1) Looking Back upon SIP-adus History

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1 Introduction

The purpose of publishing these "Final Results Reports" is to summarize the activities and results of the SIP-adus (Cross-ministerial Strategic Innovation Promotion Program Automated Driving for Universal Services) and to serve as a reference for future technological development and the promotion of industry-academia-government collaboration projects. For this purpose, it was concluded that not only technical details but also management innovations should be recorded, which are summarized in this section. In addition, many of the management innovations in the second phase of SIP-adus were based on the experiences in the first phase, so the first phase of SIP-adus will also be reviewed.

2 Looking Back on the First Phase of SIP-adus

SIP-adus started in June 2014, but before that a Program Director (PD) was selected for each theme at the end of 2013, with then-Senior Technical Executive Watanabe of Toyota Motor Corporation being selected as the PD of the "Automated Driving Systems" program, and a preparatory committee was established in early 2014 to launch the program. This preparatory committee consisted of the Steering Committee and three working groups (WGs), which met up to seven times a month. SIP-adus itself was an unprecedented experiment in which a PD from the private sector was the leader, and the Cabinet Office coordinated and promoted ministry-agency collaboration, and to be honest, the response from each ministry at the time was close to "jumping at shadows". However, thanks to the leadership of PD Watanabe, a counselor-level person attended every meeting.

On the other hand, a mirror meeting called a "Private Sector Opinion Exchange Meeting" that corresponded to each group was created and weekly meetings were held. Almost all motor vehicle OEMs members participated in these meetings, and the rules were that it was a meeting where "participants can freely express opinions as an individual, not as a representative of a company", anyone could participate, and no minutes of the proceedings were recorded. This free discussion played a large role in fostering consensus as an industry. In this "Private Sector Opinion Exchange Meeting", ideas for technology development themes necessary for automated driving, such as dynamic map and HMI (Human Machine Interface), were proposed and how to proceed with them was discussed. These details were proposed at the preparatory committee and approved for incorporation into the Research and Development Plan. These measures proposed by the private sector started small, totaling less than 100 million yen out of a total budget of approximately 2.5 billion yen in the first year.

After the official launch of the SIP "Automated Driving Systems" program, we continued to meet seven times a month, and also had frequent individual meetings with each ministry and drinking parties for communication with the private sector.

In 2015, PD Watanabe became ill and I (Kuzumaki) became acting PD. In the fall of that year, I was given the opportunity to explain the SIP "Automated Driving System" program at the Council for Science, Technology and Innovation, where then-Prime Minister Abe stated that large-scale FOTs (Field Operational Tests) would be conducted in 2017, creating an environment conducive to obtaining support from various ministries.

As we entered the third year of the project, it was considered that important themes proposed by the private sector, such as dynamic map, should be strengthened as soon as possible, and we worked on the revision and elimination of themes. Naturally, there was some resistance from the current contractors at the time, as this would mean changes to the original plan, but we managed to gain the understanding of the ministries and from FY2016 we were able to consolidate the themes and position dynamic map, cybersecurity, HMI, pedestrian accident reduction, and Next Generation Transport as the five priority issues, and allocate the budget to these areas as a priority. In March 2016, former PD Watanabe passed away in the middle of his appointment, and I (Kuzumaki) was officially appointed as PD.

One of the most notable achievements of the first phase of SIP-adus was the establishment of Dynamic Map Platform Co., Ltd. Advanced automated driving systems require high definition 3D maps. For each motor vehicle OEM to have its own maps would be a great burden for both the OEMs and the mapping companies. On the other hand, for mapping companies, the provision of map data is competitive area itself and a fundamental business issue. We then discussed what are the minimum "geographic features" necessary to realize automated driving, and decided that the "mapping" of these "geographic features" would be a cooperative area. As a result, Dynamic Map Platform Co., Ltd. was established in 2017, funded by land surveying equipment manufacturers, map vendors, land businesses, and motor vehicle OEMs. In 2017, SIP-adus performed large-scale FOTs on the Tomei Expressway using Dynamic Map, and as a result of that and the feedback which was received, commercial distribution of maps for all of the approximately 30,000 km of exclusive motorway commenced in 2018. These maps were subsequently used in the world's first Level 3 automated vehicle released by Honda, as well as in vehicles equipped with Nissan and Toyota's advanced safe driving support systems.

3 Looking Back on the Second Phase of SIP-adus

3.1. Launch and Team Building

As the second phase of SIP-adus was commenced via a supplementary budget, it overlapped with the first phase of SIP-adus for one year in 2018. The importance of realizing automated driving for the realization of Society 5.0 was recognized, and it was adopted as one of the 12 themes in the second phase also. However, the Governing Board (hereafter, GB) strongly reminded us to "work on new issues, rather than the leftovers from the first phase," and the name "*jidou unten*" for "automated driving" had also become common, so we changed the Japanese name of the theme for the second phase to "Jido unten".

A sense of mutual trust had been developed and the openness among the private sector and ministries improved through the activities of the first phase of SIP-adus, and it can be said that the launch of the second phase went smoothly. On the other hand, since the first phase was more of a voluntary activity, the relationship with related organizations was weak. From the second phase, the participation of representatives from related organizations in the Steering Committee and each working group was requested, and in particular, experts from the Japan Automobile Manufacturers Association (JAMA) actively participated in discussions with the working groups and project participants, which led to a rapid strengthening of cooperation. In the first phase, the GB pointed out that the involvement of academia was weak because the project was industry-led, so we asked a wide range of experts from universities and research institutions to participate as members of WGs, contractors, participants in experiments, and reviewers for evaluation. With these changes, I believe that a full-fledged industry-academia-government collaboration system was established from the second phase.

3.2. Schedule, Budget and Project member Management

As described in Section 2, the R&D themes were revised and eliminated in the middle of the first phase, but this required a lot of effort, including discussions to correct the course of the project. Based on this experience, in the second phase, the five-year period was considered to be three years plus two years, and milestones were set at the end of the third year to review the themes and speed up the development process itself. In addition, priority budget was allocated to themes with high potential for practical application and commercialization as of the end of the third year.

Another thing we were careful to do was to make sure that all parties involved were aware of the "objectives" of the measures. Often, the achievement of goals replaces the objectives. The objectives should come first, so if the outputs do not match the objectives, then a change of course or discontinuation of the project should be considered. For this reason, we aimed to have a thorough discussion at the beginning of a measure about why we were going to perform that R&D.

Regarding budget management, in the first phase of SIP-adus, the agreement of the ministries could sometimes not be obtained, a management agency was not established at first, and the Cabinet Office reallocated the budget to the ministries each year after the budget was decided, and the Cabinet Office also handled the administrative work of soliciting proposals from the private sector. This management of individual fiscal years was very inefficient. An agreement for NEDO to become the management agency from 2017 was reached, and changing the style to one in which multi-year contracts were concluded with project participants and the budget for the next fiscal year was fixed at the end of the fiscal year according to progress, etc. was a significant advantage. This increased the amount of time available for development and ensured flexibility in development.

On the other hand, the management of "project members" is the most difficult problem in an industry-academia-government collaboration project. Excellent engineers are necessary to produce good outputs, and naturally such personnel are indispensable within each company. In order to get them to provide people for a project, it is first necessary to have the management of each company understand the significance of the project. In addition, after the project is launched, the progress and output of the project must be made visible to the

engineers' supervisors, otherwise valuable human resources may be removed in the middle of the project. The key to these measures is "information dissemination". While it is of course necessary for the PD to personally explain the project at various opportunities, it is also essential to proactively share materials so that those involved can explain the project within their own companies.

In addition, the tenure of ministry officials was short and the handover period was also short. As a countermeasure, the monthly meetings of the Working Groups and the Steering Committee meeting held every few months were effective in maintaining continuity and momentum.

3.3. How to Proceed with Technological Development in Cooperative Areas

Technological development was conducted in cooperative areas in the SIP-adus program, but the scope of competitive areas and cooperative areas was not neatly organized from the beginning, and the boundary line between them often differed for each company. Therefore, it was difficult to gain support simply by saying, "this is a cooperative area so let's perform the development together". On the premise that "cooperation is important, but competition is also important," it is necessary to understand the boundary line of each company that cannot be compromised for any reason, and to show the benefits of cooperation and explain them to the relevant parties.

When development begins, it is easy to fall into a situation of agreement in general but disagreement with each point. For this reason, it is often more successful to not spend a long time discussing concepts and frameworks, but rather to start small and show concrete outputs in parallel and ask engineers to express their opinions based on them. Engineers often give opinions on concrete outputs precisely and from a technical point of view, so an approach that takes their opinions into account while repeatedly making improvements is effective.

3.4. Deciding Key Themes and Innovations

Deciding what should be the main theme was very difficult at the start of the second phase of SIP-adus. Having worked on the construction and distribution of high definition 3D maps in the first phase, it was natural to work on building the Dynamic Road Traffic Environment Data Framework on top of that. In light of this and in order to involve as many stakeholders as possible, we decided to make use of the Tokyo 2020 Olympic and Paralympic Games. Although it could not be realized in the end, the fact that we were able to work toward the goal of holding a large-scale joint test-ride event with JAMA at the Tokyo 2020 Olympic and Paralympic Games accelerated development, including in competitive areas, and also led to synchronization with the institutional development. Having such a "site" was useful for promoting discussions on standardization as well as for serving as a venue for information dissemination.

On the other hand, ensuring safety is an urgent issue towards the realization of automated driving and we felt the need to work on this issue. As a result of interviews, we learned that each company had to repeat many public road tests to verify safety, which had become a bottleneck in development, so we decided to start development of a simulation that could evaluate multiple sensors simultaneously. Although there were some initial setbacks, once the parties involved were able to share an image of the output, results began to emerge and the chain reaction that only an all-Japan organization can produce accelerated development and ultimately led to commercialization.[1]

To progress these and other important issues, Task Forces (TFs) were established for specific periods of time as needed to deepen the discussion. These TFs were useful because they brought together the necessary experts in a flexible manner.

4 An Overall View

I will now describe a few other good points other than those already mentioned and some other points that I noticed.

One point is the collaboration with the Digital Agency (formerly the Cabinet Secretariat), which is compiling Public-Private ITS Initiative/Roadmaps. The Cabinet Office's research and development under SIP-adus and the Digital Agency's roadmaps worked in tandem, enabling synchronized progress in technological and institutional development. In particular, the "Outline on improvement of legal system and environment for Automated Driving System" issued by the then Cabinet Secretariat in April 2018 led to the revision of the Road Traffic Act and the Road Transport Vehicle Act, and the world's first Level 3 automated driving vehicle, a product of the collaboration, went on sale in Japan in March 2021.

Another point is that, at the beginning of the first phase of SIP-adus, the parties concerned had a thorough discussion on "what is the purpose of developing automated driving?" and were able to reach an agreement that the purpose was the realization of a safe means of transportation. This led to the establishment of a firm policy of considering not only the realization of automated driving but also the evolution of advanced safe driving support systems as a set, which enabled us to work consistently throughout the project.

1 In July 2020, BIPROGY Inc. established V-Drive Technologies, Inc. as the sole investor.The company entered into a business alliance with Mitsubishi Precision Co., Ltd. and began selling DIVP® products in September of the same year.

In addition, we received advice from the Evaluation Working Group to strengthen the "fostering of public acceptance," and we were able to conduct public relations activities from a long-term perspective, which led to "strengthening communication" and greatly contributed to maintaining the project's centripetal force.

The final point is what I myself paid particular attention to, which was the "sense of speed". It took time to reach a consensus in the development of technology in the cooperative area. If the brakes are applied slightly on the planning side, it may cause "sag congestion" that completely stops at the rear. For this reason, we tried to make decisions quickly and proceed in a manner that allowed us to quickly implement small measures and revise them as needed. We also requested the creation of a schedule management chart, which is the basis of a project, and that it be shared thoroughly among the parties involved.

5 Conclusion

My experience will not be all that helpful since each person's project management style is different and the surrounding environment is also different, but I would be happy if just one of these examples is of assistance in future projects.

2) SIP-adus and Mission Oriented STI Policy

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1 Introduction

Since its inception (2016), the author has participated in the UN Forum to discuss the role of science and technology in achieving the goals of the SDGs and to develop guidelines. The author has also participated as a steering committee member in the OECD's international comparative study on mission-oriented innovation policies (MOIP).[1] Based on these experiences and knowledge, this section will introduce why the SIP-adus (Cross-ministerial Strategic Innovation Promotion Program (SIP) Automated Driving for Universal Services) is attracting attention from the international STI policy community, and explore lessons learned for future mobility-related programs and for our country's science, technology and innovation (STI) policy in general.

2 The importance of setting out a vision: Origin of SIP-adus

SIP-adus is a unique program that has involved politics, industry, academia, government and local citizens for more than 10 years, including preparation. Let us visit the origin of the program. First, the first international workshop was held in November 2014. The main theme was "Innovation of Automated Driving for Universal Services (SIP-adus) - Mobility Bringing Everyone a Smile." The purpose of the workshop was "An inclusive society where diverse people actively participate in value creation in diverse communities can achieve both individual happiness and economic development. Automated driving technology integrated with social innovation should provide mobility that allows everyone to fully demonstrate their abilities and enable the sustainable development of society," a message that still has an impact today. Second, at the start of the second phase of SIP-adus (2018), the name of the program was willfully changed from "Automated Driving Systems" in the first phase to "Automated Driving for Universal Services." This was a strong statement of the vision of not only developing technological systems, but also utilizing them to solve social issues such as logistics/mobility, and to develop a variety of services and businesses.

I think it is important that SIP-adus has been able to set out such a clear vision early on, ahead of SDGs and Society 5.0, to guide its activities over the long term.

3 Importance of historical perspective: STI policy is shifting to a social change/mission-oriented approach

Here, we review the evolution of international STI policies since the end of World War II. The objectives and institutional framework have changed to reflect political, social, and economic demands, the state of development of new technologies, and international conditions, such as security, industrial competitiveness, and solutions to social problems, and they can be roughly divided into four phases.[2] The first, second, and third periods are state-led large-scale technology development (since the 1950s), industrial technology development (since the 1970s), and national innovation system (since the 1980s), respectively. From around 2010, the fourth period began while overlapping with the third period, resulting in a shift to socially transformative/mission-oriented innovation policies (abbreviated as MOIP). SIP-adus can be regarded as a program in this fourth phase.

Last year, the OECD characterized STI policies in the post-COVID-19 pandemic era as follows: "Economic competitiveness has been the main rationale for countries' STI support over the past 30 years. In the future, sustainability, inclusiveness, resilience, and security will be key priorities in addition to this."[4][5] This reflects the recent rapid expansion and qualitative changes in the relationship between the global environment, society, economy, technology, and civic life, including the climate crisis, SDGs, COVID-19 pandemic, security crises, the 4th industrial revolution, and the digital revolution. The UN's SDGs, the OECD's MOIP, the EU's Horizon Europe, and the recent innovation policies of

Germany, UK, and other countries are all moving in the direction indicated by the OECD.

Among this, changes have begun in Japanese STI policies. In 2020, the Basic Act on Science and Technology was revised for the first time in 25 years, adding "creation of innovation" as an objective in addition to "improvement of the level of science and technology," and emphasizing the promotion of the humanities and social sciences and collaboration with science and engineering. The Sixth STI Basic Plan (March 2021), which was decided upon in response to this, sets forth different social goals and values from those of the past, namely, transformation into a sustainable and resilient society and realization of the diverse well-being of each individual. These have been the vision of SIP-adus for the past 10 years since the beginning.

4 Methodological framework for socially transformative/mission-oriented innovation policies (MOIP): OECD international collaborative study

In order to materialize MOIP, which is becoming the trend of the times, it is necessary to review the entire conventional STI system, from the setting of a vision and the process of policy formation, to the promotion system and management, the financial support system, coordination and collaboration across disciplines, organizations and industries, public acceptance and business development, human resource development and evaluation methods. This will require a review of the entire conventional STI system. Although various efforts are currently being made in various countries, common methodologies and evaluation methods have not yet been established. Therefore, the OECD, in cooperation with 13 countries including Japan, has been collecting and analyzing MOIP efforts and good practices in each country. In the process of this study, some of Japan's initiatives are also included, and SIP-adus is attracting attention as an important practical example.

Here are three frameworks of MOIP compiled by the OECD in collaboration with other countries.[1][2][3]

(1) Definition of MOIP: "A coordinated combination (package) of research and innovation policy instruments to address societal challenges."

(2) Five principles of MOIP program design and implementation: (1) setting specific goals, (2) clarifying the time frame for realization, (3) coordination among different policy areas (ministries, organizations), (4) utilization of various means (supply-side and demand-side, top-down and bottom-up), and (5) strengthening mechanisms and human resources to link the path from technology development to demonstration and market deployment.

(3) Formation of a three-tier structure for effective implementation of the MOIP program: (1) strategic direction, (2) policy coordination, and (3) policy implementation. Strengthening the human resources and systems capable of managing this multi-layered structure.

5 SIP-adus practical activities and the OECD's MOIP framework

Here, we have organized the specific practical activities, governance, and hierarchical structure of SIP-adus in line with the OECD MOIP framework introduced above, and created a bird's eye view diagram. (Fig.1)[1] The following explanation is based on this diagram.

(1) Layer 1: Strategic Direction Level

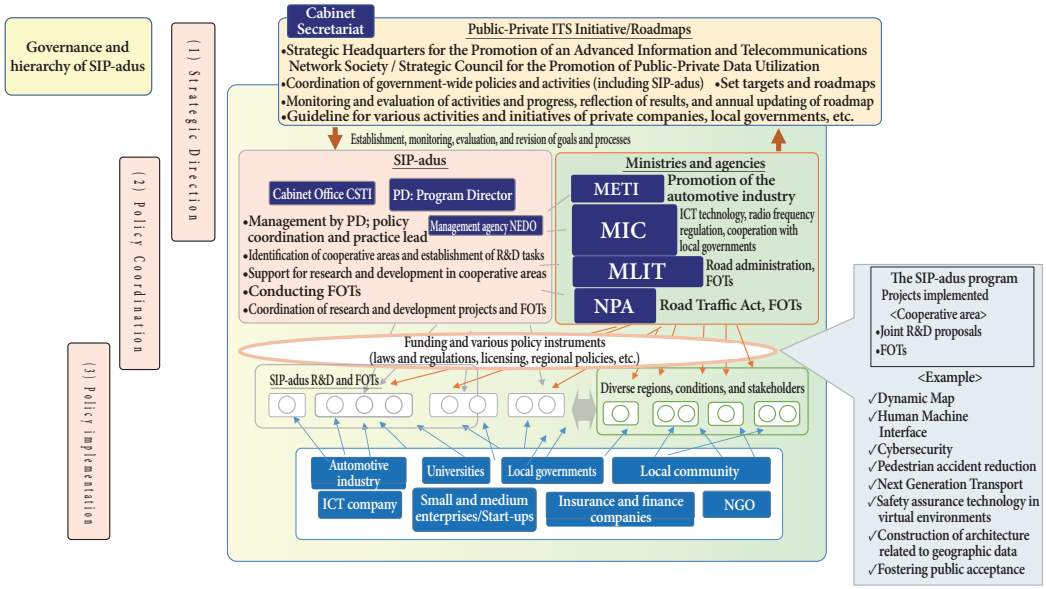

Fig.1 Bird's eye view of SIP-adus governance and hierarchy

In addition to reducing traffic accidents, reducing traffic congestion, and improving safety, the socioeconomic issues that SIP-adus aims to solve include drastic changes in the international competitive environment for mobility, and addressing social, economic, lifestyle, and mobility difficulties in local communities due to the declining birthrate, aging population, and depopulation. Based on the above, the Cabinet Secretariat has formulated Public-Private ITS Initiative/Roadmaps, setting a clear timeframe for the realization of automated driving systems and creating specific goals and itineraries. SIP-adus will share and collaborate with related organizations to promote individual activities, and monitor and analyze the progress to annually update and revise the activities in strategic direction. Public-Private ITS Initiative/Roadmaps are both the strategic direction and the driving force that binds the various activities together.

(2) Layer 2: Policy Coordination Level

An important role of SIP-adus in policy coordination is management to ensure that the Cabinet Office, Ministry of Economy, Trade and Industry (METI), Ministry of Internal Affairs and Communications (MIC), Ministry of Land, Infrastructure, Transport and Tourism (MLIT), National Police Agency (NPA), related companies, local governments, etc. act in a coordinated and timely manner, combining their respective policy/strategic measures, such as research funding, legislation and regulation, licensing, technology, standards, finance, and human resources to accelerate the development of automated driving systems, FOTs (Field Operational Tests), and social implementation based on Public-Private ITS Initiative/Roadmaps. Behind the scenes discussions and coordination are also important for this purpose. The next important role is to establish cooperative areas and competitive areas among industry, academia, government, and local communities, and to effectively promote various activities at the policy implementation level as described in (3) below. Furthermore, industry, academia, and government should work together to strengthen the international intelligence functionality, promote international cooperation and international standardization activities, and gain insight into the drastically changing international competitive environment.

The role and leadership of the program director to comprehensively manage and coordinate these diverse activities and organizations is extremely important.

(3) Layer 3: Policy Implementation Level

When a cooperative area is established in (2) and public funds are invested, related organizations can build a promotion system that transcends organizational and disciplinary boundaries, and collaborate on research and development, FOTs, and activities to foster public acceptance. To promote finances, it is possible to identify and meet diverse needs. In addition to the SIP framework, local governments and various industries are working on regional needs, natural and social conditions, and other factors unique to each region in Japan. Public-Private ITS Initiative/Roadmaps and SIP-adus are guideposts for these activities and play a catalytic role in sharing case studies and promoting projects.

6 Passing on SIP-adus legacy to the next generation

SIP-adus ends this fiscal year (2022). New programs such as "RoAD to L4" and the next phase of SIP "Construction of smart mobility platform" have begun to take over from this achievement. Across the nation, examples of materializing socially transformative innovation are beginning, including achieving carbon neutrality by 2050, and the Vision for a Digital Garden City Nation. SIP-adus is recognized around the world as an important example of these prior practices. The experience and knowledge gained over the past 10 years, as well as the achievements and methods of governance systems, cooperation and human networks, trust building, and fostering public acceptance, are invaluable and should be passed on to the next generation that creates as solid a narrative as possible.[6] We hope that SIP-adus will provide many suggestions for future innovation policy and implementation at the national and local levels, and for solving social issues and developing business.

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3) SIP-adus Achievement as Heritage and Next Step RoAD to the L4

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1 Overview of RoAD to the L4

RoAD to the L4: The Project on Research, Development, Demonstration and Deployment of Automated Driving toward the Level 4 and its Enhanced Mobility Services was launched by the Ministry of Economy, Trade and Industry (METI) and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) as a part of The Panel on Business Strategies for Automated Driving. It was launched in fiscal 2021 in line with the recommendations of the "Action Plan for Realizing Automated Driving Version 5.0" to study the direction that should be taken toward the practical application of MaaS (Mobility as a Service) in Japan.

(1) Significance

This project aims to create a sustainable mobility society based on major trends in the automotive industry such as CASE (Connected, Automated, Shared&Service, Electrification) and carbon neutrality, and is expected to contribute to reducing the environmental burden, solving mobility issues, and increasing the economic value of Japan by realizing and promoting advanced mobility services such as Level 4.

(2) Goals and KPI (Key Performance Indicator)

1) Realization and diffusion of unmanned automated driving services
- Realize automated driving services (Level 4) only by remote monitoring in limited areas and vehicles by fiscal 2022.
- Expand to a variety of areas and vehicles by fiscal 2025, with a minimum of 40 locations

2) Spread of new mobility services (MaaS) using IoT and AI
- Social implementation of new mobility services using IoT and AI in various regions of Japan to solve local social issues and revitalize local communities

3) Securing and developing human resources
- Secure human resources in a wide variety of fields, including engineers in hardware and software, and people who can match technology with local issues.

4) Fostering public acceptance
- Promoting accurate understanding and interest in automated driving, etc. and encouraging behavioral changes through easy-to-understand information dissemination from the user's perspective, provision of opportunities for realistic experiences, and organization of civil liability

(3) Implementation Policy

The project is not limited to technological development, research and analysis, and FOTs (Field Operational Tests), but also aims at social implementation of advanced mobility services such as level 4, based on the significance, goals, etc., set forth above.

(4) Status of efforts

RoAD to the L4 is a five-year project from fiscal 2021 to fiscal 2025, promoting the establishment of use cases, organization and evaluation of driving environments, development of vehicles and systems, and study of sustainable business models. For passenger transport, the project is studying three major types of spaces: limited space (low speed), limited space (medium speed), and mixed traffic space, while for freight transport, the project is studying limited space on expressways.

2 Specific Topics of Efforts

Theme 1: Efforts to realize automated driving services (level 4) by only remote monitoring

Aiming to realize an unmanned automated driving mobility service with only remote monitoring (level 4) using low-speed automated vehicles at Eiheiji Mairodo in Eiheiji-cho, Fukui Prefecture, by fiscal 2022, we are organizing a business model, verifying tasks for remote monitors, and so on.

In addition, development of automated driving systems and vehicles for mass production for level 4 mobility services, as well as remote control systems and communication systems for multiple

vehicles, and technological verification are under way. (Fig.1, Fig.2)

Fig.1: Mobility Service Vehicles in Eiheiji-cho

Fig.2 Remote Monitoring System in Eiheiji-cho

Theme 2: Initiatives to expand target area and vehicles as well as improve business feasibility

Aiming to realize an unmanned, automated driving mobility service on the Hitachi BRT (Bus Rapid Transit) in Hitachi, Ibaraki, the development and safety assurance of an automated driving system (vehicle, remote monitoring system, etc.) in accordance with the ODD (Operational Design Domain) settings has been initiated. Local FOTs are scheduled to be conducted by the end of fiscal 2022. In addition, a task force consisting of various operators involved in unmanned automated driving services has been established and has begun studying ODD classification, etc., and plans to compile various guidelines based on ODD classification during fiscal 2022. (Fig.3)

Fig.3: Hitachi BRT FOTs

Theme 3: Initiatives to implement advanced trucks, including platooning in expressways

With the aim of realizing automated driving trucks (level 4) on expressways by around fiscal 2025, the project has begun studying mainly business models, driving environments, operating conditions, etc.

Specifically, the project model is studied based on interviews with major logistics operators, and risks are extracted by examining the driving environment and operating conditions. (Fig.4)

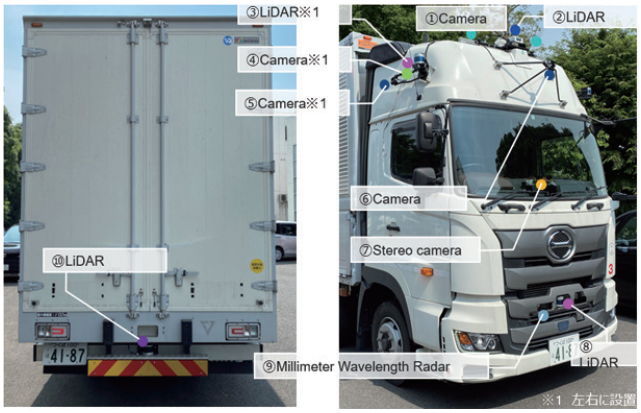

Fig.4 Truck for FOTs Equipped with Various Sensors

Theme 4: Initiatives to link vehicle-to-vehicle and pedestrian-to-vehicle and cooperative infrastructure to expand level 4 in mixed spaces

In order to realize cooperative automated driving services, we have started to organize use cases in which cooperative systems are required, and to study requirements on the infrastructure side and vehicle side and data coordination schemes required for cooperative systems.

In order to study the requirements for a cooperative system that provides safe mobility not only for level 4 users but also for various users such as pedestrians and bicycles, we have begun performance tests for demonstration purposes in Kashiwanoha, Chiba. (Fig.5)

Fig.5 Various Sensors Installed on the Infrastructure Side

3 Future Initiatives

RoAD to the L4 aims to socially implement the results of Theme 1 in society and launch automated driving services in fiscal 2023 as a leading example of this project.

For the other themes, the plan is to conduct necessary studies and preparations during the first two years, start FOTs in the third year, and then realize social implementation after undergoing review for various criteria.

For these plans, we plan to make maximum use of the results of the projects we have been working on in the second phase of SIP-adus, such as the Tokyo waterfront area traffic SPaT (Signal Phase and Timing) information provision FOTs, the study of communication methods that realize cooperative automated driving, and the study of public acceptance, with the aim of early social implementation of level 4 and other automated driving mobility services.

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3) SIP-adus Achievement as Heritage and Next Step Next Phase of SIP

Kenji Ueki (Cabinet Office)

1 Consideration of the next SIP

1.1. Background and Significance

The Cross-ministerial Strategic Innovation Promotion Program (SIP) was established by the Cabinet Office in FY2014 as a program to promote research and development from basic research to social implementation in a comprehensive manner through collaboration among, agencies, industry, academia, and government, utilizing the headquarters function of the Council for Science, Technology and Innovation (hereinafter referred to as CSTI).

The first phase of the five-year program was implemented from FY2014 to FY2018, and the second phase from FY2018 to FY2022.

For example, the high-precision 3D maps developed in the first phase of the Automated Driving System have been commercialized, and are in use in all expressways. This led to the development of Level 3 automatic driving laws by the relevant ministries and the launch of the world's first Level 3 automated vehicle (Honda "Legend"). It is indicative of SIP's contributions to the social implementation of innovative technologies.

Therefore, industry, academia, and government continue to have high expectations for SIP as a research and development program for social implementation, leading to discussions for the next phase of SIP starting in FY2023. In the interim institutional evaluation of the second phase of SIP conducted in FY2020, it was decided that the next phase of SIP would be implemented after institutional improvements, such as the establishment of a preparatory period for the formulation of research and development plans.

In response to this, the "Sixth Science, Technology and Innovation Basic Plan" (Sixth Basic Plan, Cabinet decision on March 26, 2021) states, "Candidate subjects for the next phase of SIP will be decided toward the end of 2021 in order to strengthen the headquarters function of the CSTI. Specifically,

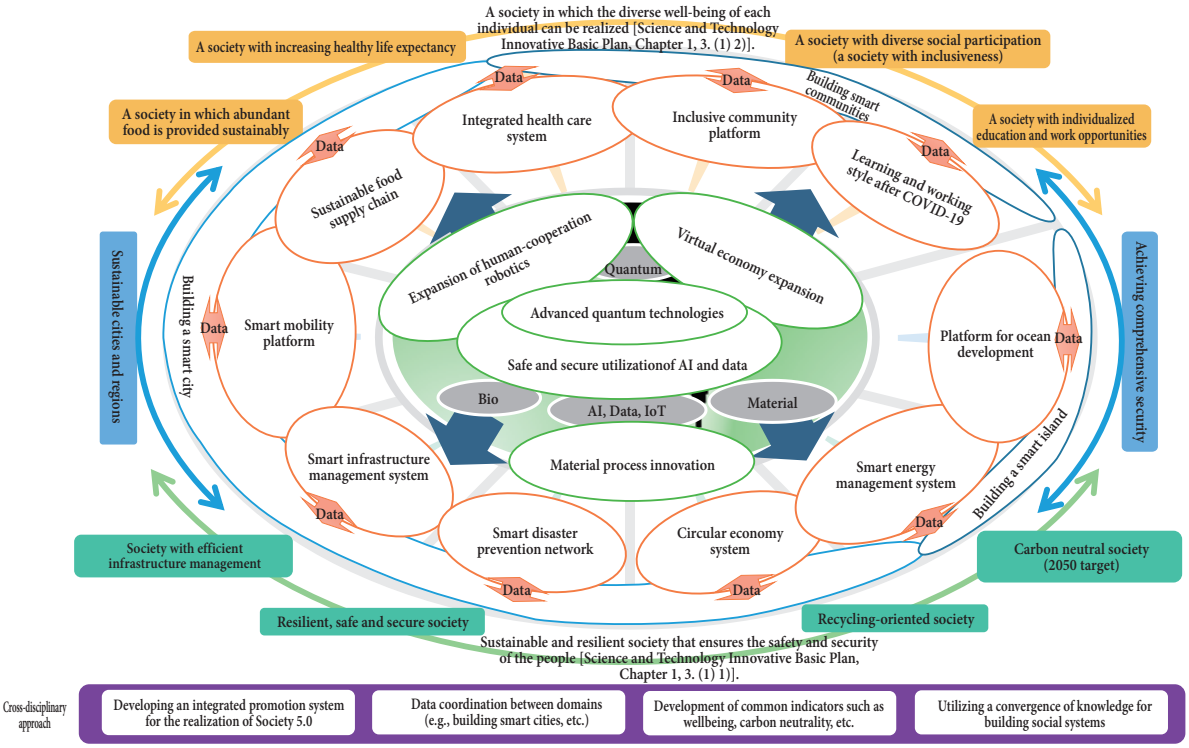

Fig.1: Candidate issues for the next SIP

it was decided that [...] CSTI will identify social issues to be addressed in the medium to long term, and will conduct research and studies on technological development themes that should be addressed across ministries and agencies, while utilizing "the convergence of knowledge."

1.2. Establishing Candidate Issues

In order to fully consider the issues to be addressed in the next phase of SIP in advance, the Governing Board of CSTI has identified 10 areas corresponding to the 10 social visions listed in the Sixth Basic Plan as "Society 5.0" that Japan is aiming for, and five areas corresponding to the technologies that will form the fundamental elements of these visions, including AI, data, quantum computing, etc. Those 15 areas form the subject candidates going forward. (Fig.1)

Meanwhile, efforts are underway at relevant ministries, industry, and academia. The next phase of SIP will not be an exhaustive effort, but will serve as a hub for collaboration among industry, academia, and government, and will work on the development of platform technologies for technological bottlenecks, on the construction of common systems, and on the establishment of rules.

In addition, rather than working independently in each area, efforts will be made to work toward the realization of Society 5.0 through the development of an integrated promotion system, data coordination among areas, the development of common indicators related to cross-cutting social issues such as wellbeing and carbon neutrality, and the utilization of the convergence of knowledge for the formation of social systems.

1.3. Request for Informtion for Research subject (RFI)

From January to February 2022, we requested for information of research theme ideas (RFI) for 15 areas, and received a total of 971 ideas from a wide range of parties in industry, academia, and government, including 384 from universities, 235 from national research institutes, 292 from private-sector companies, and 60 from sectoral associations.

Table 1: RFI results for next SIP subject candidates

Primary domain	Number of cases	Of those			
		Universities	National research institutes	Businesses	Organizations
Sustainable food supply chain	68	36	18	12	2
Integrated health care system	98	45	7	30	16
Inclusive community platform	16	9	1	6	0
Learning and working style after COVID-19	16	6	0	7	3
Platform for ocean development	80	11	54	10	5
Smart energy management system	67	35	12	16	4
Circular economy system	77	29	12	31	5
Smart disaster prevention network	191	56	59	71	5
Smart infrastructure management system	217	103	41	57	16
Smart mobility platform	43	13	4	24	2
Expansion of human-cooperation robotics	17	9	2	6	0
Virtual economy expansion	12	5	2	5	0
Advanced quantum technologies	26	9	10	7	0
Safe and secure utilization of AI and data	21	8	4	8	1
Material process innovation	22	10	9	2	1
Total	971	384	235	292	60

Although the number and scope of information varied depending on each area, ideas from a variety of universities, national research institutes, and companies were gathered from multiple perspectives. (Table 1)

Based on the results of the RFI, the overall direction and structure of sub-subjects for each subject candidate were clarified. The skills required of program director (PD) candidates who will lead the feasibility studies of each subject candidate were also clarified.

1.4. Selection of PD Candidates and Feasibility Studies

Based on the results of the RFI, the skills required of PD candidates were clarified, and an open call for PD candidates for each subject candidate was conducted from April 1 to 22. Based on the results of a documents review (primary screening) and interviews (secondary screening), the Governing Board selected 15 PD candidates on May 26.

In addition, for each subject candidate, task forces (TFs) was established under the Governing Board, chaired by PD candidates, and consisting of members from related academia, industry, ministries, and research promoting companies.

Currently, feasibility studies (FS) are being conducted under the TFs looking at the research themes provided in the RFI. The aim is to select the research themes based on the impact and feasibility from the technical and business aspects, to clarify the details and structure of the subjects, and to prepare draft research and development plans by the end of 2022.

After deliberation by the governing board and public comments, the research and development plans will be decided, and based on the plans, an open call the PD will be conducted. The next phase of SIP is scheduled to start in FY2023.

2 Feasibility study for the next phase of SIP subject candidate "Formation of smart mobility platform"

2.1. Clarifying the Concepts and RFI Results of the Subject Candidate

When the Governing Board established the subject candidates at the end of the 2021 fiscal year, "Formation of smart mobility platform" was selected as a candidate because it was reflective of a social vision. The concept was to "form a platform that realizes safe, environmentally friendly, and comprehensive mobility service by dynamically integrating means of transportation (small mobility, automated driving, MaaS, drones, etc.), transportation environment hardware and software from the perspective of people and goods on the move."

Based on this, an RFI was conducted from January to February 2022, and a total of 43 ideas were submitted. These ranged in scope from evaluation indicators and QoL improvement through mobility to elemental technologies and services such as mobility-related data platform, traffic environment simulators, multi-modal MaaS, dynamic utilization of road space, and innovative sensing technologies. (Fig.2) Of these, 13 were from universities, 4 were from national institutes, 24 were from companies, and 2 were from professional associations.

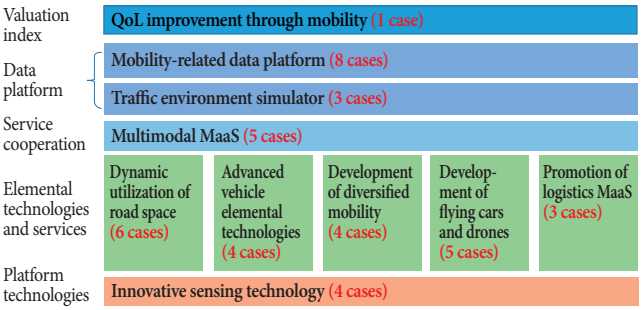

Fig.2: Organization of RFI results

Based on the RFI results, the skills required of PD candidates were defined as "knowledge, experience, and networks that enable them to look at the entire mobility field, including roads, vehicles, and logistics, and to develop an overall vision and architecture based on the functions and roles of mobility in accordance with the characteristics of cities and regions."

2.2. Feasibility Study Structure

On May 26, 2022, the Governing Board selected Dr. Haruo Ishida, Professor Emeritus of the University of Tsukuba and Visiting Professor of the Department of Transportation Systems Engineering, Nihon University, as a PD candidate, and on June 10, a TF was established with Dr. Haruo Ishida as the chair.

The TF includes Noboru Koshizuka, Professor of the Interfaculty Initiative in Information Studies, University of Tokyo, Fumihiko Nakamura, Professor of Graduate School of Frontier Sciences, University of Tokyo, Satoshi Hiyama, Chairman of the Subcommittee of the Road Traffic Section of the Connected Committee, Next Generation Mobility Committee, Japan Automobile Manufacturers Association, Shigetaka Murase, President, WILLER Inc. Ltd. as Sub PD candidates. Other related experts, ministries and agencies, and NEDO also join the TF, and the group at the Cabinet Office in charge of automated driving work as the secretariat of the TF. (Fig.3)

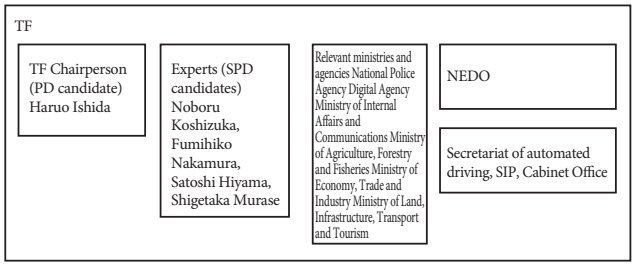

Fig.3: Feasibility study structure

2.3. Status of Feasibility Study Considerations

On June 27, 2022, the TF prepared the FS Implementation Policy ver. 1.0. In this policy, it was decided to "study the following four sub-subjects based on the RFI results in order to address social issues such as carbon neutrality, safety (zero fatalities in traffic accidents), economic vitality and regional revitalization, real and cyber integration, pursuit of wellbeing, and collaboration with overseas countries".

(1) Redefining Mobility Services and Strategies for Social Implementation
(2) Data platoform supporting mobility services (Smart Mobility Data Platform 2.0)
(3) Infrastructure Strategy to Support Mobility Services
(4) Strategies for the Social Implementation of Mobility services

Through basic research and interviews with RFI applicants, we plan to identify core research themes that should be considered individually for each subproject, and conduct a technical feasibility study for each.

These studies are expected to be advanced efforts toward a smart mobility society that include coordinated and flexible linkage with various means of transportation and transportation environments other than automated driving, while taking advantage of the results of SIP-adus (Cross-ministerial Strategic Innovation Promotion Program (SIP) Automated Driving for Universal Services).

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(1) The Sixth Science, Technology and Innovation Basic Plan, approved by the Cabinet https://www8.cao.go.jp/cstp/kihonkeikaku/6honbun.pdf, (2021.03.26)
(2) Determination of candidates for the program director (PD) of the next phase of SIP (chairperson of the task force to study each subject candidate) https://www8.cao.go.jp/cstp/stmain/20220527sip_pd.html, (accessed 2022.05.27)

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4) Final Summary of SIP-adus Program — For the Next Generation of Engineers —

Seigo Kuzumaki (SIP-adus Program Director, TOYOTA MOTOR CORPORATION)

As the SIP-adus (Cross-ministerial Strategic Innovation Promotion Program; Automated Driving for Universal Services) comes to a close, I would like to summarize it in the form of a message to the next generation of engineers.

As you know, in a "project," people with the skills and abilities necessary to accomplish a mission temporarily gather together across organizational boundaries, and when the mission is over, the organization is disbanded and ceases to exist. Strangers meet, begin by sharing an understanding of the issues, form a team, decide on a goal, stimulate each other through research and development, and become a force that is more than the sum of their parts to bring the project to a successful outcome. A "project" is a valuable opportunity to grow both technically and as a person, and a great chance to gain the wealth of human networks.

In the project under the name of SIP-adus, a sense of solidarity was gradually developed that transcended the barriers between government ministries and agencies, and between industry, academia, and government toward the goal of realizing automated driving, and ultimately produced a variety of results.

Young engineers are not expected to suddenly take on the role of promoting national projects, but as technology continues to develop and become more complex, there is no technological development that can be completed solely within one's own department. All research and development can be considered a "project." What is important is not to create barriers among ourselves, but to tackle the challenges in front of us with our colleagues with all our might. If you continue to do so, even if you fail a few times, when the next opportunity comes, you will surely get a lot of support and succeed.

With this, the SIP-adus will be "disbanded," but we hope that the next generation of engineers will boldly take up the challenge of creating Japan's next innovation.

Last but not least, I would like to reiterate my sincere thanks to all of you who have supported the SIP-adus!