# Workshop on Mission-oriented innovation policy in Japan and Germany: Rationales and experiences

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## Workshop summary

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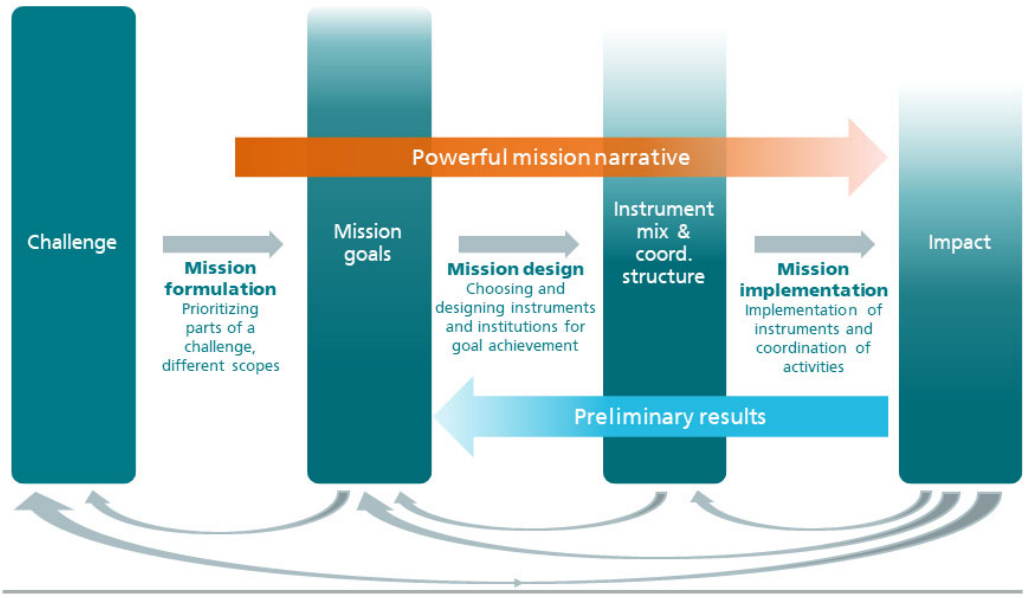
To address grand societal challenges, such as decarbonization and digitalization, many countries are turning to Mission-oriented Innovation Policy (MOIP) approaches. MOIP approaches are able to facilitate and guide complex transformative processes, but they also pose new challenges and requirements for policy-makers. To improve current practices in Japan, the Center for Research and Development Strategy (CRDS), which is an affiliate institution of the Japan Science and Technology Agency (JST), initiated a new research project on MOIP. CRDS is a think tank for Science, Technology and Innovation (STI) in Japan and also has substantial expertise in implementing funding programs at JST. In order to share experiences and exchange knowledge, the JST-CRDS organized a joint workshop with the Fraunhofer Institute for Systems and Innovation Research ISI. Fraunhofer ISI conducts applied innovation research and is responsible for the scientific support action to the German High-Tech Strategy 2025, studying the implementation of the current High-Tech Strategy and developing a framework for impact assessment of MOIP. The virtual workshop took place on 21 October 2021 and revealed several interesting opportunities to learn from each other and highlighted promising fields for future collaboration.

### Session 1: Mission-orientated innovation policy – rational, concept, and development

The first session of the workshop focused on conceptual aspects of mission-oriented innovation policy (MOIP). In the first presentation, Florian Wittmann (Fraunhofer ISI) gave an overview of conceptual aspects and general challenges of the MOIP approach. Besides highlighting the evolution of underlying rationales, reaching from science and technology policy, targeting fundamental research and fixing market failure to the re-orientation of policy towards addressing societal challenges, he emphasized two main conceptual insights of the scientific support action to the German High-Tech Strategy 2025. First, he argued that the growing popularity of MOIP is accompanied by an increasing diversity of missions that follow different logics. For this purpose, the research group had developed a typology to classify missions according to their actual formulation. Second, he introduced the conceptualization

of missions as multiple translation processes (from mission formulation and mission design to mission implementation), which can also contribute to a better understanding of the impacts of mission policies (cf. Figure 1). Despite the novelty of this approach, missions are not created from scratch, but are embedded in existing policy traditions and dynamics and are shaped by negotiation processes at different levels.

Figure 1: Role of translation processes for impact realization in missions




Source: Modified figure, based on Wittmann et al. 2021b

At the beginning of the first short discussion, Kerstin Cuhls (ISI) highlighted that policy making is not a linear process, even if it may appear as such. In practice, especially the formulation, which ideally incorporates foresight approaches, resembles an iterative process. In the following discussion, Tateo Arimoto (JST-CRDS, GRIPS, IIAS**)** shared his observation that in Germany a societal consensus about the balance between basic science and mission-orientated policies seems to have been reached as a follow up to the long history of promoting science. This appears to be one difference to Japan where certain programs are mainly promoted by policy-makers. In a direct response, Miriam Hufnagl (ISI) explained that there is always a need to justify why certain research might be necessary and funded with public tax money. However, it can be stated that policy layering is in place with old narratives as “basic science is needed” being complemented by new requirements as “science should now solve problems”. In closing remarks of the workshop’s first session, Kazuhito Oyamada (JST-CRDS) and Kimikazu Iwase (JST-CRDS) underlined that "great technology is simply not enough today", but the integration of innovation and technological advances requires a systemic view. In their opinion, a main challenge lies in the integration of MOIP into sectoral policy spheres, especially in identifying who leads/is responsible for each step and in a shared

understanding among actors. To this end, policy silos – which is a dominant feature of both countries – need to be overcome.

**Session 2: Strategic policy approaches and mission-oriented innovation policy aiming at transformative innovation in Japan and Germany**

The second session was devoted to a comparison of the historical evolution of STI policies in Japan and Germany. The first presentation was provided by Kazuhito Oyamada (JST-CRDS), presenting an overview of the historical development of Japan's STI policy for addressing societal issues and transformative innovation. In Japan, since late 1990's, addressing societal issues and strengthening industrial competitiveness are top-priorities of STI policy. To realize them, the Government of Japan has been reforming the STI governance system as well as its legal basis. In 2020, the Science and Technology Basic Act, which had provided the foundation for Japan's S&T policy was amended and renamed as Science, Technology and Innovation Basic Act and expand its scope to include "creation of innovation" and "humanities and social sciences." As for the governance system, the Council for Science and Technology Policy (CSTP) at Cabinet Office was changed to the Council for Science, Technology and Innovation Policy (CSTI) and its role as headquarters for STI policy was strengthened. CSTI strengthened its coordination role for STI-related activities, including those of sectoral ministries and its secretariat function was also reinforced. Integrated Innovation Strategy, which was developed annually, and center-of-government-led R&D programs (described in the next session) were introduced as tools for such coordination. The 6th Science, Technology and Innovation Basic Plan, which has just started in 2021, set the realization of its future vision "Society 5.0[1]" as its goal, aiming to ensure "the safety and security of the people by being sustainable and resilient" as well as the goal that "each individual can realize diverse happiness (Well-Being)."

Kazuhito Oyamada summarized that in Japan, framework conditions for MOIP have been developed. However, there are still several challenges in especially further implementation of MOIP. These include the integration with sectoral policies, utilization of demand-side policy measures, and horizontal and vertical coordination of various R&D programs.

The subsequent presentation by Miriam Hufnagl (ISI) focused on the evolution of the Germany High-Tech Strategy, which is currently in its fourth generation. After giving a quick overview of the historical development, she introduced the group to several key observations. Firstly, the narrative changed from "promoting key technologies" in 2006 to "tackling grand societal challenges" (2010-2014) and finally indicating to follow a "mission-oriented approach trying to solve 12 selected missions" in 2018. Secondly, she pointed out that even though the narratives may have changed, policy layering can be observed, entailing the risk of mere re-labeling of existing approaches without substantial change. Traditional instruments of

1 "A human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space."

research and innovation funding stay in place, while new funding schemes are introduced, raising issues of policy incoherence. Since more directionality imposes higher requirements for the definition of mission goals, coordination as well as strategic planning, the new schemes call for cooperation of heterogeneous actors, participation and increased reflexivity. Thirdly, with the High-Tech Strategy claiming "to be a comprehensive, department-spanning innovation strategy", it was concluded by Miriam Hufnagl that the new MOIP approach challenges existing practices and requires a truly cross-sectoral perspective. In other words, there is a need to overcome policy silos and achieve real cooperation. All of the aspects above result in massive challenges for impact assessment of MOIP.

Figure 2: Overview of the key areas of the first and current High-Tech Strategy


Source: Own elaboration by Fraunhofer ISI, based on documents of the High-Tech Strategy and https://www.hightech-strategie.de/hightech/en/home/home_node.html

In the subsequent discussion, Florian Roth (ISI) raised the question whether Germany – based on the Japanese experience – could benefit from moving competencies to the Chancellery as a central entity. According to the judgement of Japanese colleagues, this may be helpful for improving decision-making, but does not necessarily solve the problem of implementation. In addition to that, the observation was made that although a variety of cross-sectoral work is taking place in Japan, not all coordinated programs are well connected. Kimikazu Iwase explained that in Japan, although the power of the Council for Science. Technology and Innovation (CSTI) has been becoming stronger in policy-making, it still faces challenges regarding communication with ministries or funding agencies to implement funding programs as CSTI does not have first-hand information from the frontline of research projects. Florian Roth was also interested in the reasons for Japan's efforts to include R&I aspects into its foreign and development policies. This can be explained by a paradigm shift which took place about 20 years ago, with the government pursuing "science and technology diplomacy". Finally, Kerstin Cuhls (ISI) was wondering how important and relevant foresight activities are for current moonshot programs or initiatives. Kimikazu Iwase emphasized the strong foresight

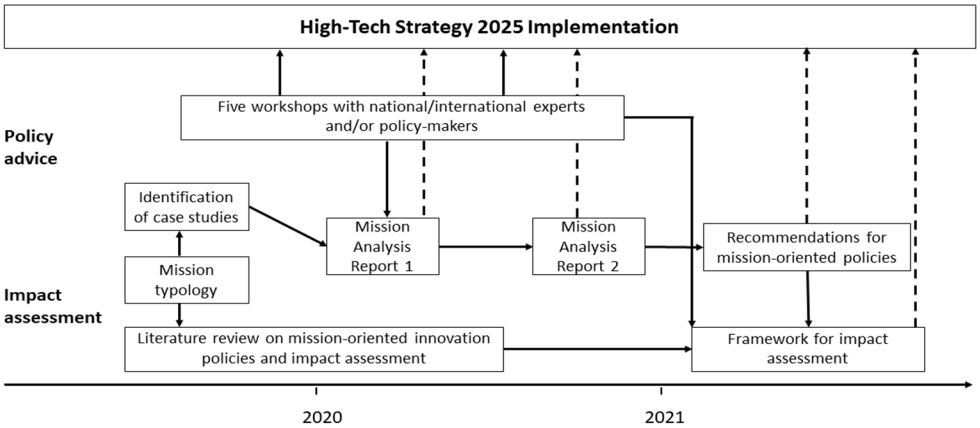
tradition in Japan but its focus has been mainly on technological aspects. Therefore, he acknowledged that there currently is a considerable need to expand capacities for foresight to discuss how societal aspects could be addressed. He also mentioned JST-CRDS's contribution to offer advice to the Moonshot Program in terms of ethical, legal, and social issues. A general and agreed observation of all participants was that thinking and acting in silos makes it difficult to formulate and implement MOIP in both countries.

## Session 3: Implementing mission-oriented innovation policies: activities and challenges

The third session was devoted to the discussion on current policies, providing insights into actual policy implementation, the scientific support action (Germany) and MOI programs (Japan). The session opened with a presentation by Florian Roth (Fraunhofer ISI) on findings from the scientific support action of the German High-Tech Strategy (HTS) 2025, which is commissioned by the Federal Ministry of Education and Research.[2]

The project has two intertwined objectives: First, it offers a scientific monitoring of the HTS and analyzes the intervention logics for individual missions. Second, it aims to develop a comprehensive impact assessment model for mission-oriented policies. To this end, the research team has put forward a new mission typology and conducted two Mission Analysis Reports on different aspects of the HTS. Further, Fraunhofer ISI has facilitated several workshops with international innovation policy-makers and scientists to foster the exchange of experiences and best practices. In crafting the Mission Analysis Reports, the research team specifically focused on four missions of the HTS: Fighting cancer, reducing greenhouse gas emissions in industry, circular economy and enabling good living conditions in urban and rural areas.

Figure 3: Structure of HTS 2025 support action project, source: Fraunhofer ISI

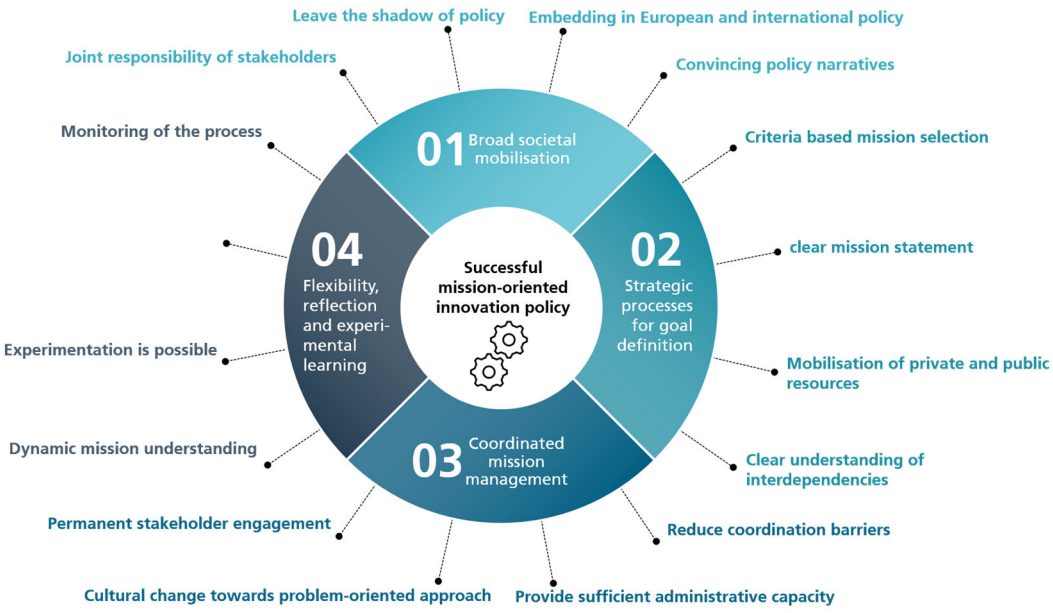



Source: Modified version based on https://www.isi.fraunhofer.de/en/competence-center/politik-gesellschaft/projekte/htf2025.html

2 For an overview of project activities and publications see https://www.isi.fraunhofer.de/de/competence-center/politik-gesellschaft/projekte/htf2025.html#123455831 or the section on additional readings.

Florian Roth presented several strengths as well as weaknesses of the HTS that have been identified in the analyses. On the positive side, the HTS covers a very broad range of relevant societal topics. Furthermore, the aspirations of the HTS go well beyond a narrow technical focus, reflecting a broad understanding of innovation processes. Finally, the HTS provides valuable links between different existing governmental programs and strategies. At the same time, Florian Roth also pointed to several weaknesses of the HTS, specifically the underdeveloped strategic mission formulation process. In addition, the research team came to the conclusion that political ownership and stakeholder involvement is rather limited for many missions that are part of the HTS. Also, there is too little horizontal as well as vertical coordination, inhibiting synergies of instruments and pursuance of shared goals. Florian Roth concluded his presentation with a set of recommendations for mission-oriented policies, based on a recently published policy brief on mission oriented innovation policies. Specifically, he put emphasis on the important role of societal activation for mission success and on the need for thought-through strategy processes for mission formulation. Further, he detailed how mission management could be better coordinated and principles of flexibility, reflection and experimental learning strengthened.

Figure 4: Elements of successful Mission-Oriented Innovation Policy

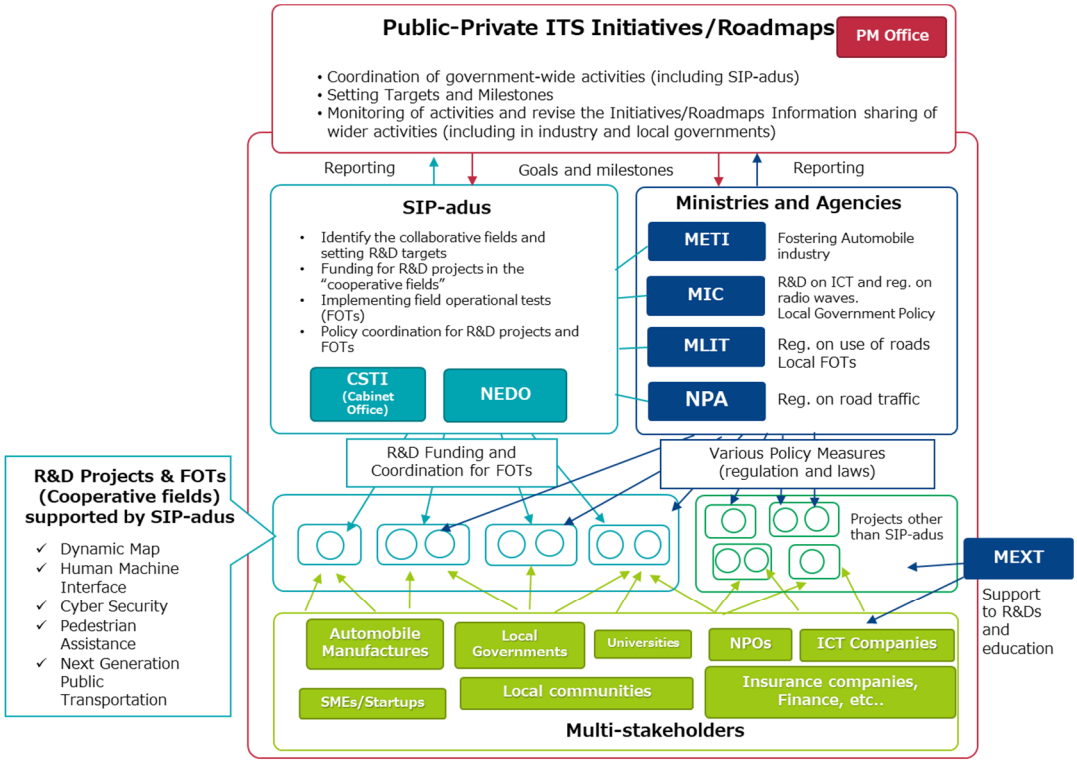



Source: Lindner et al. 2021, pp. 11-12

Kazuhito Oyamada (JST-CRDS) presented cases of mission-oriented innovation programs in Japan. He pointed out that Japanese programs can be classified by two types: 1) center of government-led programs and 2) agency-led programs. As mentioned in the previous

session, addressing social issues and enhancing industrial competitiveness are the two most important issues in Japan's STI policy. To this end, the Government of Japan has been implementing large R&D programs to achieve these two goals. The Council for Science, Technology and Innovation (CSTI) in the Cabinet Office plays a key role as a headquarters of STI policy and has directly managed these programs. These center of government-led programs include the cross ministerial Strategic Innovation Promotion Program (SIP), the Impulsing Paradigm Change through Disruptive Technologies (ImPACT) program and the Moonshot Research and Development Programs. In the SIP, the CSTI identified 12 themes for cross-ministerial cooperative R&D projects and reallocated budget to the ministries/agencies to conduct public-private cooperative R&D projects. As a successful case of the projects, he explained that SIP Automated Driving for Universal Service (SIP-adus) and the Public-Private ITS Initiatives/ Roadmaps are cases of mission-oriented R&D initiatives.

Figure 5: Overview of SIP-adus and Public-Private ITS Initiatives/Roadmaps




NEDO=New Energy and Industrial Technology Development Organization
METI=Ministry of Economy, Trade and Industry
MIC=Ministry of Internal Affairs and Communications
MLIT=Ministry of Land, Infrastructure, Transport and Tourism
NPA=National Police Agency
MEXT=Ministry of Education, Culture, Sports, Science and Technology

Source: Own elaboration by JST-CRDS based on the documents from the Public-Private ITS Initiatives/Roadmap and SIP-adus

In the cases of ImPACT and Moonshot R&D Program, CSTI set ambitious goals based on the future vision, and funding agencies conducted high-risk R&D programs. Inspired by DARPA of the United States, Program Director/Manager systems were applied to both programs.

On the other hand, Japan also has been conducting the programs that supported bottom-up efforts to address societal challenges. The Research Institute of Science and Technology for Society (RISTEX) conducted R&D programs to develop prototypes of solutions that could be utilized to address societal problems and contribute to system transformation. The Center of Innovation (COI) program set the future visions and support university-industry collaborative research sites at universities to promote research and development activities to realize shared future visions. Both programs required stakeholder engagement and cross-disciplinary collaboration. Such “transdisciplinary” approaches are also necessary for the mission-oriented research and innovation activities.

Finally, he pointed out that Japanese approaches heavily rely on supply side efforts (e.g. R&D programs). As demonstrated in the exceptional cases of the SIP-adus and the Public-Private ITS initiative and Roadmaps, mobilization of demand side measures and wider engagement of stakeholders are necessary to promote the MOIP approach to realize transformative innovation.

In addition, Tateo Arimoto listed the significant points that could lead SIP-adus to be successful. Firstly, in the Pubic-Private ITS Initiatives/Roadmaps, the Prime Minister Office was strategically involved, and this top-down governance structure contributed to giving incentives to different ministries to align their policy measures to the roadmap. Secondly, the Program Director of SIP-adus from the car industry had strong leadership based on the trust among related actors, which helped to mobilize the capacities of various stakeholders. Thirdly, continuity of funding is also an important element to transfer knowledge to a successor program. Finally, the strategy to disseminate the result of the project in society, especially in local areas in relation to a local university, should be taken into account as well.

In the discussion, Ralf Lindner (ISI) shared his observation that Japanese policy making seems to begin with a clear vision as a starting point, and ensures the involvement of key actors. These visions provide guidance for "real policies" and the implementation of missions. However, Ralf Lindner was wondering how the match between challenges and programs/policies is assessed. The plenum agreed that this is still a rather unsolved challenge in its own, due to the complexity of the MOIP approach that claims to foster the transformation of socio-technological systems. Since many societal challenges cannot be solved by technologies alone, the Japanese focus on tech-supporting activities needs to be complemented by more participatory bottom-up initiatives by societal and other actors, as the Japanese colleagues pointed out.

Miriam Hufnagl raised the issue of sharing responsibilities and ensuring mobilization. Kazuhito Oyamada explained that the Public-Private ITS Initiatives and Roadmaps pursued

a broader approach that allowed to incorporate regulation by the government and bottom-up initiatives by industry. Under such conditions, the SIP-adus conducted research and development activities in the collaborative fields, and field operational tests (FOTs) of the developed systems could not be conducted solely by individual companies. While joint funding was not required in the first period of the program for autonomous driving, it is necessary for the second stage. The Program Director and the Sub-Program Directors of this program are from the car companies, and considerable commitments where made by industry. Tateo Arimoto added that the case of autonomous driving is an exception, due to the urgency of how to maintain industrial competitiveness, and to secure local public transportation services. The case shows how MOIP's success relies on a close cooperation between industry and policy-makers. The main challenge will be finding out how this successful approach from the automobile case could be transferred into other programs.

**Session 4: Open discussion: Towards implementation of more sophisticated MOIP**

In order to start the open discussion, Ralf Lindner summarized the discussions so far by pointing out that despite different approaches and policy legacies, both countries seem to be facing very similar challenges.

Guiding questions for the open discussion:

1. What can be done to bring mission-orientated, transformative change forward?
2. What kind of gaps can be identified between ideal MOIPs in academic/public discourse and actual implementation of MOIP initiatives in each country?
3. What is performed by the national governments in both countries, and how can government agencies/funding agencies foster transformative innovation ecosystems?
4. What can be done to go forward in regard to MOIP while also considering certain limits?

Kazuhito Oyamada and Tateo Arimoto again highlighted **the importance of past policy structures** while asking how to realize cross-ministerial cooperation and what kind of approaches have been employed in Germany for enhancing cross-sectoral cooperation and ownership. In this context, Miriam Hufnagl explained that it is misleading to think of Germany as a good example for cross-ministerial cooperation. In the High-Tech Strategy, formally a couple of ministries are involved in each mission, however, this is due to a compilation of already existing policy instruments under the mission headline through an editorial process for publications by government. Ralf Lindner indicated **path dependencies in funding structures that are still dominated by a classical paradigm. This underlines the need for creating new ties and linkages to other stakeholders, as current funding primarily focuses on research activities**. Florian Roth moreover emphasized the need for an in-depth understanding of the socio-technical system. Specifically, we need to analyze non-linear effects across system scales, to avoid unintended or even counterproductive effects of mal-aligned policies. Another issue was raised by Florian Wittmann, pointing to the fact that **a**

**credible agent of change might be needed**. The question is how can actors be mobilized effectively, and how do ministerial procedures need to be rearranged? Missions are not supposed to duplicate or simply bundle existing policies, but **need to take into consideration the existing policy landscape during the process of mission formulation and design and adapt it in order to match the purpose of the mission goals**.

Tateo Arimoto emphasized **the importance of accompanying science-based support**, sharing his observation that in Japan, scientific monitoring/analysis on the result of a funding program/strategy has been relatively marginal, although such research measures are necessary to **evaluate a program based not only on scientific excellence but also on social impact**. With regard to how to reflect the impact on society, Tateo Arimoto and Kimikazu Iwase also underlined that it is **necessary to adjust both the mindset and priorities**, combing a traditional technological focus while also considering new societal changes. This cannot be achieved without a combination of top-down policies and bottom-up actions **from universities, the tech-sector and the needs articulated by the problem-owners**. Ralf Lindner supported this argument, emphasizing that many structures in research systems need to be changed, as existing incentives (e.g. focus on publications) are not necessarily in line with creating impact. This requires new science indicators and new perspectives on how to track (and possibly measure) activities of researchers. Kazuhito Oyamada pointed out that **in the Moonshot Program a portfolio management scheme was introduced, however, the key question remains what criteria can be used for decision-making. Unlike DARPA, there are no clear metrics, and especially the decisions which projects should be terminated are very difficult**.

The participants agreed on the aspect that fostering basic research is very expensive and that the need of opening up for industrial problems might enable some co-funding of research facilities. Miriam Hufnagl furthermore pointed out the need for policy experiments and learning if current structures and approaches to change significantly. Accepting failures along the way is important, equally important though is keeping track of change with useful monitoring and impact assessment tools.

Ralf Lindner summarized the workshop with some closing remarks:

- Firstly, he stressed the importance of the need for further exchange as many helpful insights any similarities have been indicated throughout the discussion. It might be beneficial for both sides to focus on methods for impact assessment of MOIP in another workshop.
- Secondly, all participants agreed that policy-making itself needs to be transformed. This touches upon characteristics of the mission formulation process, including visioning, the usage of strategic intelligence and foresight processes, and the provision of sufficient capacities for mission management etc. While there is

consensus that missions require the mobilization of different actors, both countries would need to further clarify the own understanding.

- Thirdly, to achieve transformative change it is necessary to combine STI policy instruments with other policy sectors and instruments, the Japanese SIP-adus case presented provided a very good example for this.
- Finally, challenges of coordination and mission management can be identified as a main obstacle in both countries. The high-level political responsibility in Japan might not overcome all potential problems (as discussed earlier), but seems like an interesting way forward. Similar approaches are currently being debated in Germany, discussing whether it might be necessary to transfer responsibilities for MOIP to some agency outside of ministries or to the Federal Chancellery.

**Participants of the workshop**

| Name | Organization |
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| Miriam Hufnagl | Fraunhofer ISI |
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**Related literature:**


Government of Japan (2021): Science, Technology and Innovation Basic Plan (tentative translation). https://www8.cao.go.jp/cstp/english/sti_basic_plan.pdf

Larrue, P. (2021a): The Design and Implementation of Mission-oriented Innovation Policies: A New Systemic Policy Approach to Address Societal Challenges; OECD Science, Technology and Industry Policy Papers, No. 100: Paris, OECD Publishing: https://doi.org/10.1787/3f6c76a4-en.

Larrue, P. (2021b): Mission-oriented Innovation Policy in Japan: Challenges, Opportunities and Future Options, OECD Science, Technology and Industry Policy Papers, No. 106: Paris, OECD Publishing: https://doi.org/10.1787/a93ac4d4-en.

Lindner, R.; Edler, J.; Hufnagl, M.; Kimpeler, S.; Kroll, H.; Roth, F.; Wittmann, F.; Yorulmaz, M. (2021): Mission-oriented innovation policy. From ambition to successful implementation. Karlsruhe: Fraunhofer Institut für System- und Innovationsforschung ISI.https://www.isi.fraunhofer.de/content/dam/isi/dokumente/policy-briefs/policy_brief_mission-oriented-innovation-policy.pdf

Strategic Conference for the Advancement of Utilizing Public and Private Sector Data, Strategic Headquarters for the Advanced Information and Telecommunications Network Society (2020): Public-Private ITS Initiative/Roadmaps 2019: https://japan.kantei.go.jp/policy/it/2019/2019_roadmaps.pdf

Wittmann, F.; Hufnagl, M.; Lindner, R.; Roth, F.; Edler, J. (2021a): Governing varieties of mission-oriented innovation policies: A new typology. In: Science and Public Policy, 48 (5), S. 727–738. https://academic.oup.com/spp/article/48/5/727/6332628

Wittmann, F.; Hufnagl, M.; Roth, F.; Yorulmaz, M.; Lindner, R. (2021b): From mission definition to implementation: Conceptualizing mission-oriented policies as a multi-stage translation process. Karlsruhe: Fraunhofer Institut für System- und Innovationsforschung ISI. https://www.isi.fraunhofer.de/content/dam/isi/dokumente/cci/innovation-systems-policy-analysis/2021/discussionpaper_71_2021.pdf

Wittmann, F.; Hufnagl, M.; Roth, F.; Yorulmaz, M.; Lindner, R. (2021c): Second Mission Analysis Report of the Scientific Support Action to the German Hightech Strategy 2025: Zooming in: Translating missions into policy instruments. Karlsruhe: Fraunhofer Institut für System- und Innovationsforschung ISI. https://www.isi.fraunhofer.de/content/dam/isi/dokumente/ccp/2021/Hightech_Strategy_2025-second_mission_analysis_report.pdf

Wittmann, F.; Roth, F.; Hufnagl, M. (2020): First Mission Analysis Report of the Scientific Support Action to the German Hightech Strategy 2025. Setting the stage: Positioning the missions in the socio-technical system. Karlsruhe: Fraunhofer Institut für System- und Innovationsforschung ISI. https://www.isi.fraunhofer.de/content/dam/isi/dokumente/ccp/2020/Hightech%20Strategy%202025%20-%20first%20mission%20analysis%20report.pdf