



Technical Report

ISO/TR 16497-1

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

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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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 16497-2¹⁾.

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

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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.

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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).

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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		⇒	Overview of On-demand Transportation		
		Tram			Vehicle size	8 seat	
		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	auto parts company	
		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	○	○	○			

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Operation scheme (FA)	Structure	Business consignment from the Maas operator to transport operators				
	Costs	Operated by fare revenue and sponsorship money from local governments and local commercial facilities				
Introducing effects (FA)	KPI	Index value		KPI	Index value	
		Before	After		Before	After
	number of service subscribers	0	2000 (2021)	number of passengers per day	0	35-40 (2021)
【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						
Addressing social issues (MA)	Promote diversity and barrier-free		○	Develop sustainable and resilient community		○
	Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation			Promote thorough energy conservation		
	Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society		○	Countermeasures against climate change		
	Reinforcing technology and foundation of local areas			Child safety		
	Promotion of sustainable tourism					
Service contents (FA)	Overview	• 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				

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, <u>rural area</u> , 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	<u>Resident</u> , <u>Visitor</u> , <u>Senior</u> , <u>Disabled</u>			
	Trip Purpose	<u>Commuting</u> , <u>School</u> , <u>Business</u> , <u>Shopping</u> , <u>Sightseeing</u> , etc.			
	Trip range	Feeder mode (access, <u>egress</u>), overall trip			
Needs of main target (SA)	Speed, Frequency, Timeliness, <u>Accessibility to services</u>				
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			
		Bus	○		
		Taxi	○		
	New Mobility	On-demand transportation	○	⇒ Service style	Vehicle size
		Shared Taxi			10-seater
		Car sharing			Route
		Ride-hailing		Stop	<u>Fixed</u> / <u>Not-fixed</u>
		Shared cycle			<u>Fixed</u> / <u>Not-fixed</u>
		Other	○ (mixed passenger-cargo vehicle)		<u>Fixed</u> / <u>Not-fixed</u>
	MaaS Function	Search for multiple modes		Operator's primary business	Taxi operator/ Resident Drivers
		Reservation	○		
		Payment			
		Ticketing			
		Collaborate with business, tourism, etc.			
		Create opportunities to go out (events)			
Service provided (MA)	Supplementary Services	Other	()	Position in local transport system	Transportation in inconvenient areas Effective use of existing assets
	Leading organization (SA)				
Organization involved (style of collaboration)	Local government	○			○
	Transport operator				○
	Non-profit organization				
	Public sector				
	Private sector		○		○
Operation scheme (FA)	Structure				
	Costs				

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Introducing effects (FA)	KPI	Index value		KPI	Index value	
		Before	After		Before	After
	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	(1)156 (2)22 (3)97H17min	(1)47 (2)75 (3)20H40min	Secure income by transporting freight on welfare buses		Less than expected amount of freight
	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		Paid services are more readily available without hesitation Expanded opportunities to go out	Passenger transportation using delivery vehicles of logistics companies in the region (passenger freight consolidation, free of charge)		The number of passengers is limited, but the hours of use have been expanded.
	【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.					
Addressing social issues (MA)	Promote diversity and barrier-free			Develop sustainable and resilient community		
	Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation"			Promote thorough energy conservation		
	Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society		○	Countermeasures against climate change		
	Reinforcing technology and foundation of local areas			Child safety		
	Promotion of sustainable tourism					
Service contents (FA)	Overview	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)				

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, <u>rural area</u> , 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, <u>Senior</u> , Disabled						
	Trip Purpose	Commuting, School, Business, Shopping, Sightseeing, etc.						
	Trip range	Feeder mode (access / egress), <u>overall trip</u>						
Needs of main target (SA)	Speed, Frequency, Timelines, <u>Accessibility to services</u>							
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						
		Bus	○					
		Taxi	○					
	New Mobility	On-demand transportation	○	⇒	Vehicle size	Fixed / <u>Not-fixed</u>		
		Shared Taxi				Stop	Fixed / <u>Not-fixed</u>	
		Car sharing				Time-table	Fixed / <u>Not-fixed</u>	
		Ride-hailing		Operator's primary business	On-demand Mobility Services			
		Shared cycle					Position in local transport system	Transportation in inconvenient areas
		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							

Introducing effects (FA)	KPI	Index value		KPI	Index value	
		Before	After		Before	After
	Degree of improvement in frequency of access to medical care (i) Reduction of patient travel burden	Maximum 30 minutes Average 10 minutes	No transfer	(i)Reduction of travel time during health guidance (operational efficiency of health guidance)	Maximum 10 km one way, 20 minutes Average 5 km, 10 minutes	Town Health guidance can be provided while in the town hall
	Degree of improvement in frequency of access to medical care (ii) Increase in number of medical visits, etc.	Frequency of going to the hospital once a month 50%.	100% (Possible increase in number of consultations.)	(ii)Willingness to pay for each service		Online medical care, health guidance and health consultation have a certain level of willingness to pay
	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.	Operating costs were extracted as a benchmark for the break-even point in a two-tier cost structure.	Income 552,000 yen Operating costs 389,460 yen Investment cost 222222 yen (Per municipality /month)	(iii) Verification of business feasibility (extraction of break-even point)		
	【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.					
Addressing social issues (MA)	Promote diversity and barrier-free			Develop sustainable and resilient community		○
	Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation		○	Promote thorough energy conservation		
	Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society		○	Countermeasures against climate change		
	Reinforcing technology and foundation of local areas		○	Child safety		
	Promotion of sustainable tourism					

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.
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Key

- SA single answer
- MA multiple answers
- FA free answer

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

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A.4 Japan-04 Case in Muroran city

Service name	Murooran City MaaS by Murooran 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/km²							
	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		Overview of On-demand Transportation					
		Tram							
		Bus	○				Vehicle size	Total length 5,000mm, total width 2,000mm,	
		Taxi	○				Service style	Route	Fixed, Not-fixed
	New Mobility	On-demand transportation	○	⇒	Stop	Fixed, Not-fixed			
		Shared Taxi	○		Time-table	Fixed, Not-fixed			
		Car sharing			Operator's primary business	Taxi operators			
		Ride-hailing		Position in local transport system	Transportation in inconvenient areas Effective use of existing assets				
	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								

Introducing effects (FA)	KPI	Index value		KPI	Index value	
		Before	After		Before	After
Introducing effects (FA)	Frequency of going out, intention to return driver's license, user satisfaction		Improved.	Business Operator Ensure profitability		Reduction of business income and expenses
	Changed to an easy-to-use UI (Driver App)	Difficult to book	Improved usability	Administration Suppress or maintain public transportation-related subsidies		Appropriateness is expected
	【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.					
Addressing social issues (MA)	Promote diversity and barrier-free			Develop sustainable and resilient community		○
	Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation			Promote thorough energy conservation		
	Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society		○	Countermeasures against climate change		
	Reinforcing technology and foundation of local areas			Child safety		
	Promotion of sustainable tourism					
Service contents (FA)	Overview	• 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.				

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 <table><tr><td colspan="2">Vehicle size</td></tr><tr><td rowspan="3">Service style</td><td>Route</td><td>Fixed / Not-fixed</td></tr><tr><td>Stop</td><td>Fixed / Not-fixed</td></tr><tr><td>Time-table</td><td>Fixed / Not-fixed</td></tr><tr><td colspan="2">Operator's primary business</td><td colspan="2">General Consultants</td></tr><tr><td colspan="2">Position in local transport system</td><td colspan="2">Transportation in inconvenient areas</td></tr></table>		Vehicle size		Service style	Route	Fixed / Not-fixed	Stop	Fixed / Not-fixed	Time-table	Fixed / Not-fixed	Operator's primary business		General Consultants		Position in local transport system		Transportation in inconvenient areas	
		Vehicle size																				
		Service style	Route			Fixed / Not-fixed																
			Stop			Fixed / Not-fixed																
	Time-table		Fixed / Not-fixed																			
	Operator's primary business		General Consultants																			
	Position in local transport system		Transportation in inconvenient areas																			
	Tram																					
	Bus	○																				
	Taxi	○																				
	New Mobility	On-demand transportation	○																			
		Shared Taxi																				
Car sharing																						
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																					

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Introducing effects (FA)	KPI	Index value		KPI	Index value	
		Before	After		Before	After
	Number of users of on-demand transportation Fares ¥ 300	265	530	Number of users of high-frequency shuttle buses Fares ¥ 100	120	450
	Percentage of changes in behavior and awareness due to the introduction of this mobility	50%	74,1%	Proceeds from the Mobility Business	34 million yen/year	Approx. 33.1 million yen/year
	Proceeds from work trip and school bus agency	20 million yen/year	35 million yen/year	Proceeds from the passenger-freight consolidation car business	800,000 yen/year	Approx. 200,000 yen/year
	Balance difference = deficit compensation amount	Less than 20 million yen/year	23 million yen/year			
	【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.					
Addressing social issues (MA)	Promote diversity and barrier-free		○	Develop sustainable and resilient community		○
	Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation		○	Promote thorough energy conservation		
	Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society		○	Countermeasures against climate change		
	Reinforcing technology and foundation of local areas		○	Child safety		○
	Promotion of sustainable tourism					
Service contents (FA)	Overview	○ 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.				

Key

SA single answer

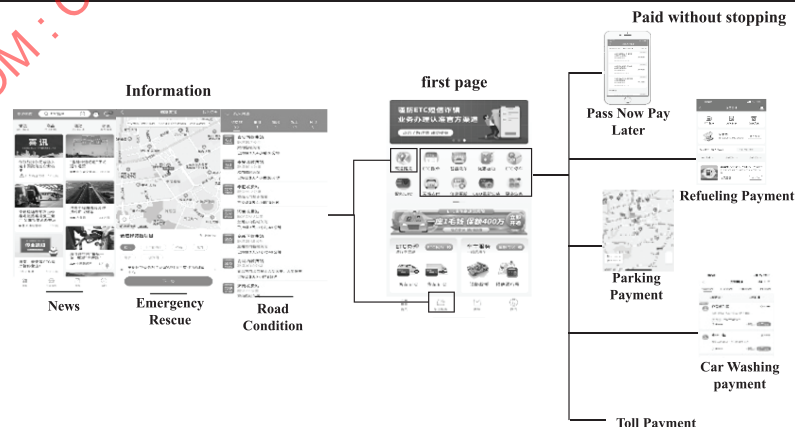
MA multiple answers

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		⇒	Overview of On-demand Transportation			
		Tram						
		Bus			Vehicle size			
		Taxi			Service style			
	New Mobility	On-demand transportation			Route	Fixed / Not-fixed		
		Shared Taxi				Stop	Fixed / Not-fixed	
						Time-table	Fixed / Not-fixed	
		Car sharing			Operator's primary business			
		Ride-hailing			Position in local transport system			
		Shared cycle						
	Other	(Highway Transportation)						
	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						

Introducing effects (FA)	KPI	Index value		KPI	Index value	
		Before	After		Before	After
	number of service subscribers	\	20,619,677 (2022)	"Pass Now Pay Later" service users	\	14,399,336 (2022)
【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.						
Addressing social issues (MA)	Promote diversity and barrier-free		○	Develop sustainable and resilient community		
	Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation		○	Promote thorough energy conservation		○
	Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society		○	Countermeasures against climate change		○
	Reinforcing technology and foundation of local areas		○	Child safety		
	Promotion of sustainable tourism					
Service contents (FA)	Overview	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.				
	System Structure	 Source: Data provided by CRRC Qingdao Sifang Rolling Stock Research Institute Co., Ltd.				

Key

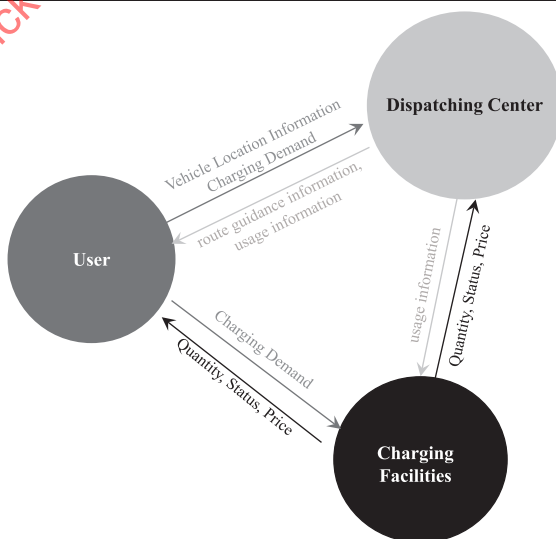
- SA single answer
 MA multiple answers
 FA free answer

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		⇒	Overview of On-demand Transportation		
		Tram			Vehicle size		
		Bus			Service style	Route	Fixed / Not-fixed
	New Mobility	Taxi			Stop	Fixed / Not-fixed	
		On-demand transportation			Time-table	Fixed / Not-fixed	
		Shared Taxi			Operator's primary business		
		Car sharing			Position in local transport system		
		Ride-hailing					
		Shared cycle					
	Other	(Highway Transportation)					
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					

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Introducing effects (FA)	KPI	Index value		KPI	Index value	
		Before	After		Before	After
	charging stations	\	169 (2022)	charging facilities	\	796 (2022)
	【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.					
Addressing social issues (MA)	Promote diversity and barrier-free		○	Develop sustainable and resilient community		
	Technology and data as the foundation for "Creation of Growing Market, Regional Revitalization, and Technological Innovation		○	Promote thorough energy conservation		○
	Foundation, technologies, and institutions that support regional revitalization and the creation of a future-oriented society		○	Countermeasures against climate change		○
	Reinforcing technology and foundation of local areas			Child safety		
	Promotion of sustainable tourism					
Service contents (FA)	Overview	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.				
	System Structure	 <pre> graph LR User((User)) -- "Vehicle Location Information" --> DC((Dispatching Center)) User -- "Charging Demand" --> DC DC -- "route guidance information" --> User DC -- "usage information" --> User DC -- "usage information" --> CF((Charging Facilities)) CF -- "Quantity, Status, Price" --> DC CF -- "Charging Demand" --> User User -- "Quantity, Status, Price" --> CF </pre>				

Source: Data provided by CRRC Qingdao Sifang Rolling Stock Research Institute Co., Ltd.

Key

SA single answer

MA multiple answers

FA free answer