before the pilot	after the pilot
Technical	ready	38%	53%
	short	39%	31%
	long	23%	16%
Added value	ready	63%	85%
	short	7%	7%
	long	29%	8%
Coopetition		61,6%	61,6%

Osijek

Osijek aims to develop a multimodal journey planner. Although it is a technical development, the features of the existing MSPs are already well-developed; thus, there is no change observed in terms of the technical index. Solely the coopetition index is affected by three indicators: the willingness to collaborate, the experience in cooperation, and the willingness to share data (MSP). A good journey planner is the basis of a MaaS scheme, so with this pilot, the coopetition circumstances increase significantly (Table 8).

Table 8 - Osijek MRI results

Osijek		before the pilot	after the pilot
Technical	ready	83%	83%
	short	13%	13%
	long	4%	4%
Added value	ready	49%	49%
	short	7%	8%
	long	44%	43%
Coopetition		55,8%	61,8%

Castelfranco Emilia

The Castelfranco Emilia pilot site in Modena region plans to test a proper MaaS scheme based on the current technical feasibilities. A new application is promoted and launched, where the demand responsive transport (DRT) services and the conventional services are connected. Since Castelfranco is next to Modena city, urban service providers from the city are represented in the survey, as well. This means that the technical index remains the same, whereas the added value and the coopetition indexes change (Table 9), even though both have already been adequate. The changing indicators are the multimodal experience and the willingness to collaborate.

Table 9 - Castelfranco Emilia MRI results

Castelfranco Emilia		before the pilot	after the pilot
Technical	ready	66%	66%
	short	14%	14%
	long	20%	20%
Added value	ready	64%	85%
	short	7%	7%
	long	29%	8%
Coopetition		60,4%	61,3%

A major limitation of this solution is the potential lack of proper input data. Descriptive data sets about mobility are not available in comprehensive databases. However, in the Coopetition index six indicators can be provided by Eurostat, which is an advantage of our approach. While MaaS is considered as an urban solution, mainly in larger urban areas, in this research a more comprehensive approach was considered to include other types of areas. This means that the methodology fits best to European NUTS2 regions, but if the statistical data are available, adaption can be done for any region. All other input data are either provided by the responsible organization or evaluated by multiple partners to enhance accuracy. Future research should focus on more comprehensive indicators, which are useful and meaningful for describing mobility in a specific area.

4. CONCLUSIONS

Our aim with this research was to show how MRI can be used to understand and evaluate pilot activities towards smart mobility solutions. The innovative approach of MRI uses a scale, which is easy-to-understand and meaningful without comparison, but also uses weighting at the same time, which provides more accurate and comprehensive final results.

ACKNOWLEDGMENT

RegiaMobil is co-funded by the European Union under the INTERREG Central Europe Programme.

REFERENCES

Aaltonen S. (2017). MaaS readiness level indicators for local authorities. Civitas Eccentric.

Esztergár-Kiss D., Kerényi T., Mátrai T., Aba A. (2020). Exploring the MaaS market with systematic analysis. European Transport Research Review, 12(1), 1-16.

Hietanen S. 2014. Mobility as a Service. the new transport model, 12(2), 2-4.

Kamargianni M., Goulding R. (2018). The mobility as a service maturity index: Preparing the cities for the mobility as a service era. In Transport Research Arena (Vol. 7).

Kamargianni M., Matyas M. 2017. The business ecosystem of mobility-as-a-service. In transportation research board (Vol. 96). Transportation Research Board.