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Sustainable mobility and transportation — Sustainable mobility services —

Part 1: Use cases

Mobilité et transports durables — Services de mobilité durable —

Partie 1: Cas d'utilisation

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Foreword

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This document was prepared by Technical Committee ISO/TC 268, *Sustainable cities and communities*, Subcommittee SC2, *Sustainable cities and communities - Sustainable mobility and transportation*.

A list of all parts in the ISO 16497 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is intended to clarify items for standardization based on gap analysis of collected use cases of Mobility as a Service (MaaS) or sometimes called as Mobility on Demand (MoD) (only in the US), and related projects.

The objective of this document is to gather use cases for the implementation of sustainable mobility services and facilitate international sharing of experiences and knowledge. The collected data will be analyzed to identify issues for international standardization.

The ISO 16497 series consists of two parts (other parts are planned):

— ISO TR 16497-1 (this document): for case collection and preparation for the further analyses.

— ISO TR 16497-2[1)].

1) Under development. Stage at time of publication: ISO/PWI TR 16497-2.

Sustainable mobility and transportation — Sustainable mobility services —

Part 1: Use cases

1 Scope

This document compiles use cases for the implementation of sustainable mobility services. The collected data will be analysed to identify issues for international standardization.

This document focuses on use cases that aim to implement sustainable transport services. The use cases considered are at the city scale or metropolitan scale, aligned with the scope of smart cities and communities. The use cases encompass land transport, water transport, and air transport for both passengers and freight.

Ideas related to connection and integration, including demand-side, supply-side, and policy framework aspects, are included.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Use case collection

Multiple use cases have been collected from Japan, China, and India. All cases can be found in Annex A.

5 Use case analysis

The use cases are analysed based on policy making and planning, travel mode characteristics, multimodal connectivity and coordination, and operational organization structure.

6 Subjects for standardization

6.1 General

By analysing the gathered use cases, discussion points for conducting gap analysis towards standardization have been organized. These points take into account policy goal setting, targeted travel modes, intermodal connections and coordination, as well as operational organizational structures.

6.2 Policy making and planning

6.2.1 General

Discussion points for policy goal setting are structured based on the types of policy objectives and their evaluations. Five perspectives are considered, integrating well-being and resilience into the three foundational aspects of sustainability: environmental, social, and economic.

6.2.2 Policy goals and objectives

The policy objectives and goals for mobility services vary in each use case. To achieve sustainable cities and communities, the relationships between policy goals and various mobility services are organized from five perspectives: environment, social issues, economy, well-being, and resilience.

6.2.3 Environment

Assessment is made on the contribution of mobility services towards mitigating climate change, conserving resources, reducing waste and pollution, and enhancing residential environments.

6.2.4 Society

Assessment is made on the contribution of mobility services towards ensuring equitable access to needs, maintaining and promoting social participation, and strengthening social cohesion.

6.2.5 Economy

Assessment is made on the contribution of mobility services towards economic growth, enhancing the attractiveness of cities and communities, fostering creativity and innovation, and improving the financial stability of service provision.

6.2.6 Well-being

Assessment is made on the contribution of mobility services towards promoting health, enhancing quality of life, and fostering a sense of self-efficacy.

6.2.7 Resilience

Assessment is made on the contribution of mobility services towards ensuring redundancy, managing uncertainty and risks, and fostering the development of social capital and capability.

6.3 Evaluation of each policy goal

6.3.1 General

The assessment of each policy objective focuses on how quantitative and qualitative evaluations are integrated. The contribution of mobility services towards achieving the policy objectives listed in 6.2.3 to 6.2.7 is evaluated through quantitative and qualitative approaches. Additionally, the alignment of these contributions with the 169 targets of the Sustainable Development Goals (SDGs) is confirmed.

6.3.2 Quantitative evaluation

Key Performance Indicators (KPIs) are employed for quantitative evaluations. Output indicators that objectively illustrate the results of each policy measure and outcome indicators that quantitatively reflect the achievement of policy objectives are established, with prominent indicators being determined as KPIs.

6.3.3 Qualitative evaluation

In cases where assessing the contribution of mobility services to policy objectives using numerical or statistical data is challenging, qualitative outcome indicators based on users' subjective perceptions and experiences are utilized. These indicators are then comprehensively evaluated in conjunction with the KPIs in 6.3.2.

6.3.4 Responding to the SDGs (contribution to solving social issues)

By employing the quantitative and qualitative evaluations in 6.3.2 and 6.3.3, the alignment between policy objectives with confirmed contributions from mobility services and the 169 targets of the SDGs is delineated. This clarifies the contributions of relevant mobility services to the SDGs. Examples of SDG targets closely related to mobility services include:

— Target 3.6: By 2020, halve the number of global deaths and injuries from road traffic accidents.

— Target 7.2: By 2030, increase substantially the share of renewable energy in the global energy mix.

— Target 7.3: By 2030, double the global rate of improvement in energy efficiency.

— Target 8.9: By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products.

— Target 9.1: Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.

— Target 11.2: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.

— Target 11.7: By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.

6.4 Travel modes

6.4.1 General

From the perspective of travel modes, the situations requiring mobility services and the forms of mobility services provided are delineated based on the categories of targeted travel needs, combinations of travel modes, and combinations of mobility services.

6.4.2 Target travel needs corresponding to policy goals

6.4.2.1 General

The travel demands of cities and communities are classified based on travellers' attributes and purposes, identifying the travel needs that correspond to policy objectives.

6.4.2.2 Classification of travel needs

The mobility scenarios in cities and communities are classified based on the attributes of travellers (e.g. age, car ownership) and their trip purposes (e.g. commuting, shopping, leisure).

6.4.2.3 Identification of travel needs requiring mobility services

Travel needs closely related to the policy objectives to be achieved are determined. In situations where alternative travel mode choices are limited, some form of mobility service is considered necessary.

6.4.3 Combination of travel modes (inter-modal transport)

6.4.3.1 General

In terms of travel mode combinations, evaluation is given to the integration of diverse mobility tools and the merging of distinct mobility services.

6.4.3.2 Mobility tool combinations

Combinations of mobility tools are organized based on combining existing tools (e.g. private cars and car-sharing), combining existing tools with new ones (e.g. conventional buses and autonomous electric wheelchairs), and combining new tools with each other (e.g. electric kick scooters and autonomous buses).

6.4.4 Mobility service combinations

Combinations of mobility services are delineated based on temporal aspects, such as variations in travel demand by time of day, day of the week, and season, as well as spatial aspects, such as the distribution of urban functions and residential populations.

6.5 Multimodal connectivity and coordination

6.5.1 General

In a multimodal situation, users have the option to choose from multiple travel modes. In such cases, it is necessary to organize how connections and coordination between travel modes are established. This organization is based on what is being connected and coordinated, the purpose, and how these connections and coordination are achieved in terms of systems and technology. Identifying the advantages and disadvantages for users or potential users is particularly important.

Examples of connectivity and coordination discussion are based on three aspects:

— Demand-side aspects include bundling daily travel and tourism travel, and induced demand created by new services.

— Supply-side aspects involve coordination between existing vehicles and new mobility tools, coordination between existing services and new services, coordination between rails and micro-mobility modes, such as small electric vehicle sharing services, and coordination between buses and autonomous electric wheelchair sharing.

— Policy framework aspects encompass the connection between policy evaluation and strategy confirmation based on mobility data, space activities, the connection for available and attractive tourism options, and the connection of existing services based on new services.

6.5.2 Situations of connection and coordination

Possible scenarios for connections and coordination between travel modes include situations where travellers gather information about their trips (e.g. routes, travel time, fares and fees), situations where they reserve mobility services, and situations where they pay for fares and fees associated with these services.

6.5.3 Objective

The policy objectives intended for connecting and coordinating different mobility services, include promoting a modal shift away from private cars, encouraging out-of-home activities that contribute to personal health improvement and local economic revitalization, among other aspects.

6.5.4 Methods and technology

Methods and technologies for connecting and integrating mobility services can be organized according to their purposes. Potential objectives include streamlining the collection of travel-related information,

simplifying service reservations and payments, consolidating fares and fees between different services, and offering new services through collaboration with other entities (e.g. MaaS apps) and the motivation that comes from these initiatives.

6.6 Operational organization structure

6.6.1 General

It is crucial to highlight the significant disparities across various use cases, particularly in terms of the stakeholders involved in projects aiming to connect and integrate mobility services, the nature of relationships among these participants, and the methods employed to secure funding for successful implementation.

6.6.2 Participants' roles and relationships

For each use case, it is necessary to define the roles and relationships of the entities involved in the project. This includes clarifying the leading entities responsible for policy and decision making, as well as the operators of the MaaS platform.

6.6.3 Finance

Each use case will be structured to encompass the financial scale required for project execution, the relationships between all cost bearers and the direct and indirect beneficiaries resulting from connected and coordinated mobility services, as well as the mechanisms for revenue reallocation and internal subsidization.

Annex A
(informative)

Use case examples

This annex contains examples of use cases (shown in Figures A.1 to A.9). Five use cases have been reported from Japan, three from China, and one from India (as of April 2023).

A.1 Japan-01 Case in Toyoake city

Service name	"choisoko" by AISIN					
Overview of the area (SA) (FA)	Geographic conditions	large city, regional city, rural area, tourist destination				
	Population size/ population density	(70,000) persons/area ・ (2,962) persons/km^2				
	Older population share	(21,6) %				
	Modal share (car)	(60,7) %				
Policy targets (MA)	Mitigation of environmental impacts					
	Ensuring diversity, equity, and inclusiveness	○				
	Economic growth, regional revitalization, sustaining and improving competitiveness					
	Promoting health	○				
	Other	( )				
Primary target of the policy (SA)	Attribute	Resident, Visitor, Senior, Disabled				
	Trip Purpose	Commuting, School, Business, Shopping, Sightseeing, etc.				
	Trip range	Feeder mode (access / egress), overall trip				
Needs of main target (SA)	Speed, Frequency, Timeliness, Accessibility to services					
Travel modes considered Transportation modes for the service (MA) Overview of On-demand Transportation (SA/FA)	Existing transport mode	Railroad				
		Tram				
		Bus				
		Taxi				
	New Mobility	On-demand transportation	○	⇒		
		Shared Taxi				
		Car sharing				
		Ride-hailing				
		Shared cycle				
		Other	( )			

Overview of On-demand Transportation		
Vehicle size		8 seat
Service style	Route	Fixed / Not-fixed
	Stop	Fixed / Not-fixed
	Time-table	Fixed / Not-fixed
Operator's primary business		auto parts company
Position in local transport system		Transportation in inconvenient areas

Service provided (MA)	MaaS Function	Search for multiple modes		
		Reservation		
		Payment		
		Ticketing		
	Supplementary Services	Collaborate with business, tourism, etc.		
		Create opportunities to go out (events)	○	
		Other	( )	

Organization involved (style of collaboration)		Leading organization (SA)	Operator (SA)	Participant(s) (MA)
	Local government			○
	Transport operator			○
	Non-profit organization			
	Public sector			
	Private sector	○	○	○

<table>
<tr><td rowspan="2">Operation scheme
(FA)</td><td>Structure</td><td colspan="5">Business consignment from the Maas operator to transport operators</td></tr>
<tr><td>Costs</td><td colspan="5">Operated by fare revenue and sponsorship money from local governments and local commercial facilities</td></tr>
<tr><td rowspan="5">Introducing effects
(FA)</td><td colspan="2" rowspan="2">KPI</td><td colspan="2">Index value</td><td colspan="2" rowspan="2">KPI</td><td colspan="2">Index value</td></tr>
<tr><td>Before</td><td>After</td><td>Before</td><td>After</td></tr>
<tr><td colspan="2">number of service subscribers</td><td>0</td><td>2000
(2021)</td><td colspan="2">number of passengers per day</td><td>0</td><td>35-40
(2021)</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="8">【Qualitative Effects】
・As being able to travel at the nearest bus stop from home to the one near destination in an expected time period, they would go out more often
・The share-ride service would increase the opportunity to meet their neighbors, promoting communication in local communities
・As the transit service operators plan events for the elderly, it would create opportunities for them to go out and communicate
・Contributed to regional revitalization by providing the elderly opportunity of new interests and meeting people through the events
・Securing transport means to commercial areas made customers visit there repeatedly and even new customers to visit
・Cooperated with local taxi operators and utilized existing transport infrastructure efficiently</td></tr>
<tr><td rowspan="6">Addressing social issues
(MA)</td><td colspan="2">Promote diversity and barrier-free</td><td>○</td><td colspan="2">Develop sustainable and resilient community</td><td>○</td></tr>
<tr><td colspan="2">Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation</td><td></td><td colspan="2">Promote thorough energy conservation</td><td></td></tr>
<tr><td colspan="2">Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society</td><td>○</td><td colspan="2">Countermeasures against climate change</td><td></td></tr>
<tr><td colspan="2">Reinforcing technology and foundation of local areas</td><td></td><td colspan="2">Child safety</td><td></td></tr>
<tr><td colspan="2">Promotion of sustainable tourism</td><td></td><td colspan="2"></td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Service contents
(FA)</td><td>Overview</td><td colspan="6">・Outsourced the operation to local taxi company from 9:00 to 16:00 (fare: JPY200/ride), avoiding peak hours for taxi industry
・Improved convenience for the elderly by locating bus stops near the sites that they are expected use frequently, including shopping centers, hospitals, etc.
・Enabled reservations on the internet or by phone, and optimized share-ride users, driving route through the use of AI technologies</td></tr>
</table>

Key

SA single answer
MA multiple answers
FA free answer

Figure A.1 — Japan-01 Case in Toyoake city

A.2 Japan-02 Case in Kamishihoro town

Service name	Kamishihoro Town MaaS by Innovation Challenge Organizing Committee						
Overview of the area (SA) (FA)	Geographic conditions	large city, regional city, (rural area), tourist destination					
	Population size/ population density	（4874） persons/area ・（ 7,14 ）persons/km^2					
	Older population share	（35,30）%					
	Modal share (car)	（ ）%					
Policy targets (MA)	Mitigation of environmental impacts						
	Ensuring diversity, equity, and inclusiveness						
	Economic growth, regional revitalization, sustaining and improving competitiveness	○					
	Promoting health						
	Other	（ ）					
Primary target of the policy (SA)	Attribute	(Resident), Visitor, (Senior), Disabled					
	Trip Purpose	(Commuting), School, Business, Shopping, Sightseeing, etc.					
	Trip range	Feeder mode (access, egress), (overall trip)					
Needs of main target (SA)	Speed, Frequency, Timeliness, (Accessibility to services)						
Travel modes considered Transportation modes for the service (MA) Overview of On-demand Transportation (SA/FA)	Existing transport mode	Railroad					
		Tram					
		Bus	○				
		Taxi	○				
	New Mobility	On-demand transportation	○	⇒	Overview of On-demand Transportation		
		Shared Taxi			Vehicle size		10-seater
		Car sharing			Service style	Route	(Fixed), Not-fixed
		Ride-hailing				Stop	(Fixed), (Not-fixed)
		Shared cycle				Time-table	(Fixed), (Not-fixed)
		Other	○ （ mixed passenger-cargo vehicle ）		Operator's primary business		Taxi operator/ Resident Drivers
					Position in local transport system		Transportation in inconvenient areas Effective use of existing assets
Service provided (MA)	MaaS Function	Search for multiple modes					
		Reservation	○				
		Payment					
		Ticketing					
	Supplementary Services	Collaborate with business, tourism, etc.					
		Create opportunities to go out (events)					
		Other	（ ）				

Organization involved (style of collaboration)		Leading organization (SA)	Operator (SA)	Participant(s) (MA)
	Local government	○		○
	Transport operator			○
	Non-profit organization			
	Public sector			
	Private sector		○	○
Operation scheme (FA)	Structure			
	Costs			

<table>
<tr><td rowspan="4">Introducing effects
(FA)</td><td rowspan="2">KPI</td><td colspan="2">Index value</td><td rowspan="2">KPI</td><td colspan="2">Index value</td></tr>
<tr><td>Before</td><td>After</td><td>Before</td><td>After</td></tr>
<tr><td>Expand use of welfare buses by making them available on demand (free of charge)
(1) Number of buses in operation
(2) Number of users
(3) Operating hours</td><td>(1)156
(2)22
(3)97H17min</td><td>(1)47
(2)75
(3)20H40min</td><td>Secure income by transporting freight on welfare buses</td><td></td><td>Less than expected amount of freight</td></tr>
<tr><td>Secure income through paid passenger transportation on welfare buses (paid operation)
*This fiscal year, introduce a hypothetical means of transportation through a private paid system</td><td></td><td>Paid services are more readily available without hesitation
Expanded opportunities to go out</td><td>Passenger transportation using delivery vehicles of logistics companies in the region (passenger freight consolidation, free of charge)</td><td></td><td>The number of passengers is limited, but the hours of use have been expanded.</td></tr>
<tr><td colspan="6">【Qualitative Effects】
-The estimate was positive in terms of business feasibility (subsidy reduction) as a result, since the subsidy amount was reduced by streamlining multiple lines against the cost of introduction by installing the system.
-There is a high possibility that simply converting to demand will not be effective against the cost of introduction. However, in areas where there are still multiple routes and room for efficiency improvement, the system can be expected to be effective by bundling multiple demands and improving efficiency.
-Demand clusters are considered to be more effective than hub-and-spoke type.</td></tr>
<tr><td rowspan="6">Addressing social issues
(MA)</td><td colspan="2">Promote diversity and barrier-free</td><td></td><td colspan="2">Develop sustainable and resilient community</td><td></td></tr>
<tr><td colspan="2">Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation</td><td></td><td colspan="2">Promote thorough energy conservation</td><td></td></tr>
<tr><td colspan="2">Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society</td><td>○</td><td colspan="2">Countermeasures against climate change</td><td></td></tr>
<tr><td colspan="2">Reinforcing technology and foundation of local areas</td><td></td><td colspan="2">Child safety</td><td></td></tr>
<tr><td colspan="2">Promotion of sustainable tourism</td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>Service contents
(FA)</td><td>Overview</td><td colspan="5">To improve the efficiency of welfare buses by making them available on demand, to verify the feasibility of multitasking such as mixed freight/passenger loading through visualization of available time, and to explore the possibility of reducing the burden on the town's single expense.
(1) Expand use of welfare buses by making them available on demand (free of charge)
(2) Secure income by using welfare buses to transport freight (mixed freight/passenger service, free of charge)
(3) Secure income by using welfare buses to transport passengers for a fee (free of charge)
(4) Passenger transportation using delivery vehicles of logistics companies in the region (mixed freight, free of charge)</td></tr>
</table>

Key

SA single answer

MA multiple answers

FA free answer

Figure A.2 — Japan-02 Case in Kamishihoro town

A.3 Japan-03 Case in MIE six towns

Service name	MIE six towns MaaS by MRT Inc.						
Overview of the area (SA) (FA)	Geographic conditions	large city, regional city, rural area, tourist destination					
	Population size/ population density	(8100~2300) persons/area ・ (25~562) persons/km^2					
	Older population share	(29~48) %					
	Modal share (car)	(69~83) %					
Policy targets (MA)	Mitigation of environmental impacts						
	Ensuring diversity, equity, and inclusiveness						
	Economic growth, regional revitalization, sustaining and improving competitiveness						
	Promoting health	○					
	Other	( )					
Primary target of the policy (SA)	Attribute	Resident, Visitor, Senior, Disabled					
	Trip Purpose	Commuting, School, Business, Shopping, Sightseeing, etc.					
	Trip range	Feeder mode (access / egress), overall trip					
Needs of main target (SA)	Speed, Frequency, Timeliness, Accessibility to services						
Travel modes considered Transportation modes for the service (MA) Overview of On-demand Transportation (SA/FA)	Existing transport mode	Railroad		⇒	Overview of On-demand Transportation		
		Tram			Vehicle size		
		Bus	○		Service style	Route	Fixed / Not-fixed
		Taxi	○			Stop	Fixed / Not-fixed
	New Mobility	On-demand transportation	○			Time-table	Fixed / Not-fixed
		Shared Taxi			Operator's primary business		On-demand Mobility Services
		Car sharing			Position in local transport system		Transportation in inconvenient areas
		Ride-hailing					
		Shared cycle					
		Other	( )				
Service provided (MA)	MaaS Function	Search for multiple modes					
		Reservation	○				
		Payment					
		Ticketing					
	Supplementary Services	Collaborate with business, tourism, etc.					
		Create opportunities to go out (events)					
		Other	(Medical MaaS)				

Organization involved (style of collaboration)		Leading organization (SA)	Operator (SA)	Participant(s) (MA)
	Local government			
	Transport operator			
	Non-profit organization			○
	Public sector			
	Private sector	○	○	○
Operation scheme (FA)	Structure			
	Costs			

<table>
<tr><td rowspan="5">Introducing effects (FA)</td><td rowspan="2">KPI</td><td colspan="2">Index value</td><td rowspan="2">KPI</td><td colspan="2">Index value</td></tr>
<tr><td>Before</td><td>After</td><td>Before</td><td>After</td></tr>
<tr><td>Degree of improvement in frequency of access to medical care
(i) Reduction of patient travel burden</td><td>Maximum 30 minutes Average 10 minutes</td><td>No transfer</td><td>(i)Reduction of travel time during health guidance (operational efficiency of health guidance)</td><td>Maximum 10 km one way, 20 minutes Average 5 km, 10 minutes</td><td>Town Health guidance can be provided while in the town hall</td></tr>
<tr><td>Degree of improvement in frequency of access to medical care
(ii) Increase in number of medical visits, etc.</td><td>Frequency of going to the hospital once a month 50%.</td><td>100%
（Possible increase in number of consultations.）</td><td>(ii)Willingness to pay for each service</td><td></td><td>Online medical care, health guidance and health consultation have a certain level of willingness to pay</td></tr>
<tr><td>Verification of business feasibility
Based on the trip data from the experiment, we assumed the extent to which efficient medical examinations and health guidance could be conducted, and established the revenue and income/expense per month assumed for each service area.</td><td>Operating costs were extracted as a benchmark for the break-even point in a two-tier cost structure.</td><td>Income 552,000 yen
Operating costs 389,460 yen
Investment cost 222222 yen
（Per municipality /month）</td><td>(iii) Verification of business feasibility (extraction of break-even point)</td><td></td><td></td></tr>
<tr><td colspan="6">【Qualitative Effects】
The elderly often has difficulty getting to the clinic by themselves. The study found that reducing the burden of patient transportation by using multitasking vehicles can contribute to improving access to medical care.
On-demand medical MaaS is positioned to improve access to medical care, early treatment, and prevention of serious illness.
From the next fiscal year onward, they will aim to implement sustainable services, including medication guidance, drug delivery, and other consistent services, and to achieve collaboration among the six towns.</td></tr>
<tr><td rowspan="6">Addressing social issues (MA)</td><td colspan="2">Promote diversity and barrier-free</td><td></td><td colspan="2">Develop sustainable and resilient community</td><td>○</td></tr>
<tr><td colspan="2">Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation</td><td>○</td><td colspan="2">Promote thorough energy conservation</td><td></td></tr>
<tr><td colspan="2">Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society</td><td>○</td><td colspan="2">Countermeasures against climate change</td><td></td></tr>
<tr><td colspan="2">Reinforcing technology and foundation of local areas</td><td>○</td><td colspan="2">Child safety</td><td></td></tr>
<tr><td colspan="2">Promotion of sustainable tourism</td><td></td><td colspan="2"></td><td></td></tr>
</table>

Service contents (FA)	Overview	On-demand medical MaaS utilizing multitasking vehicles (online medical care, health guidance, health consultation, medical consultation recommendation, etc.) Online medical care: Doctors at the Houtoku Clinic (participating clinic in the experiment) will provide medical care online. Online health guidance: Health nurses or nutritionists provide health guidance online. Online health counseling: Specialized doctors provide health counseling online. Trial session : Equipment operation and simulated experience for the staff of each town, etc.

Key

SA single answer

MA multiple answers

FA free answer

Figure A.3 — Japan-03 Case in MIE six towns

A.4 Japan-04 Case in Muroran city

Service name	Muroran City MaaS by Muroran Advancement Center of Technology and Management						
Overview of the area (SA) (FA)	Geographic conditions	large city, regional city, rural area, tourist destination					
	Population size/ population density	(81000) persons/area ・ ( ) persons/km^2					
	Older population share	(38) %					
	Modal share (car)	(72) %					
Policy targets (MA)	Mitigation of environmental impacts						
	Ensuring diversity, equity, and inclusiveness						
	Economic growth, regional revitalization, sustaining and improving competitiveness	○					
	Promoting health						
	Other	( )					
Primary target of the policy (SA)	Attribute	Resident, Visitor, Senior, Disabled					
	Trip Purpose	Commuting, School, Business, Shopping, Sightseeing, etc.					
	Trip range	Feeder mode (access / egress), overall trip					
Needs of main target (SA)	Speed, Frequency, Timeliness, Accessibility to services						
Travel modes considered Transportation modes for the service (MA) Overview of On-demand Transportation (SA/FA)	Existing transport mode	Railroad					
		Tram					
		Bus	○				
		Taxi	○				
	New Mobility	On-demand transportation	○	⇒	Overview of On-demand Transportation		
		Shared Taxi	○		Vehicle size		Total length 5,000mm, total width 2,000mm,
		Car sharing			Service style	Route	Fixed / Not-fixed
		Ride-hailing				Stop	Fixed / Not-fixed
		Shared cycle				Time-table	Fixed / Not-fixed
		Other	( )		Operator's primary business		Taxi operators
					Position in local transport system		Transportation in inconvenient areas Effective use of existing assets
Service provided (MA)	MaaS Function	Search for multiple modes	○				
		Reservation	○				
		Payment	○				
		Ticketing					
	Supplementary Services	Collaborate with business, tourism, etc.					
		Create opportunities to go out (events)					
		Other	( )				

Organization involved (style of collaboration)		Leading organization (SA)	Operator (SA)	Participant(s) (MA)
	Local government			○
	Transport operator			○
	Non-profit organization	○	○	
	Public sector			
	Private sector			○
Operation scheme (FA)	Structure			
	Costs			

<table>
<tr><td rowspan="4">Introducing effects
(FA)</td><td rowspan="2">KPI</td><td colspan="2">Index value</td><td rowspan="2">KPI</td><td colspan="2">Index value</td></tr>
<tr><td>Before</td><td>After</td><td>Before</td><td>After</td></tr>
<tr><td>Frequency of going out, intention to return driver's license, user satisfaction</td><td></td><td>Improved.</td><td>Business Operator
Ensure profitability</td><td></td><td>Reduction of business income and expenses</td></tr>
<tr><td>Changed to an easy-to-use UI（Driver App）</td><td>Difficult to book</td><td>Improved usability</td><td>Administration
Suppress or maintain public transportation-related subsidies</td><td></td><td>Appropriateness is expected</td></tr>
<tr><td colspan="6">【Qualitative Effects】
Some users enjoy making plans for outings and shopping, and this leads to the creation of a sense of fulfillment and improved quality of life.
The new transportation service point, "shared rides and carpooling," has a certain level of acceptability and is effective as a solution to regional issues.
New communication that cannot be experienced in everyday transportation is expected to be realized through the MaaS service.
Future traffic simulations will enable the identification of candidate areas for expansion within the city, which is expected to accelerate studies for future restructuring.</td></tr>
<tr><td rowspan="6">Addressing social issues
(MA)</td><td colspan="2">Promote diversity and barrier-free</td><td></td><td>Develop sustainable and resilient community</td><td>○</td></tr>
<tr><td colspan="2">Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation</td><td></td><td>Promote thorough energy conservation</td><td></td></tr>
<tr><td colspan="2">Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society</td><td>○</td><td>Countermeasures against climate change</td><td></td></tr>
<tr><td colspan="2">Reinforcing technology and foundation of local areas</td><td></td><td>Child safety</td><td></td></tr>
<tr><td colspan="2">Promotion of sustainable tourism</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Service contents
(FA)</td><td>Overview</td><td colspan="4">・Providing a MaaS service that makes it easy to make reservations without a smartphone, such as by installing tablets in shopping center storefronts.
・The application uses a "room-style" approach to carpool matching, whereby reservations, carpool matching, and cab dispatch are all handled by the application. This is an advanced system that eliminates the hassles of coordinating between users and making reservations for taxi dispatch.</td></tr>
</table>

Key

SA single answer
MA multiple answers
FA free answer

Figure A.4 — Japan-04 Case in Muroran city

A.5 Japan-05 Case in Kiyama city

Service name	Kiyama City MaaS by FUKUYAMA CONSULTANTS CO., LTD.						
Overview of the area (SA) (FA)	Geographic conditions	large city, regional city, rural area, tourist destination					
	Population size/ population density	（17500） persons/area ・ （795） persons/km^2					
	Older population share	（27） %					
	Modal share (car)	（50） %					
Policy targets (MA)	Mitigation of environmental impacts						
	Ensuring diversity, equity, and inclusiveness						
	Economic growth, regional revitalization, sustaining and improving competitiveness	○					
	Promoting health	○					
	Other	（ ）					
Primary target of the policy (SA)	Attribute	Resident, Visitor, Senior, Disabled					
	Trip Purpose	Commuting, School, Business, Shopping, Sightseeing, etc.					
	Trip range	Feeder mode (access / egress), overall trip					
Needs of main target (SA)	Speed, Frequency, Timeliness, Accessibility to services						
Travel modes considered Transportation modes for the service (MA) Overview of On-demand Transportation (SA/FA)	Existing transport mode	Railroad		⇒	Overview of On-demand Transportation		
		Tram			Vehicle size		
		Bus	○		Service style	Route	Fixed / Not-fixed
		Taxi	○			Stop	Fixed / Not-fixed
	New Mobility	On-demand transportation	○			Time-table	Fixed / Not-fixed
		Shared Taxi			Operator's primary business		General Consultants
		Car sharing			Position in local transport system		Transportation in inconvenient areas
		Ride-hailing					
		Shared cycle					
		Other	（ ）				
Service provided (MA)	MaaS Function	Search for multiple modes					
		Reservation	○				
		Payment					
		Ticketing					
	Supplementary Services	Collaborate with business, tourism, etc.	○				
		Create opportunities to go out (events)					
		Other	（ ）				
Organization involved (style of collaboration)		Leading organization (SA)	Operator (SA)	Participant(s) (MA)			
	Local government			○			
	Transport operator			○			
	Non-profit organization			○			
	Public sector						
	Private sector	○					
Operation scheme (FA)	Structure						
	Costs						

<table>
<tr><td rowspan="6">Introducing effects
(FA)</td><td rowspan="2">KPI</td><td colspan="2">Index value</td><td rowspan="2">KPI</td><td colspan="2">Index value</td></tr>
<tr><td>Before</td><td>After</td><td>Before</td><td>After</td></tr>
<tr><td>Number of users of on-demand transportation
Fares￥300</td><td>265</td><td>530</td><td>Number of users of high-frequency shuttle buses
Fares￥100</td><td>120</td><td>450</td></tr>
<tr><td>Percentage of changes in behavior and awareness due to the introduction of this mobility</td><td>50%</td><td>74,1%</td><td>Proceeds from the Mobility Business</td><td>34 million yen/year</td><td>Approx. 33.1 million yen/year</td></tr>
<tr><td>Proceeds from work trip and school bus agency</td><td>20 million yen/year</td><td>35 million yen/year</td><td>Proceeds from the passenger-freight consolidation car business</td><td>800,000 yen/year</td><td>Approx. 200,000 yen/year</td></tr>
<tr><td>Balance difference = deficit compensation amount</td><td>Less than 20 million yen/year</td><td>23 million yen/year</td><td></td><td></td><td></td></tr>
<tr><td colspan="6">【Qualitative Effects】
・ Three types of mobility vehicles with different functions are operated to improve the efficiency of transportation within the town.
・ Transportation of agricultural products within the town by on-demand transportation
・ Transportation and sales of local products to urban areas using the existing express bus freight consolidation service.
・ Improve customer attraction and profitability by transporting customers to stores in the city center and regional development facilities.
・ Create opportunities to raise awareness of the need for private cars and the importance of public transportation by having people declare and observe "No My Car Day".
・ Create a "mechanism" to encourage people to use public transportation voluntarily by utilizing the nudge theory.</td></tr>
<tr><td rowspan="6">Addressing social issues
(MA)</td><td colspan="2">Promote diversity and barrier-free</td><td>○</td><td>Develop sustainable and resilient community</td><td>○</td></tr>
<tr><td colspan="2">Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation</td><td>○</td><td>Promote thorough energy conservation</td><td></td></tr>
<tr><td colspan="2">Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society</td><td>○</td><td>Countermeasures against climate change</td><td></td></tr>
<tr><td colspan="2">Reinforcing technology and foundation of local areas</td><td>○</td><td>Child safety</td><td>○</td></tr>
<tr><td colspan="2">Promotion of sustainable tourism</td><td></td><td></td><td></td></tr>
<tr><td>Service contents
(FA)</td><td>Overview</td><td colspan="4">○In addition to corporate shuttle buses, school buses will be incorporated into government services to verify the acceptability and business feasibility of transportation services.
• Based on the movement characteristics and facility location status grasped from big data, They provide two types of public transportation: on-demand transportation and high-frequency shuttle buses.
• In order to secure revenue sources other than the above-mentioned public transportation fare revenues, "Commuting to work and school Bus Substitute Business" and "Freight Passenger Consolidation Business" utilizing on-demand transportation and highway buses on a trial basis
• Through simulated license return experiences and roundtable discussions, we encourage people to move outside of their own cars, and promote changes in behavior and awareness.</td></tr>
</table>

Key

SA single answer

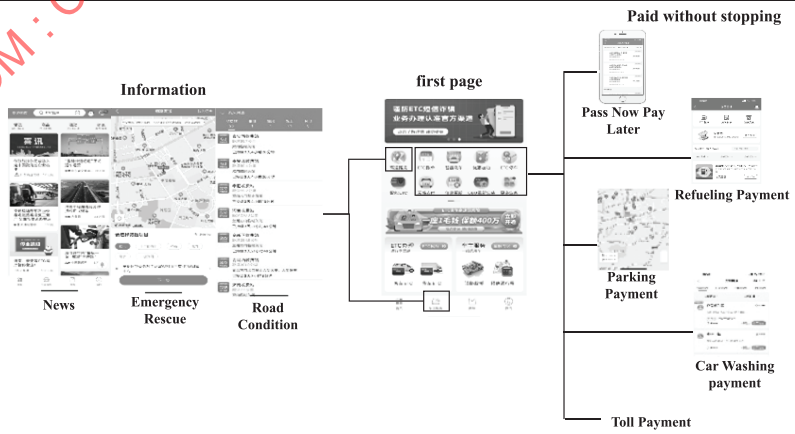
MA multiple answers

FA free answer

Figure A.5 — Japan-05 Case in Kiyama city

A.6 China-01 Case in Shandong Province

Service name	E-highway						
Overview of the area (SA) (FA)	Geographic conditions	large city, regional city, rural area, tourist destination					
	Population size/ population density	（101,700,000） persons/area （653） persons/km^2					
	Older population share	（15,9） %					
	Modal share (car)	（26,9） % （89,1） %					
Policy targets (MA)	Mitigation of environmental impacts	○					
	Ensuring diversity, equity, and inclusiveness	○					
	Economic growth, regional revitalization, sustaining and improving competitiveness	○					
	Promoting health						
	Other	( )					
Primary target of the policy (SA)	Attribute	Resident, Visitor, Senior, Disabled					
	Trip Purpose	Commuting, School, Business, Shopping, Sightseeing, etc.					
	Trip range	Feeder mode (access / egress), overall trip					
Needs of main target (SA)	Speed, Frequency, Timeliness, Accessibility to services						
Travel modes considered Transportation modes for the service (MA) Overview of On-demand Transportation (SA/FA)	Existing transport mode	Railroad					
		Tram					
		Bus					
		Taxi					
	New Mobility	On-demand transportation		⇒	Overview of On-demand Transportation		
		Shared Taxi			Vehicle size		
		Car sharing			Service style	Route	Fixed / Not-fixed
		Ride-hailing				Stop	Fixed / Not-fixed
		Shared cycle				Time-table	Fixed / Not-fixed
		Other	(Highway Transportation)		Operator's primary business		
					Position in local transport system		
Service provided (MA)	MaaS Function	Search for multiple modes					
		Reservation					
		Payment	○				
		Ticketing					
	Supplementary Services	Collaborate with business, tourism, etc.	○				
		Create opportunities to go out (events)					
		Other	( )				
Organization involved (style of collaboration) 関係機関		Leading organization (SA)	Operator (SA)	Participant(s) (MA)			
	Local government			○			
	Transport operator		○	○			
	Non-profit organization						
	Public sector	○		○			
	Private sector						
Operation scheme (FA)	Structure	Various applications of Electronic Toll Collection					
	Costs	Operated by fare revenue and sponsorship money from public sector					

<table>
<tr><td rowspan="5">Introducing effects
(FA)</td><td rowspan="2">KPI</td><td colspan="2">Index value</td><td rowspan="2">KPI</td><td colspan="2">Index value</td></tr>
<tr><td>Before</td><td>After</td><td>Before</td><td>After</td></tr>
<tr><td>number of service subscribers</td><td>\</td><td>20,619,677 (2022)</td><td>“Pass Now Pay Later” service users</td><td>\</td><td>14,399,336 (2022)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="6">【Qualitative Effects】
Greatly alleviated the congestion problem of MTC lanes by the "Pass Now Pay Later" service for MTC lanes, and helpful for travelers to pass quickly.
Adding identification system to the existing parking and refueling facilities would utilize existing transport facilities efficiently.
Realizing One-card payment of parking, refueling and other car services made it more convenient for users to travel and promoted them to choose ETC.
Providing users with the "one-touch rescue" service would help them get out of trouble nearby and reduce them hidden danger of life.
Released real-time highway road conditions and control information and facilitated drivers to travel.</td></tr>
<tr><td rowspan="6">Addressing social issues
(MA)</td><td colspan="2">Promote diversity and barrier-free</td><td>○</td><td>Develop sustainable and resilient community</td><td></td></tr>
<tr><td colspan="2">Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation</td><td>○</td><td>Promote thorough energy conservation</td><td>○</td></tr>
<tr><td colspan="2">Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society</td><td>○</td><td>Countermeasures against climate change</td><td>○</td></tr>
<tr><td colspan="2">Reinforcing technology and foundation of local areas</td><td>○</td><td>Child safety</td><td></td></tr>
<tr><td colspan="2">Promotion of sustainable tourism</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Service contents
(FA)</td><td>Overview</td><td colspan="4">Realized "Pass Now Pay Later" service by using the Password-not-required paying method. Paid at toll, park and refuel without stopping and reduced travelers' time spent by existing equipment. Organized the "one-touch rescue" service. Real-time updated road conditions and control information.
In 2022, E-highway served 20 million persons, and provided more than 269 million services for more than 14 million the “ Pass Now Pay Later” users.</td></tr>
<tr><td>System Structure</td><td colspan="4"> 

Source: Data provided by CRRC Qingdao Sifang Rolling Stock Research Institute Co., Ltd.</td></tr>
</table>

Key

SA single answer

MA multiple answers

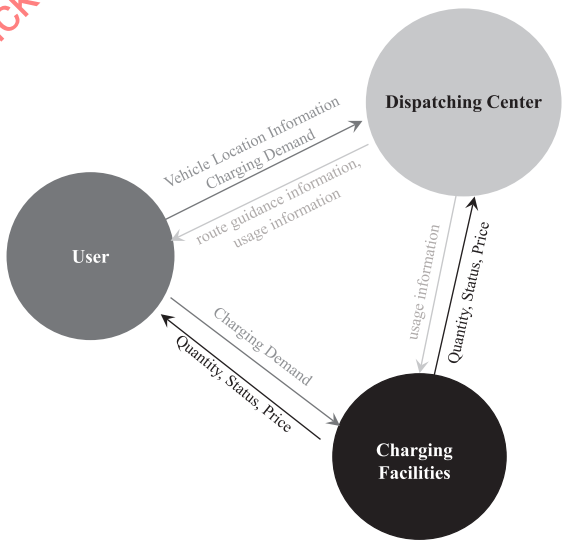
FA free answer

Figure A.6 — China-01 Case in Shandong Province

A.7 China-02 Case in Shandong Province

Service name	Charging Facilities					
Overview of the area (SA) (FA)	Geographic conditions	large city, regional city, rural area, tourist destination				
	Population size/ population density	(101,700,000) persons/area (653) persons/km^2				
	Older population share	(15,9) %				
	Modal share (car)	(26,9) % (89,1) %				
Policy targets (MA)	Mitigation of environmental impacts	○				
	Ensuring diversity, equity, and inclusiveness	○				
	Economic growth, regional revitalization, sustaining and improving competitiveness	○				
	Promoting health					
	Other	( )				
Primary target of the policy (SA)	Attribute	Resident, Visitor, Senior, Disabled				
	Trip Purpose	Commuting, School, Business, Shopping, Sightseeing, etc.				
	Trip range	Feeder mode (access / egress), overall trip				
Needs of main target (SA)	Speed, Frequency, Timeliness, Accessibility to services					
Travel modes considered Transportation modes for the service (MA) Overview of On-demand Transportation (SA/FA)	Existing transport mode	Railroad				
		Tram				
		Bus				
		Taxi				
	New Mobility	On-demand transportation		⇒	Overview of On-demand Transportation	
		Shared Taxi			Vehicle size	
		Car sharing			Service style	Route: Fixed / Not-fixed
		Ride-hailing				Stop: Fixed / Not-fixed
		Shared cycle				Time-table: Fixed / Not-fixed
		Other	(Highway Transportation)		Operator's primary business	
					Position in local transport system	
Service provided (MA)	MaaS Function	Search for multiple modes	○			
		Reservation				
		Payment				
		Ticketing				
	Supplementary Services	Collaborate with business, tourism, etc.	○			
		Create opportunities to go out (events)				
		Other	( )			

Organization involved (style of collaboration) 関係機関		Leading organization (SA)	Operator (SA)	Participant(s) (MA)
	Local government			○
	Transport operator		○	○
	Non-profit organization			
	Public sector	○		○
	Private sector			
Operation scheme (FA)	Structure	Charging facilities in Highway service area		
	Costs	Operated by fare revenue and sponsorship money from public sector		

<table>
<tr><td rowspan="5">Introducing effects
(FA)</td><td rowspan="2">KPI</td><td colspan="2">Index value</td><td rowspan="2">KPI</td><td colspan="2">Index value</td></tr>
<tr><td>Before</td><td>After</td><td>Before</td><td>After</td></tr>
<tr><td>charging stations</td><td>\</td><td>169
(2022)</td><td>charging facilities</td><td>\</td><td>796
(2022)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="6">【Qualitative Effects】
Attract new energy vehicle to use highway and reduced carbon emissions.
As the route guidance service, it would facilitate drivers to travel.
Deployed charging Facilities more rationally and reduced unnecessary equipment expenditures by analyzing the charging demand of new energy vehicles.
Promoted the development of new energy vehicle technology.</td></tr>
<tr><td rowspan="6">Addressing social issues
(MA)</td><td>Promote diversity and barrier-free</td><td>○</td><td>Develop sustainable and resilient community</td><td></td></tr>
<tr><td>Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation</td><td>○</td><td>Promote thorough energy conservation</td><td>○</td></tr>
<tr><td>Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society</td><td>○</td><td>Countermeasures against climate change</td><td>○</td></tr>
<tr><td>Reinforcing technology and foundation of local areas</td><td></td><td>Child safety</td><td></td></tr>
<tr><td>Promotion of sustainable tourism</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Service contents
(FA)</td><td>Overview</td><td colspan="4">New energy vehicles can effectively access information on charging facilities to meet charging demand.
Provided refined route guidance combining with vehicle types.
Deployed charging facilities based on charging demand data and highway traffic data.
At present, there are 169 charging stations and 796 charging facilities under the jurisdiction of Shandong Expressway.</td></tr>
<tr><td>System Structure</td><td colspan="4"> 

Source: Data provided by CRRC Qingdao Sifang Rolling Stock Research Institute Co., Ltd.</td></tr>
</table>

Key

SA single answer

MA multiple answers

FA free answer