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THE DESIGN AND IMPLEMENTATION OF MISSION-ORIENTED INNOVATION POLICIES

A NEW SYSTEMIC POLICY APPROACH TO ADDRESS SOCIETAL CHALLENGES

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The design and implementation of mission-oriented innovation policies: A new systemic policy approach to address societal challenges

By Philippe Larrue

(OECD Directorate for Science, Technology and Innovation)

This paper analyses 'mission-oriented innovation policies' (MOIPs), a new type of systemic intervention that a growing number of countries has implemented in order to tackle mounting societal challenges. These policies aim to alleviate some of the most prevalent weaknesses within many national systems of innovation, notably the lack of holistic strategic orientation and policy co-ordination, and fragmented policy mixes. This paper leverages a dedicated analytical framework to systematically explore the challenges and opportunities that these policies present at initiative and country levels. In doing so, it provides a better understanding of the different ways in which governments design, fund and coordinate MOIPs, and contributes to broadening the range of options available to either improve or initiate this policy approach. This paper complements the MOIP Online Toolkit (https://stip.oecd.org/stip/moip), the OECD knowledge platform on MOIPs.

Keywords: Science and technology, Innovation, societal challenges

JEL codes: O14, O25, O38, Q55

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This report draws on the MOIP Online Toolkit (https://stip.oecd.org/stip/moip), a comprehensive knowledge platform on mission-oriented innovation policies. The Toolkit was developed by Philippe Larrue, with support from the STIP Compass team, in particular Andres Barreneche, Sylvain Fraccola, Michael Keenan, Blandine Serve (all from the Directorate for Science, Technology and Innovation, OECD) and Thierry Vebr (Executive Directorate, OECD). The web design company Buddyweb carried out the technical development of the platform.

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Executive summary

Faced with mounting societal challenges and acknowledging the limitations of traditional STI policies, such as weak directionality, lack of holistic co-ordination and fragmentation of the policy mix, a number of countries have started experimenting with various types of systemic interventions, commonly labelled as 'Mission-oriented innovation policies' (MOIPs).

MOIPs are defined as a co-ordinated package of policy and regulatory measures tailored specifically to mobilise science, technology and innovation in order to address well-defined objectives related to a societal challenge, in a defined timeframe. These measures possibly span different stages of the innovation cycle from research to demonstration and market deployment, mix supply-push and demand-pull instruments, and cut across various policy fields, sectors and disciplines.

To allow for a finer-grained characterisation of MOIPs initiatives, their expected features are defined along three dimensions:

- Strategic orientation – Legitimacy, Directionality, Intentionality, Flexibility
- Policy co-ordination – Horizontality, Verticality, Intensity, Novelty
- Policy implementation – Policy mix consistency, Fundability, Evaluability, Reflexivity

These so-called 'MOIP design principles' constitute an ideal-type of MOIP since few initiatives – if any – can 'tick all boxes'. Their identification as 'mission-oriented' is therefore a matter of interpretation and debate. A systematic scan of policy landscapes worldwide allows to identify at this stage about 40 policy initiatives that match the design principles to a *significant* extent. Following a pragmatic and formative approach, the MOIP initiatives considered in this study should be sufficiently close to the ideal-type to allow learning on the wide variety of opportunities and challenges of mission-orientation.

MOIPs take a variety of organisational forms, such as for instance a strategic or policy framework, a programme or a policy scheme. Their common characteristic is to include consistent and integrated arrangements that allow strategic orientation (co-creation of an agenda for addressing the challenge), holistic policy co-ordination (across policy silos) and integrated implementation (a policy mix of interventions covering all relevant needs). They are therefore distinct for instance from a strategy that would not have a dedicated governance structure and mechanisms for implementation. Similarly, a research programme that ambitiously aims to overcome scientific bottlenecks, but without formal linkages with instruments for innovation and market launch, would not qualify as an MOIP.

The diversity of MOIPs calls for a typological approach in order to find regularities in consistent groups of initiatives. Four types of MOIPs are distinguished, with specific opportunities and challenges: Overarching mission-oriented strategic frameworks, Challenge-based programmes, Ecosystem-based mission programmes, Mission-oriented thematic programmes. The type of MOIP established in a country hinges significantly on the type of missions they pursue, notably their level of wickedness. As an initial approach, 'Overarching mission-oriented strategic frameworks' seem to allow for more transformational missions and the 'Challenge-based programmes' for missions seem better suited for (faster) provision of solutions to a well-identified problem. A finer-grained analysis reveals a more nuanced association whereby the various types of MOIPs guide different pathways to societal transformation. 'Challenge-based programmes' might start

with 'niche innovations' by small networks of actors which, if scaled up and diffused, can result in significant transformations of established socio-technical regimes. Whereas larger and more directly ambitious initiatives might intervene upfront at the level of the socio-technical regime through conscious and planned efforts to transform it and make it more sustainable.

Based on 20 MOIP initiative case studies and 4 MOIP country case studies, this report systemically formalise and categorise mission oriented practices and patterns along the three dimensions of strategic orientation, policy co-ordination and policy implementation. While there is no single 'silver bullet' to be simply replicated, the following results can be put forward:

- Most MOIPs follow an open and non-prescriptive approach whereby they 'pick problems, not solutions'. However, as the organisations promoting and leading this approach are mainly from the science and technology policy fields, few of them consider social innovation.
- Few of MOIP initiatives have set objectives that have the expected mission characteristics: clear, bold and inspirational, with wide societal relevance, ambitious but realistic, targeted, measurable, time-bound and solution neutral.
- Missions are generally not set at the inception of MOIP initiatives, but are a result of very gradual and inclusive process, through which the scope of objectives is progressively narrowed down from broad challenges and missions to objectives set in projects.
- Almost all MOIP initiatives mix societal and economic objectives. This can generate some mismatch in terms of the geographic scope of the policy intervention needed to fulfil these different objectives.
- All MOIPs are steered and governed through elaborated multi-level governance structure, e.g. 'nested', multi-polar and cross-ministerial / cross-agency governance structure.
- The implementation of a portfolio approach within MOIPS allows a coordinated exploration of the different options to a given challenge.
- There are very few evaluations of MOIPs to date and almost all of them still rely on traditional (non-systemic) evaluation tools and methods.
- Although they are difficult to estimate, MOIPs involve additional costs, mainly related to their dedicated strategic, programming and operational governance bodies. However, there have been only a few evaluations that could shed light on the costs and benefits of MOIPs;
- No MOIP initiative was started from scratch; they all build on previous policies implemented in the country. They result from a gradual process with dedicated effort to make the existing policies better oriented and coordinated, either 'from the inside' (e.g. improvement of a scheme to make it more challenge-oriented and cross-sectoral) or 'from the outside' (most often by adding a governance layer to coordinate various existing interventions);
- The design of MOIPs is significantly influenced by the specificities of the national institutional setting in which they are embedded. MOIPs are the result of a gradual and country-specific process. National 'MOIP trajectories' unfold and move forward through experimentation, negotiation and learning in an evolutionary way, building on existing policy settings and instruments;

- Several countries that have experimented MOIPs are now confronted with the difficulty to scale them up and integrate them in the broader strategic and policy framework. This requires not only a capacity to learn from these experiments and reflect this knowledge into existing or new initiatives (reflexivity), but also a high level political commitment.

1. Introduction

1.1. The urge to mobilise science, technology and innovation policies to tackle mounting societal challenges

Developed and developing countries are facing mounting societal challenges with potentially tremendous impact on people's life and well-being in the not too distant future (OECD, 2016a). Against this backdrop, a growing number of policy makers, experts and scholars have increasingly called for new policy approaches to address simultaneously economic growth, societal wellbeing and global challenges.

Traditional STI policy mixes implemented today are characterised by an increasing weight of indirect incentives (Appelt *et al.*, 2019) which cannot be leveraged to strategically orientate research STI activities towards priorities. More generally, the effectiveness and relevance of horizontal policies are increasingly questioned in the public debate traditional (OECD, 2020a). Furthermore, most national policy landscapes remain largely fragmented across different public interventions, owing at least in part to silos between governmental bodies at ministry and/or agency levels.

Policy fragmentation results in numerous policy initiatives addressing related but dispersed objectives with specific emphasis on certain disciplines, sectors or stages of the innovation process. These policy mixes fall short of what is needed, for instance, to combat global warming or find solutions to feed 7 billion people in a sustainable way:

- Societal challenges raise multifaceted and interrelated scientific, technological and socio-economic issues that require coherent government support across disciplinary, sectoral and policy silos (OECD, 2019);
- When dealing with issues such as climate change or aging, innovations will have to be embedded in a wider set of co-ordinated social, economic and political changes contributing to a genuine socio-technical or sustainable transitions/transformation (Geels and Schot, 2007); (Fagerberg, 2018); (Schot and Steinmueller, 2018).

Tackling challenges of this unprecedented scale and scope requires better strategic orientation and holistic co-ordination of Science, Technology and Innovation (STI) interventions. More recently, the COVID-19 pandemic has reinforced the urgency for better frameworks of collective action towards common and well-defined objectives (OECD, 2020b).

Taking advantage of an existing concept used to describe the government support to large technological projects in the space and military areas, this new policy approach has been called (new) 'Mission-oriented innovation policy' (MOIP). It aims at better orientating and co-ordinating public interventions in order to address ambitious societal goals. MOIPs are defined as a *co-ordinated package of research and innovation policy and regulatory measures tailored specifically to address well-defined objectives related to a societal challenge, in a defined timeframe. These measures possibly span different stages of the innovation cycle from research to demonstration and market deployment, mix supply-push and demand-pull instruments, and cut across various policy fields, sectors and disciplines*.

While none of them fully corresponds to this definition, about 40 policy initiatives worldwide match it to a *significant* extent. Those that come the closest to the definition are the most recent ones.

1.2. The OECD project on the design and implementation of mission-oriented innovation policies

The present report concludes a first project on MOIPs launched in 2019 by the OECD Committee for Scientific and Technological Policy (CSTP), with a follow-up project already in the pipeline for the next biennium. This project's objectives was to provide a better understanding of the different ways in which governments design, fund and coordinate this new policy approach. It aims to broaden the range of options available to policy makers to either improve or initiate such an approach, and explore the opportunities and challenges in doing so.

The present report develops a taxonomy of current approaches to MOIPs at initiative and country levels, and draws a number of lessons from their comparative analysis. The analysis points to challenges, opportunities and ways forward for each specific type of MOIP. The report addresses both those who are currently responsible for some form of MOIP and wish to improve their implementation and think about the 'next stage in mission-orientation', as well as those who are wondering about the opportunity and challenges of adopting such policy approaches.

To succeed in this, a systematic scan of policy landscapes worldwide, based on a dedicated analytical framework, allows identifying and categorising the most advanced MOIP initiatives currently in place in a range of countries. Detailed information on 20 of them, covering the main types of MOIPs, were collected and analysed to provide a better understanding of the different ways in which governments design, fund and coordinate this new policy approach. These investigations 'across-the-board' are complemented by more in-depth analysis of how MOIP initiatives fit in their national institutional settings in four countries (Austria, Japan, Korea, Norway). The results of the project are available in two complementary products, this final report and an online policy toolkit (available at https://stip.oecd.org/stip/moip). The four national case studies are also available as stand-alone reports.

1.3. Caveats

At the early stage of their development, providing analyses and lessons-learned on MOIPs run two main risks: over-optimism and excessive prudence:

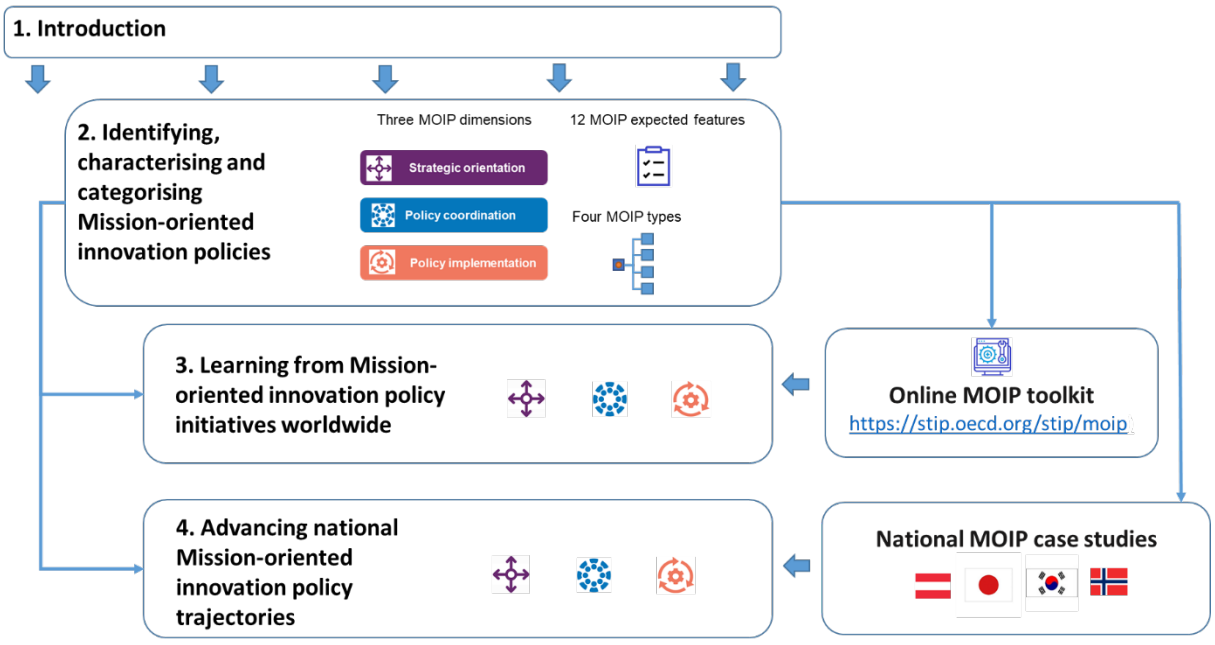
- When a new policy approach arises – possibly becoming 'fashionable' as it sometimes seems to be the case with MOIPs – one typical pitfall is to be over optimistic about what it can achieve. None of the MOIP initiatives considered in this report, nor the specific ways in which they perform strategic orientation, policy co-ordination and policy implementation, are presented as a recipe for success. First of all, MOIPs may come at a high cost – often not accounted for – and they hold limitations and risks. Second, their effectiveness, although quite clear in principle since they correspond to the STI 'common wisdom', is still to be proven through evaluations adapted to their systemic nature. To date, no such evaluation has been performed, nor the relevant evaluation methods been developed. Third and last, these policies are highly 'local', *i.e.* specific to a national context and a specific challenge area;
- At the same time, there is also a danger of policy hesitation in the face of the complexity and level of ambition of these policies. Interactions with policy makers in some countries tend to show that their position is that '*this is too big to handle*'.

The analysis in this report aims to avoid these two risks. The examples of MOIP initiatives do not aim to be presented as universal silver bullets but to broaden the range of options available to policy makers to either improve or initiate such policy approach. Although not readily replicable, these experiments, pilots and early MOIPs provide essential inputs into the policy process of other countries. The analysis also shows the process that led to the design and launch of these initiatives; in almost all cases it has been a very gradual process, building on existing schemes and proceeding by progressive reforms. Finally, it reveals that there are many types of MOIPs, some of them very complex and overarching, others more focused and small scale. There is little in common between, for instance, the Dutch Mission-driven Topsector and Innovation Policy that covers the whole economy and intends to crosses sector and mission agendas, and the Science Foundation Ireland's Innovative Prize that aims to make call for proposals more challenge-based. Still, they both aim for making a difference on societal challenges through better oriented and coordinated intervention. Therefore, there is no one size fits all, and all countries can find types of MOIPs that are more relevant to their own national agenda and capacity.

1.4. Structure of the Policy Paper

Following the introduction and a methodological chapter that presents the definition and typology of MOIPs that are used throughout the whole report, two main substantive chapters present the result of the analysis of MOIPs at initiative and country levels respectively (Figure 1). The details of each MOIP initiative case is available in the MOIP toolkit and are accessible through countries, societal challenges or types of MOIPs. Direct access to specific analytical 'how to' questions are available via the 'MOIP learning hub'. The complete MOIP country case studies are available in stand-alone reports.

Figure 1. Structure of the report



2. Identifying, characterising and categorising Mission-oriented innovation policies

2.1. The definition of Mission-oriented innovation policies

2.1.1. The origin of the Mission-oriented innovation policy concept

1. Originating from the space and military areas and the emulation of the design of the Manhattan or Apollo programmes, the content and domain of application of the concept of mission-orientation gradually shifted towards systemic intervention aiming to address societal challenges.
2. The first reference to 'mission-orientation' was applied to the type of activities being supported, not to the policy itself. Weinberg (1967) argued in favour of "Mission-oriented R&D", defined as "*big science deployed to meet big problems*". The author clamed that large-scale research, notably those in the space and nuclear field, should to be redirected towards societal issues such as pollution and energy.
3. The term evolved to qualify certain types of policies or national innovation systems, and in particular those with prominent defence and/or space R&D components. The term "mission" itself reveals strong connotations of military operations. Often referred to as examples of this 'old type of MOIPs' – as they became to be called – were the 'Manhattan Project' or the 'Apollo Programme'. The dominant feature of a mission-oriented policy as initially defined by Ergas (1987) was its concentration in terms of decision-making, number and types of technologies, projects and participants on the preferred technological development path.
4. In the 1990s, and especially at the beginning of the 2000s, the interest grew around the deployment of focused and proactive policies to fight mounting societal challenges such as global warming. This was coined in the so-called Maastricht Memorandum as a 'new mission for science and technology policy' (Soete and Arundel, 1993). While 'old mission-oriented projects' targeted the areas of nuclear, defence, and aerospace programmes, 'new mission-oriented policies' are expected to produce economically feasible technical solutions to particular environmental problems. Examples include policies with the mission of helping countries cut greenhouse-gas emissions by developing and commercialising carbon-free primary power technologies (Hoffert et al., 1998; Michaelson, 1998), developing hydrogen energy (Dunn, 2002), or biofuels (Somerville, 2006).
5. Freeman (1996) is among the first scholars to refer to mission-oriented policies in the context of a 'systemic model' of innovation policy in order to enable a worldwide transition to a 'green techno-economic paradigm'. Mission-oriented policies supporting such transition require:
    - a wide range of participants including government, private firms and consumer groups contributing to influence goal setting and the direction of technical change;
    - a systemic policy including a coherent portfolio of complementary instruments.
6. The design of such "new" mission-oriented policies contrasts with that of 'old' mission-oriented programmes (Mowery, Nelson and Martin, 2010). The Manhattan or Apollo projects were designed, funded, and managed by a few federal agencies, using mostly supply-side instruments to achieve a specific technological solution of which the government was effectively the sole customer. Systemic global challenges require efforts from several agencies, deploying supply- and demand-side instruments that aim to achieve a global mission of which humanity is the ultimate customer.

7. The concept of mission-oriented policies picked up a new momentum when the European Commission started discussing the application of this approach to the design of the Pillar 2 of the next Framework Programme Horizon Europe. The high-level group of leading experts chaired by Pascal Lamy (President Emeritus of the Jacques Delors Institute) recommended in 2017 that the next framework programme should focus on a few large-scale research and innovation 'missions' which encompass an entire portfolio of activities, rather than individual calls, with a view to address global challenges (European Commission, 2017). Based on this injunction and the results of the interim evaluation of the ongoing Horizon 2020 programme – which appeared still geared toward the achievement of knowledge-related objectives rather than the resolution of societal challenges (European Commission, 2017) – the Commission launched two strands of studies. First, the leading economist Mazzucato set the basis of the concept (European Commission, 2018). The second was conducted by a consortium of research institutes – the Joint Institute for Innovation Policy (JIIP) – which conducted an early inventory of mission-oriented policy initiatives in advanced and emerging countries (European Commission, 2018)and a study into the impact of these policies (European Commission, 2018).

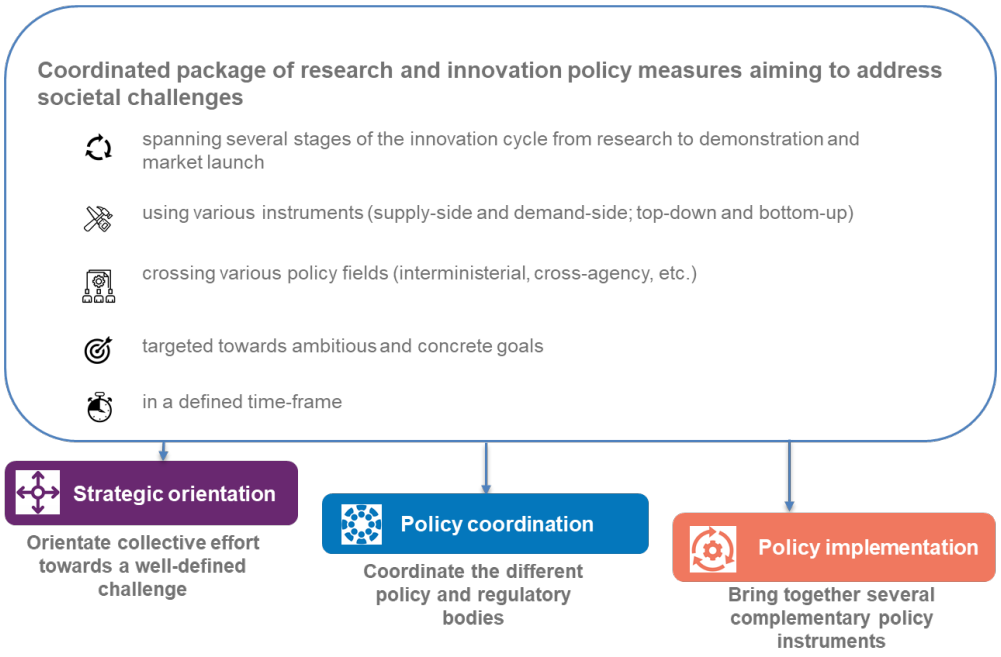
2.1.2. The definition of MOIPs

8. Building upon an extensive literature review, the definition of MOIPs used in this study is the following:

> *A mission-oriented innovation policy is a co-ordinated package of policy and regulatory measures tailored specifically to mobilise science, technology and innovation in order to address well-defined objectives related to a societal challenge, in a defined timeframe. These measures possibly span different stages of the innovation cycle from research to demonstration and market deployment, mix supply-push and demand-pull instruments, and cut across various policy fields, sectors and disciplines.*

This definition can be broken down in three main dimensions of MOIPs: strategic orientation, policy co-ordination and policy implementation (Figure 2).

Figure 2. Synthetic view of the MOIP definition and the three MOIP dimensions



2.2. The MOIP initiative design principles

2.2.1. The expected features of MOIPs

9. Each of these 3 dimensions can be further disaggregated in features that are expected from policy interventions matching the MOIP definition. These features (hereafter the 'MOIP features') are gathered and formalised in the so-called 'MOIP design principles' (Table 1). The notion of design principles conveys the idea that a generic MOIP initiative is expected to satisfy a set of documented requirements on precise criteria, pertaining to different dimensions.

Table 1. The MOIP 'design principles'

MOIP dimension	Main task to be achieved	Definition of the MOIP feature
Strategic orientation	Informing and selecting specific societal challenge(s) and strengthening legitimacy of focused policy intervention towards clear and precise objectives	*Legitimacy* • A consensus is found among a wide group of stakeholder (including citizen) regarding the need and relevance of the mission
		Directionality • The policy is guided by clear and well-informed orientations and strategic guidance formalised in a mission
		Intentionality • Specific and well-articulated need-based goals, with clear timeline and milestones, are derived from the mission
		Flexibility • The targets and means of intervention to meet them can be revised at different stages of the process when needed
Policy co-ordination	Coordinating the strategies and activities of the different institutions involved in the policy	*Horizontality* • The plans and activities of policy bodies covering different policy fields are coordinated to achieve the mission
		Verticality • The plans and activities of policy bodies at different levels of government are coordinated to achieve the mission
		Intensity • The decisions regarding the intervention (objectives, modalities, level of resources) are taken collectively by the involved policy bodies and are binding to them
		Novelty • The plans and activities of different policy bodies and stakeholders are co-ordinated (*e.g.* via a portfolio approach) so as to cover and experiment various alternative solutions to achieve the mission
Policy implementation	Ensuring he consistency and effectiveness of the modes of intervention and resources of the public and private partners mobilised to achieve the policy objectives	*Policy mix* consistency • The policy encompasses a diverse and consistent set of policy interventions (technical, financial, regulatory, etc.) to support different disciplines, sectors, areas and markets, across the innovation cycle, as needed to achieve the mission
		Fundability • Public and private stakeholders involved in the different facets of the initiatives (phases of the innovation process, sectors, markets, etc.) are mobilised to commit resources for the achievement of the mission
		Evaluability • The policy is endowed at the outset with input and output indicators as well as evaluation procedures adapted to its systemic nature, in order to assess its results and learn from its implementation in view of continuous improvement
		Reflexivity • Evaluation and monitoring results are used to inform decision-making and reform the initiative (revision of objectives, adaptation of governance and operating procedures, etc.), as needed to achieve the mission

2.2.2. The distance to the MOIP ideal-type

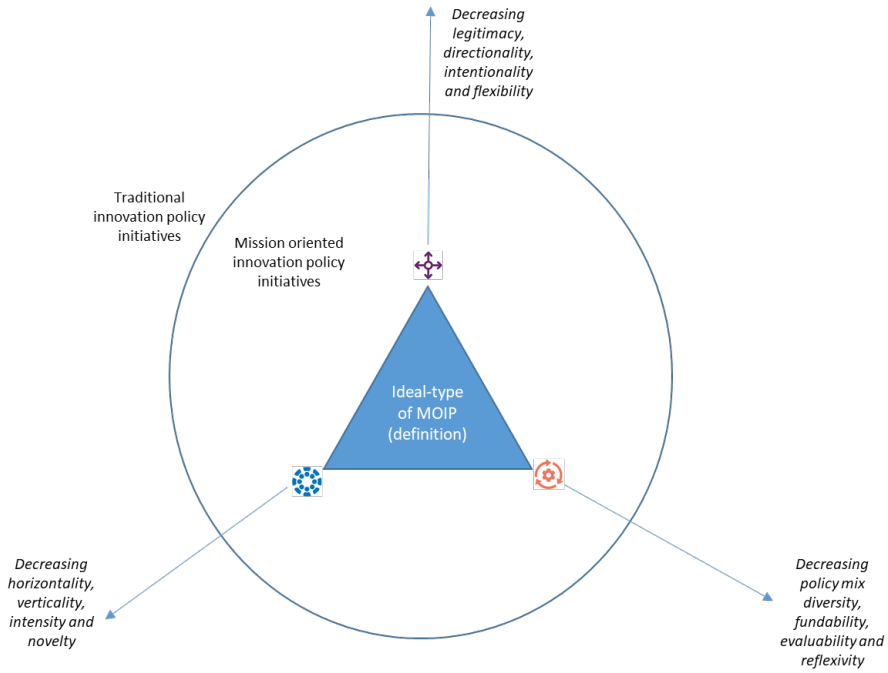
The MOIP design principles should be considered as applying only to an *ideal-type* of MOIPs since few initiatives – if any – can 'tick all boxes'.[1] This notion, invented by Max Weber in 1904, defines the general traits of a phenomena.

Following this open and flexible approach centered around an MOIP ideal-type, the design principles are used analytically as a map and a compass:

- *A map* – the main characteristics of the initiatives identified are positioned in terms of distance to this ideal-type. Following a pragmatic and formative approach, the minimal condition considered in this study is that potential MOIP initiatives should be sufficiently close to allow learning on the opportunities and challenges of mission-orientation.
- *A compass* – although there is not a single best way to design MOIPs, they can take very different forms along the three dimensions, the ideal features of MOIPs provide a useful tool to benchmark the extent of mission-orientation both at the initiative and country level.

While the initiatives apprehended in the analysis might only imperfectly match the MOIP ideal-type, they should be sufficiently close to it to allow learning from the added value and challenges of mission-orientation along its different dimensions. Broadly speaking, MOIP initiatives differ in their proximity to the MOIP definition along the three dimensions of strategic orientation, policy co-ordination and policy implementation (Figure 3).

Figure 3. The distance of MOIP initiatives to the MOIP ideal-type

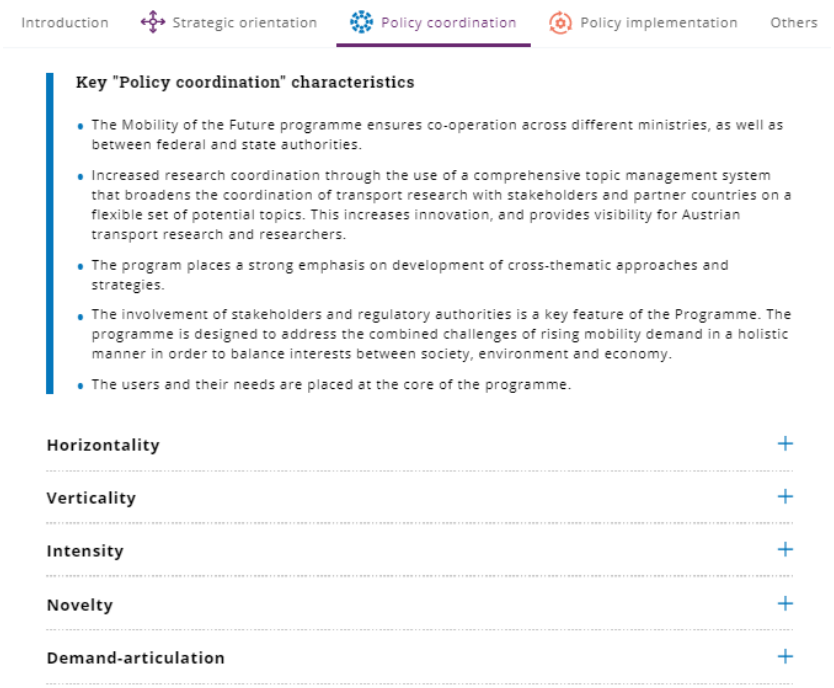


In this formative perspective, an important criterion for drawing an (appreciative) line between mission- and non-mission- oriented policies concerns not only the distance to the ideal-type at one moment in time but also the evolution of the initiatives towards the ideal-type. Through trial, error, international exchanges and policy learning, initiatives gradually change their position in the multi-dimensional space of MOIP features. Furthermore, MOIP initiatives are embedded in a particular institutional-setting, and therefore highly context-dependent.

Due to the evolutionary and context-dependent relation to the MOIP ideal-type, the design principles are used in this study only to characterise – not evaluate –policy initiatives. They are an analytical device to collect and analyse information on various MOIP initiatives. To

do so, a template directly based on the MOIP design principles has been developed. It is also used to make the information collected widely available in an analytically structured way via the Online MOIP toolkit (Figure 4).

Figure 4. Use of the MOIP design principles in the Online MOIP toolkit (partial screenshot)



Source: https://stip.oecd.org/stip/moip

2.3. Types of mission-oriented innovation policies

The diversity of MOIPs revolving around the ideal-type calls for a typological approach in order to find regularities in consistent groups of initiatives. Based on a review of policy landscapes four main types of MOIPs are identified (Table 2). Among them 'Overarching mission-oriented strategic frameworks' and the 'Challenge-based programmes' are the most frequent types of MOIPs currently implemented in countries and several of them are purpose-built MOIP initiatives, *i.e.* they have been designed consciously, *ex ante*, as MOIPs.

Table 2. Basic characteristics of the four main types of MOIPs

Type	Leadership	Missions	Examples
Overarching mission-oriented strategic frameworks	• Center of government • High-level committee	• Multiple missions or mission areas • Pursuing ambitious challenges • Long-term horizon	• Horizon Europe's missions (EU) • Mission-driven Topsector and Innovation Policy (NL) • High Tech Strategy 2025's missions (DE) • Moonshot R&D Program (JP))
Challenge-based programmes and schemes	• Agency	• Focused • Seeking acceleration of (most often technological) innovation • Mid- to long-term horizon	• Pilot-E (NO) • Industrial Strategy Challenge Fund (UK) • The Genomics Health Futures Mission (AU) • Science Foundation Ireland's Innovative Prize (IE)
Thematic mission-oriented programmes	• Ministry • Agency	• Focused on competitiveness in the research consortia of the 1980s – 1990s • Mix of societal and competitive challenges in current programmes	• VLSI (JP) • USABC (US) • Mobility of the Future (AT) • Building of Tomorrow/Cities of the Future (AT)
Ecosystem-based mission programmes	• Ministry • Agency	• Innovation agenda developed by the innovation actors themselves, with neutral support from public authorities	• SIP (SE) • Vision-Driven innovation milieus (SE)

Categorising MOIPs proves challenging, in no small part due to their systemic and multifaceted nature. For instance, one MOIP initiative might contain elements from different types (Wittmann *et al.*, 2020). This holds true in particular for the broader initiatives. The Mission-driven Topsector and Innovation Policy for instance is categorised as an Overarching mission-oriented framework while it shares some 'self-organising' characteristics with Ecosystem-based mission programmes. Furthermore, as MOIPs evolve, they can blur the boundaries between types (Janssen *et al.* 2020, p. 10). Finally, some initiatives with several missions can have very different design features (related to their specific governance arrangements for instance) to achieve each mission.

2.3.1. Overarching mission-oriented strategic frameworks

Overarching mission-oriented strategic frameworks are broad initiatives set up at the highest level of policy making. They coordinate actions among a wide array of public and private actors toward missions (from two in Australia to twenty-five in the Netherlands…) with concrete and ambitious targets. They encompass several instruments and, even sometimes, policies, however with a stronger degree of integration than other types of 'umbrella interventions'. They can also include far more than missions, as it is the case for instance of the High Tech Strategy 2025.[2] They differ notably in their level of integration, ranging from large 'umbrella' frameworks to programmes and strategies with stronger governance.

The most renowned example of Mission-oriented strategic framework is the set of missions included in the pillar 2 'Global Challenges and European Industrial Competitiveness' of Horizon Europe, European Commission's research and innovation programme covering the period 2021-2027. Other examples are, for instance, the Dutch Mission-driven Topsector and Innovation Policy since 2019 (Box 1) and the German High Tech Strategy 2025 (which includes 12 missions) enacted in 2018.

Box 1. Focus on an overarching mission-oriented strategic framework: the 'Mission-driven Top Sectors and Innovation Policy' in The Netherlands

The Top Sectors approach was initiated in the early 2000s as an overall framework to promote innovation with the deliberate goal of raising Dutch international competitiveness. As the policy evolved, addressing societal challenges gradually became a more prominent objective. It was reformed in 2018 to become the Mission-Driven Top Sectors and Innovation Policy (MTIP). It is among the most ambitious mission-oriented strategic frameworks as it aims to systematically structure the interactions between two main axes of collective action: economic sectors and societal missions. Sectoral organisations (the Top Sectors), led by business firms, collaborate to develop strategic agendas that include missions to address societal challenges (Figure 5).

Strategic Orientation

The MTIP focuses on 25 missions across 4 societal themes. For instance, the theme 'Agriculture, water and food' comprises 5 missions including the objective of making the agricultural and nature system carbon-neutral by 2050.

Under this new framework, some of the nine Top Sectors collaborate to develop strategic agendas (the Knowledge and Innovation Agendas - KIAs) in each of the 4 societal themes, involving not only business firms and policy makers but also a wide array of stakeholders. Two additional agendas are developed for horizontal themes (key technologies; valorisation of knowledge). These strategic agendas are not inspirational or incantatory guidance but practical action roadmaps: they include concrete Multi-year mission-driven innovation programs (MMIPs) for each of the 25 missions. Each MMIP sets out what is needed to achieve the missions: the required research and innovation activities over time, the respective contributions of the different partners, the needed financial resources and mobilised policy instruments, etc.

Policy Co-ordination

The policy has a 3-layer governance framework: at the level of the overall policy (Steering committee); within each Top Sector; and for each of the societal themes. Within each of the latter, a Thematic team (Thematean) oversees the activities and, under it, a Core team (Kernteam) or several Mission teams take care of activities' implementation. These teams gather relevant representatives of Top Sectors, government departments, universities and research institutes, regions, investors etc. Such a team can easily bring 20 members at the table. Various officials of ministries and regional authorities are involved in the dedicated sectoral and thematic governance bodies to facilitate policy and regulatory co-ordination, along with business firms, research organisations and stakeholders.

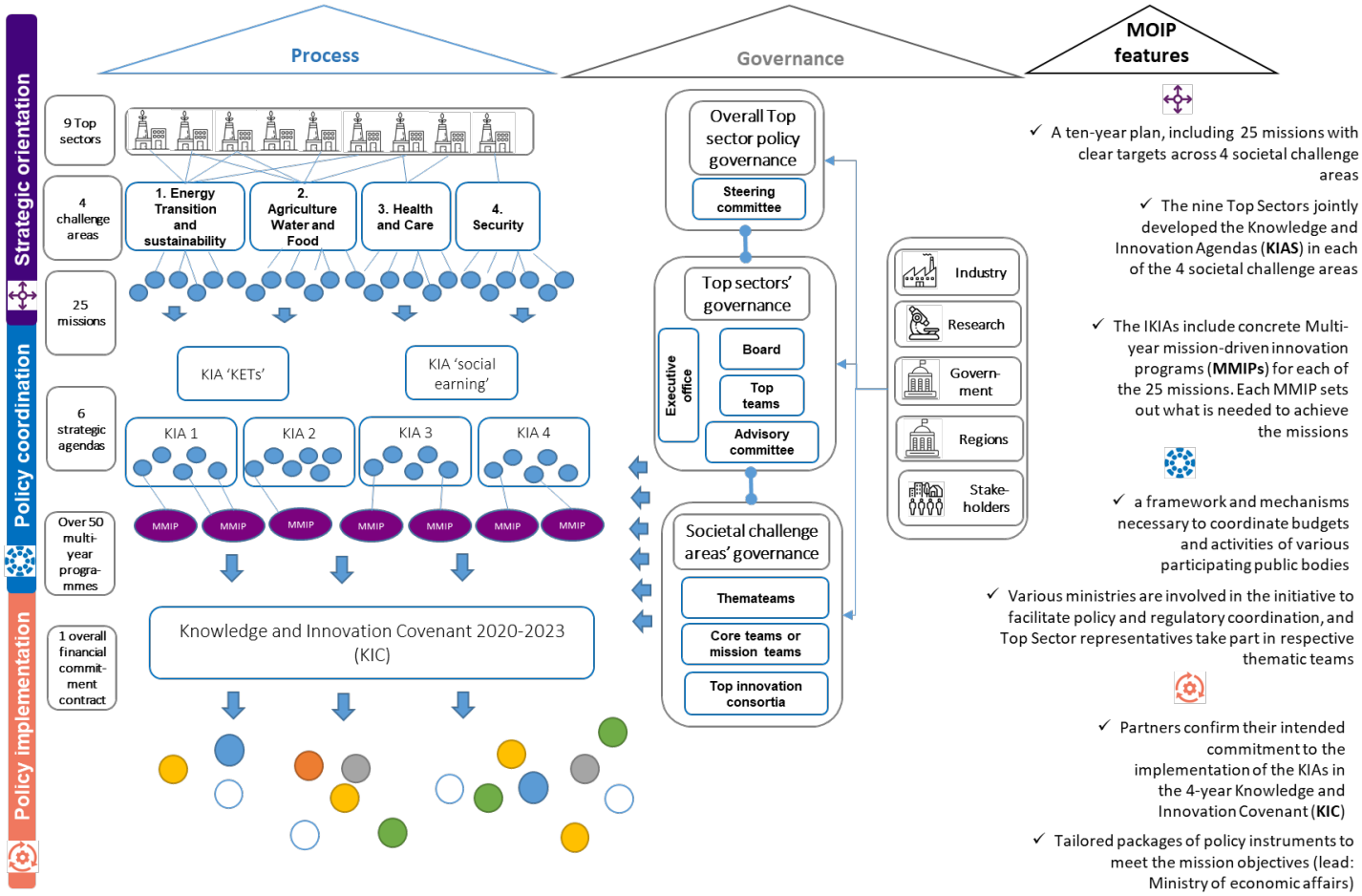
Policy Implementation

Beyond financial instruments such as subsidies, the MTIP policy mixes a variety of instruments (at national and regional level) as needed and identified in the MMIPs, from support to R&D to regulatory reforms, pricing mechanisms and public procurement. An important elements of this policy resides in the public-private Top Consortium for innovation (TKIs) to implement the strategic agendas' MMIPs. These nine TKIs are small foundations, employing up to 20 staff. They are well-connected to their sector and to their societal theme.

The MTIP involves a strong engagement of all partners, not least the private companies. The 4-year Knowledge and Innovation Covenants (KICs) are the agreement in which all partners confirm their intended commitment, in-kind and financial, for the implementation of the policy. The KIC 2020-2023 includes commitment indications for a total value of €4.9 billion each year during the first 2 years of the period, €2.05 billion of which will come from private sources.

Note: Information provided by EZK; See also https://stip.oecd.org/stip/moip/case-studies/3

Figure 5. The Dutch Mission-driven Top Sectors and Innovation Policy: process, governance and main mission-oriented policy features



2.3.2. Challenge-based programmes and schemes

Challenge-based programmes and schemes focus on specific and ambitious problems and are generally implemented by agencies. These have multiplied in recent years under various forms from light reforms of calls for proposal to orientate them towards clearly explicated challenges to more elaborated and integrated schemes, including different instruments covering an array of needs (financial and beyond) and stages of the innovation cycle.

Ireland provides an example of the 'lighter' type of challenge-based scheme, with interesting specificities, including a bottom-up definition of the challenge and an international dimension (Box 2). Pilot-E in Norway is one of the most advanced integrated challenge-based scheme (Box 4).

Box 2. Focus on a challenge-based scheme: Science Foundation Ireland's Innovative Prizes

Science Foundation Ireland (SFI) has embraced a challenge-based approach through the SFI Future Innovator Prize programme. Over the past three years, SFI has launched five Prizes, including the 'Artificial Intelligence for Societal Good Challenge', the 'Zero Emissions Challenge' and the 'Plastics Challenge'.

The key principles of these Prizes are the following:

- A process of engagement and co-creation with stakeholders, beneficiaries and end-users of research should define and validate Challenges. These should be visionary and inspirational but achievable and should lead to transformative economic and societal impact if addressed successfully. There is a strong focus on delivering solutions.
- Challenges are complex and require an interdisciplinary approach. Teams supported under the SFI Future Innovator Prize programme must include both researchers and stakeholders/beneficiaries or end-users of research who are represented on a team by a Societal Impact Champion. This engaged approach ensures that teams have both the technical and non-technical expertise to understand the complexities of the challenge and it supports the development of novel, potentially disruptive, technologies to address significant societal challenges. Given the focus of the prize on solution delivery, the team is expected to include technical capabilities in design and prototyping.
- Challenge funding uses competitive mechanisms and close monitoring to mobilise and incentivise innovators. This includes stage-gate funding, tight delivery timeframes and a final prize. Teams work through a 3-month "Concept" phase (focusing on team formation, stakeholder engagement, challenge validation, solution concept and impact pathway, up to €20K) after which their progress is assessed by expert review and successful teams progress to the "Seed" phase (focusing further on team development and prototype development up to €200K). Following the Seed phase, an overall Prize Award is made to teams to progress their solution to deployment (up to €2M).
- Although a key objective is to incentivise researchers in Ireland to address national challenges, the Prize has an international dimension and encourages researchers to address challenges that also have broader global relevance.
- Through a partnership with the Department of Foreign Affairs (Irish Aid) a selection of projects are focused on the potential societal impact of their proposed solution to challenges in one or more partner countries where Ireland's Overseas Development Assistance is directed. These teams are required to include a relevant Societal Impact Champion associated with that country.

Such a challenge-based approach is still new and remains small scale to date. The 2019 mid-term review of Innovation 2020 (the national governmental STI strategy launched in 2015) called to enhance "*mission-oriented funding to address societal challenges, most notably associated with the pursuit of the UN Sustainable Goals, also with some alignment of this funding with EU Research programmes*". SFI and other agencies and Government Departments in Ireland plan to pool resources in order to scale up these schemes in coming years.

Source: Information provided by Science Foundation Ireland; SFI website https://www.sfi.ie/challenges/; DBEI (2019) *Mid-term Review of Innovation 2020*, Department of Business, Enterprise and Innovation, https://dbei.gov.ie/en/Publications/Mid-term-Review-of-Innovation-2020.html; European Commission (2020), *Enhancing the efficiency of the cooperation between business and science – Lithuania in the international context*, Interim Report, EFIS and Visionary Analytics, Forthcoming.

To various degrees, these initiatives emulate some of the characteristics of high-risk high-reward model implemented by the US Defence Advanced Research Projects Agency (DARPA) (Box 3).[3]

Box 3. Main characteristics of the US Defence Advanced Research Projects Agency' model

The characteristics of DARPA's model are the object of a voluminous literature. The main ones can be summarised as follows:

- *Leadership and 'embedded autonomy' of the Programme Manager (PM)* – As it is often claimed, a PM is a conductor of an orchestra with a four to five year contract. It needs to have ample knowledge of all instruments and music in general but does not play any instrument. Its role is to develop a systemic understanding of the challenge area under its responsibility through numerous interactions with the researchers and experts and exert strong leadership on how to solve this challenge. The PM is both empowered to take strong decisions (including regarding the allocation and reallocation of funding) and deeply embedded in the scientific, technological and market environment.
- *Independence of the agency* – the agency operates at arms' length from its principal(s). This is important to protect it from political interference, notably pressure to work on short-term conventional projects rather than long-term technologies that are potentially disruptive.
- *Derogation from traditional competitive mechanisms and comitology* – Under strict rules regarding possible conflict of interest and following extensive consultations, the PM can intervene directly in the project selection process (without picking technologies). This allows some degree of discretion and flexibility in the final choice that depends on the PM, not on the average opinion of a committee of peers based on pre-established criteria. The power of the PM to redeploy funding on the basis of monitoring and evaluation at key milestone (stage-gate funding) allows to reduce the risks and impact of failure.
- *Pro-active community and project portfolio management* – During the selection process, the PM interacts with project applicants and help them develop the most relevant proposal. During the implementation stage, the PM generates occasions and ways for research performers (even star scientists competing against each other) to exchange knowledge between projects addressing the same challenge (e.g. in closed-door workshops). Particularly in cases of challenges that might require disruption from established technologies and actors, this hands-on approach can lead the PM to act as a broker and network facilitator to facilitate the creation of new communities, across discipline and sector boundaries. Portfolio management is also a way to reduce risk and cover different potential solutions under condition of strong uncertainty.

Source: Bonvillian W.B., Van Atta R and Windham P. (2019), *The DARPA model for transformative technologies - Perspectives on the U.S. Defense Advanced Research Projects Agency*, OpenBook Publishers; Reinhardts B. (2020), *Reflection on 'how DARPA works?'*, June, at https://bit.ly/2HYPngD ; Fuchs, E. (2010), Rethinking the Role of the State in Technology Development: DARPA and Embedded Network Governance, *Research Policy*, Vol. 39: Issue 9. https://doi.org/10.1016/j.respol.2010.07.003; (Schlenoff, Weiss and Steves, 2010[11]); OECD (2020c), *Effective Policies to Foster High-risk/High-reward Research*, Global Science Forum, Forthcoming.

Several examples of success (in military, ICT, energy, health, etc.) have demonstrated the effectiveness of this model, notably in dealing with challenges of technological nature and in areas with strong procurement power of public authorities. This explains for the heightened level of interest far beyond the United States, for instance in Germany, which

founded in 2019 the federal disruptive innovation agency ("SprinD"),[4] or at the level of the European Union (the European Innovation Council [EIC] [5], or the call for a biomedical research agency in 2020[6]). Some of the principles of the model are also used outside dedicated agencies, notably in innovation schemes (such as Pilot-E in Norway – see Box 4) or in programmes (such as ImPACT in Japan). The main challenge of this model consists in striking a sustainable balance between the autonomy given to the programme manager and its hands-on involvement in activities on the one hand and the need for accountability and fair competitive practices on the other hand. The governance (e.g. various monitoring and evaluation mechanisms) is key to ensure that the autonomy and accountability principles function together.

As effective as it can be to achieve technological or scientific breakthroughs, an important concern relates to the extent to which this model is also fit for addressing complex, multi-dimensional, societal challenges.

Box 4. Focus on a challenge-based scheme: 'Pilot-E' in Norway

Pilot-E is a cross-agency scheme that aims to be a one-stop-shop that provide seamless support from idea to market to various climate emission free and energy saving solutions (Figure 6). It was launched in 2016 by three of the main Norwegian agencies (the Research Council, Innovation Norway and Enova), with a view to both initiate the necessary energy transition and develop new business activities. Since its creation; its budget has significantly increased from NOK 70m in 2016 to NOK 100m in 2017 and NOK 120m in 2018. It has been adapted and adopted in the ICT and transport area (Pilot-T), and some sectoral organisations called for setting up of such mission-oriented schemes in other areas (such as health and healthcare).

Strategic Orientation

Pilot-E follows a clearly affirmed proactive and hands-on policy approach. It aims to orientate the innovation and market creation process in the area of climate emission free and energy saving projects without targeting specific solutions. It provides concrete but broad orientations to potential beneficiaries by issuing targeted calls for proposal each year. Pilot-E aims to result in very concrete results, i.e. the deployment of new full-scale solutions in energy and transportation, such as for instance various types of electric ships, but the calls for proposal include no indication of any preferred technological options (for instance battery-powered or fuelled by hydrogen).

The funding agencies and the applicants interact closely during the mobilisation and evaluation process in order to provide tailored guidance to applicants.

Users participate in the projects from the inception stage; applicants must have a market deployment plan in their proposals.

Policy Co-ordination

Within Pilot-E, three agencies systematically coordinate their actions to provide tailored and seamless support to industry-led consortia along the entire pathway from research to market deployment. The scheme is governed by a dedicated structure of governance involving representatives of the 3 agencies. They also collectively hire and share the cost of a secretary supporting the implementation of the scheme.

The co-ordination of the agencies enable them to implement a project portfolio approach to diversify the risks and explore the different technological options for various market segments and components of the value chain.

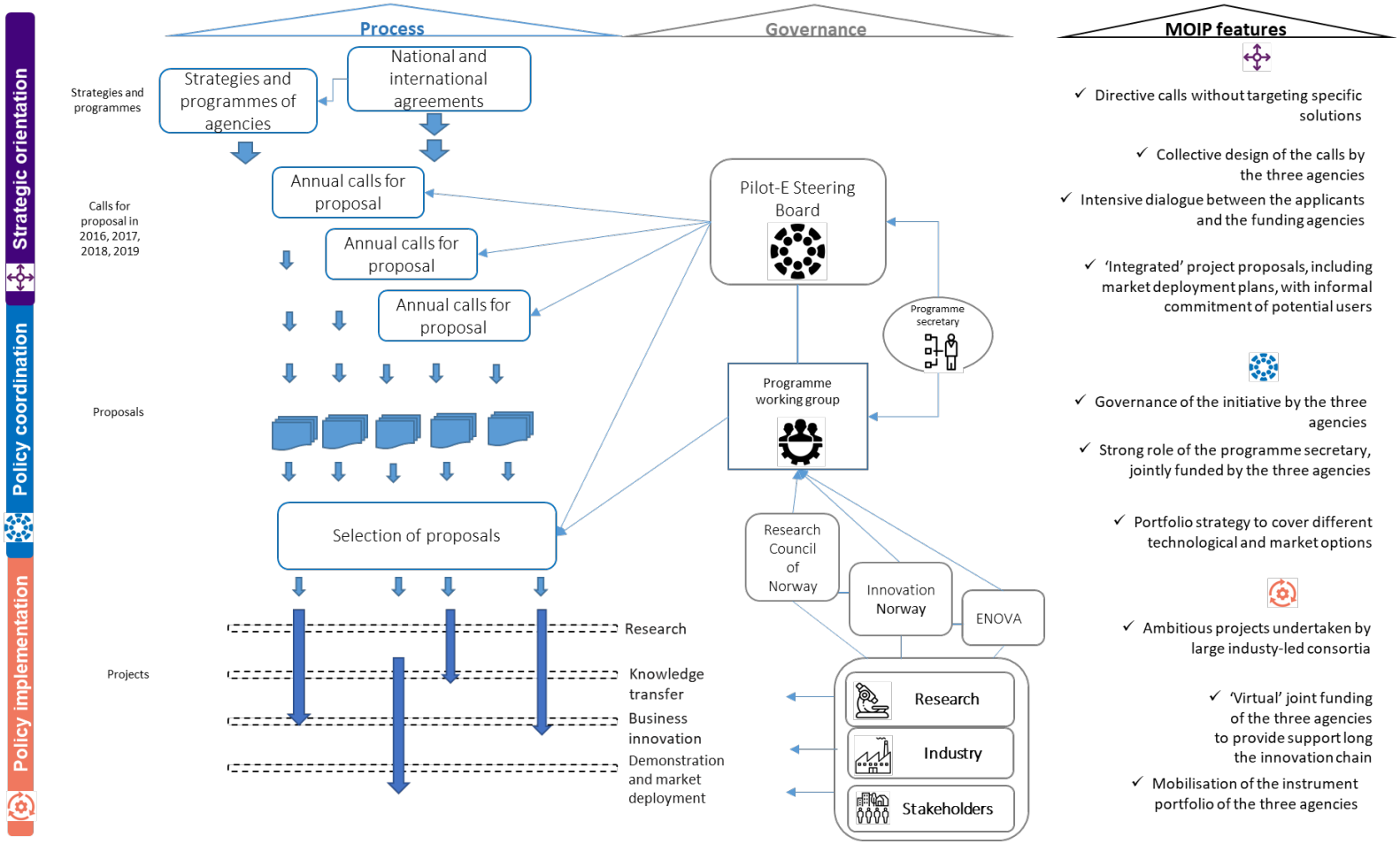
Policy Implementation

Pilot-E is a joint funding instrument, gathering technology push and market pull funding instruments of the three agencies to provide comprehensive support along the innovation chain. Enova provides financial incentives for the uptake of new solutions among end-users, including public procurement for innovation. Moreover, regulatory authorities are active in removing legal barriers to technology implementation.

Through joint up action of the agencies and close monitoring of projects, Pilot-E is suited for larger consortia that address more complex challenges than traditional projects that are supported by any of the partner agency individually.

Note: Information provided by RCN; See also https://stip.oecd.org/stip/moip/case-studies/2

Figure 6. Pilot-E: process, governance and main mission-oriented policy features



2.3.3. Thematic mission-oriented programmes

Since the end of the 1950s, governments have supported the formation and funded different types of large scale research and innovation programmes. These initiatives gathered a significant number of relevant public and private organisations to develop new technologies, most often in established sectors subject to international competitive pressure. These programmes encompassed a wide variety of different designs, from the numerous pre-competitive research consortia set up until the 1990s to nowadays' more flexible and modular arrangements such as co-ordination platforms. The justification of the former initiatives largely relied on their ability to mitigate and internalise knowledge spillover through co-operation, share risks, and shore up firms' incentives under conditions of low appropriability of results and high uncertainty. These organisations came under increasing criticism for their lack of flexibility, their heavy administrative costs and the complicated management of cooperative relationships between competitors. Highly visible consortia at the time were mainly to be found in the ICT area (for instance, in the semiconductor area in the 1980s, SEMATECH in the United-States and VLSI in Japan). In the 1990s, the United-States kept on using this organisation form legalised by the 1984 National Cooperative Research Act (NCRA) in areas such as alternative vehicles, notably the United States Advanced Battery Consortia (USABC) and the Partnership for a New Generation of Vehicles (PNGV) (Larrue, 2003).

Pre-competitive research consortia hold several features that make them 'early' forms of mission-oriented innovation policies:

- The business firms and the federal government define together the objective of the programme. These objectives are then translated into precise performance targets for the technologies to be developed. The results achieved by the competing teams are tested under normalised test procedures developed by the consortium with national laboratories. The targets and test manuals can become standards even beyond the boundaries of the consortium. The targets are revised regularly to adapt to technical progress and external changes
- The cooperation between various end-user and developer firms allows the coordinated exploration of various technological options and market segments. For instance, in the 1990s, before the convergence towards lithium batteries, the USABC systematically supported different teams (composed of battery manufacturers and national labs) developing and testing the various battery technologies under the supervision of end users (the car manufacturers).

The most recent initiatives focus on the co-ordination of wide interdisciplinary and cross-sectoral programmes to meet ambitious objectives related to a mix of societal and competitive challenges. The French government operated during about 15 years the PREDIT, a programme to orientate and coordinate all public support to research and innovation activities in road, rail and fluvial transport, across ministries, sectors and disciplines. A more recent example of such 'modern' thematic programmes, with a gradual evolution of the programme towards a MOIP design characterised by increasing strategic orientation and improved policy coordination, is provided by Building of Tomorrow / City of the Future' in Austria (Box 5).

Box 5. Focus on a thematic mission-oriented programme: 'Building of Tomorrow / City of the Future' in Austria

Over the past decades, there has been a persistent line of thematically oriented programmes in Austria, aiming at transition to low-energy buildings, and realizing the concept of zero energy passive housing. Building on earlier (regional) activities, the Programme 'Building of Tomorrow' was a larger scale research and technology programme addressing these targets, starting in 1999. It supported incorporating ways of using environmentally friendly and renewable materials in construction, new designs and emissions free construction materials, higher energy efficiency throughout the entire life-cycle of a building, greater use of sustainable raw materials and efficient use of materials in general, greater use of renewable energy sources, especially solar energy, and had a strong focus on user needs.

Since 2013, the funding activities have been continued in a wider framework in the "City of the Future" technology programme, which pursues the mission of enabling the implementation of 'plus-energy' neighbourhoods through research and development of technologies, system integration, new solutions and digitalisation. Its focus is on innovative technologies and concepts for energy generation, distribution, conversion and storage, but also on consumption optimization in buildings and building associations, as well as technologies and efficiency for new construction and renovation. BMVIT (now BMK) provided EUR 37.8m to the programme 'building of tomorrow plus' initiative.

Strategic Orientation

The programme's strategic objectives were derived from the grand challenge of sustainability and climate change, but at the start targets and milestones were quite broad. Yet, from the second programme phase, "Building of Tomorrow Plus", targets and milestones became more clearly defined and thus made for a gradual evolution of the programme towards MOIP. The scope of the programme included basic and applied research as well as the development and preparation or support of the market launch or market penetration of economically feasible, innovative technical and organisational solutions for a CO2-neutral construction sector .

Policy Co-ordination

Strong driver from the centre and good co-ordination with the agency level: The programme was initiated, implemented and financed under the responsibility and guidance of the Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT, now BMK). Agencies and other institutions were commissioned for operational programme activities. The ministry, together with the most important concerned agencies (the Austrian Society for Environment and Technology (ÖGUT), Research Promotion Agency (FFG) and Austria Wirtschaftsservice GmbH (aws) formed the management team of the programme, which ensured a smooth cooperation and programme implementation.

Policy Implementation

User and demand side are well articulated in the programme. The accompanying measures were implemented through tenders or commissioning to external service providers. Citizens were engaged through a number of these measures, bringing in the users. Another measure to include the demand side was the close interaction with regulatory bodies. In many cases, the agencies (especially ÖGUT) were assigned a pro-active role beyond mere implementation (e.g. monitoring the content of the programme, further development of the programme, the support and networking of potential submitters and project participants, and the integration of important stakeholders). Furthermore, ÖGUT has taken over measures for project generation, project coaching and dissemination, e.g. preparation of calls for proposals, support of calls for proposals, pre-proposal checks, statements on interim and final reports of the project participants, or networking activities in Austria and abroad.

Note: Information provided by BMK. See also https://stip.oecd.org/stip/moip/case-studies/9

2.3.4. Ecosystem-based mission programmes

A few programmes intend to allow stronger directionality and legitimacy by delegating responsibilities related to strategic orientation to relevant community (or ecosystems) of stakeholders in priority or emerging areas. One of the main added value of this type of MOIP is to engage wider participation and significant investment from a variety of partners in the initiatives that build on the strategic agenda they have collectively designed.

Three noticeable initiatives falling under this type were created in Sweden and Finland:

- The Strategic Innovation Programmes (SIPs) were created in 2013 under the leadership of the Swedish innovation agency Vinnova (Box 6). They were designed after the Finnish Strategic Centres for Science, Technology and Innovation (SHOKs) established in 2006 and phased out gradually in 2015 following a negative evaluation in 2014. SHOKs were limited companies owned by groups of co-shareholders led by industry, together with universities, municipalities, and other stakeholders. These entities were tasked with i) the definition of their own strategic research agendas (SRA); ii) the management of specific collaborative programmes to implement the collectively defined agendas.
- The Vision-Driven Health scheme was rolled out by Vinnova in 2019 to establish eco-systems ('milieus') that work towards a common vision and a long-term systemic transformation. One key feature of this initiative lies in its self-organised nature: applicants propose the objective they will pursue in addressing a societal challenge, the means to realise this objective, the governance of the milieu as well as the way the project should be evaluated. The scheme is currently being tested in the health and life sciences area. Prior to the call, the Agency performed an extensive consultation with 50-80 organisations (incl. companies, government agencies, civil society, patient organisations) during 1.5 years. Five coalitions have been selected so far to build their own milieu (e.g. in the area of elderly malnutrition; antibiotic resistance). Each milieu has a clear mission (*e.g.* "*no elderly in Sweden will be malnourished in 2030*") and is supported via tailored-made policy approaches.
- The Finnish Growth Engine initiative was established under the new Suunta ("direction" in Finnish) strategy jointly developed by the main innovation agencies. This scheme allows to fund a group of companies to develop, with partners from academia and other sectors, a growth vision and a detailed action plan to be implemented in an area with significant jobs and export potential. Business Finland funds selected Growth Engines for up to 10 years (two-year funding period) to support the development of cooperative networks within the ecosystem in order to build joint research, pilot and demo projects and international activities. The initiative is unfolded in three stages (development of the vision for 3 to 6 months; funding of activities to implement the vision; creation of a 'platform company' in the most promising ecosystems supported via a capital loan). Compared to other initiatives of the same type (such as the SIPs), Growth Engines put a greater emphasis on the business dimension.

Box 6. Focus on an Ecosystem-based mission programme: 'Strategic Innovation Programmes'

The Strategic Innovation Programme (SIP) is an initiative led by the Swedish innovation agency Vinnova. It aims to improve the international competitiveness of Sweden's economy and find sustainable solutions to global challenges by enhancing interactions between universities, companies, and other civil society organizations and government agencies. It was preceded by a specific scheme allowing innovation actors themselves to develop bottom-up Strategic Innovation Agendas (SIAs). The SIP aimed to fund selected consortia to realise parts of the SIAs.

Strategic Orientation

In sharp contrast with previous Swedish modes of intervention, the government does not decide which areas are deemed strategic and what activities should be conducted to develop these areas in the SIP. It only facilitates the process acting as a broker and establishing a framework for developing and implementing the strategic agendas. Under the SIA initiative that ran from 2012 to 2016, seed funding was first provided to wide sets of partners to co-develop a common vision and an innovation agenda to guide the emergence and growth of nascent eco-systems.

During the calls for proposal of SIAs, in some cases, applicants of rejected proposals were asked to consider resubmitting them after taking into account the existence of overlapping proposals. For example, communities submitting ten separate agendas related to the forestry sector eventually submitted one single combined proposal.

In the second stage, calls for proposals for SIPs were opened to constellations of actors which had completed SIAs meeting certain standards. Such calls were launched on four occasions with the result of 17 SIPs being selected for funding. Some of the SIPs built on a combination of several SIAs. SIPs gather a wide set of actors covering different stages and components of the innovation process and pertaining to different communities and sectors. The orientation of the successive waves of SIPs has evolved from a focus on traditional Swedish sectors towards societal challenges in the 3rd and 4th selected SIPs.

Policy Co-ordination

The SIP initiative as a whole is managed jointly by the three agencies which have established a joint steering group for the purpose. The Program officers for individual SIPs and the members of the steering group meet regularly to coordinate policies, administrative procedures, communication activities and budgets across the portfolio of SIPs. Information about activities in the different SIPs is shared among concerned program officers in the three agencies.

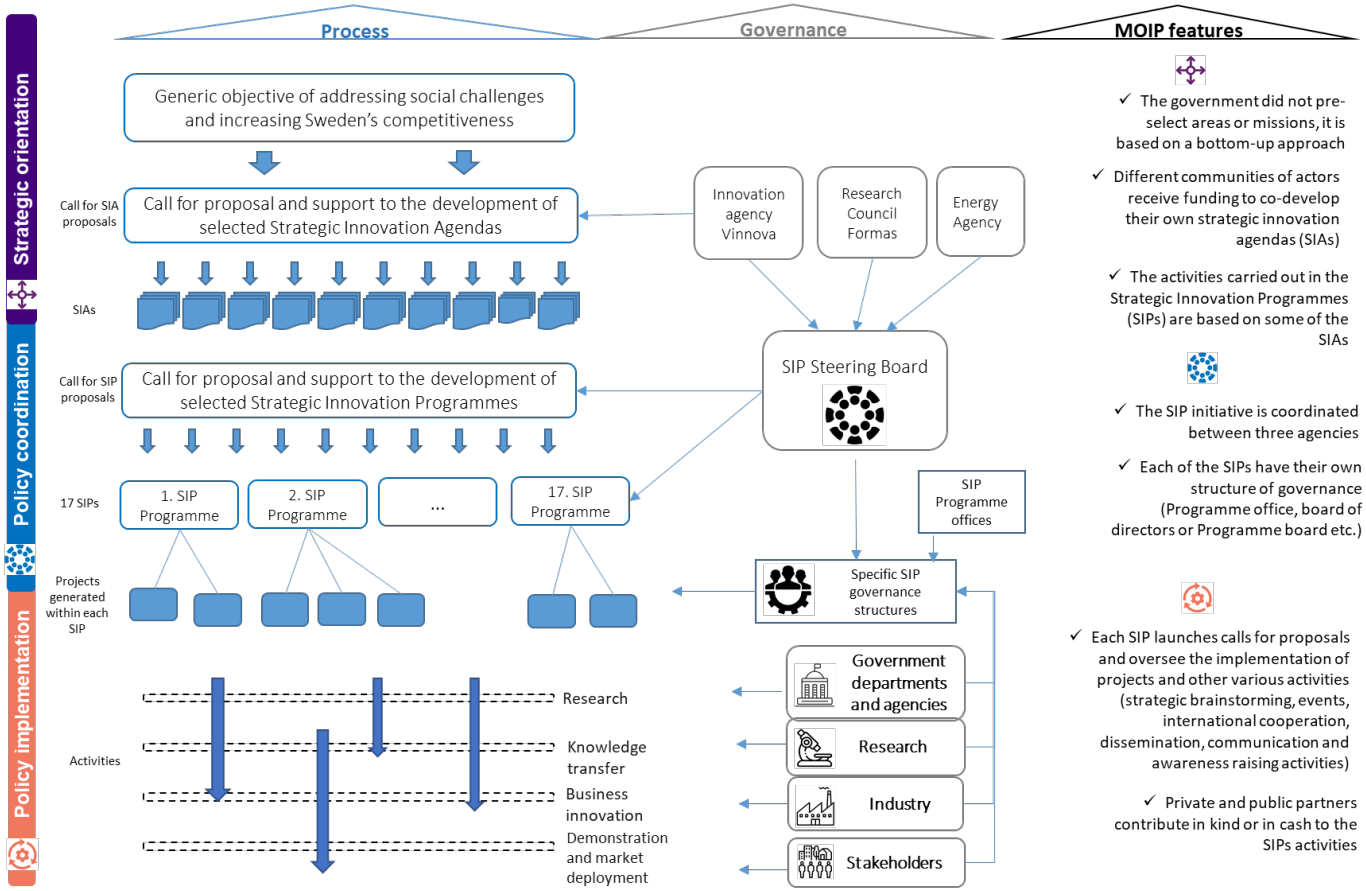
Each SIP is managed by a Program Office hosted by an organisation (Industry Association, Research Institute, etc.) and is overseen by a governance body (Board of directors or Programme board), which is responsible for the SIP activities (often assisted by an appointed "agenda council" comprising of select members of the community).

Policy Implementation

Once selected, the SIPs are scheduled to run for 12 years if intermediate evaluations are sufficiently positive. They function as mini-programmes, designing and launching calls for proposals (about one or two calls every year for each SIP) with significant empowerment of the SIP governance bodies. However, responsibility for the selection of projects to be funded remains with the panels of independent experts constituted by VINNOVA. The nature of projects funded by the SIPs varies enormously, from breakthrough research and innovation to the production of demonstrators as outputs and plans to include product vendors. SIPs also conduct a range of other activities, such as holding regular meetings of core participants to review progress and take management decisions. The evaluations of the SIAs and SIPs to date confirm the success of these initiatives.

Note: Information provided by Vinnova; OECD, 2016b; See also https://stip.oecd.org/stip/moip/case-studies/11

Figure 7. Strategic Innovation Programmes: process, governance and main mission-oriented policy features



2.4. Types of policies and types of missions

The relation between the nature of challenges and the design of MOIPs is still largely unexplored. So far, only a broad level of correspondence has been drawn out.

2.4.1. Missions' wickedness

MOIPs vary in relation to the degree and type of 'wickedness' of the challenge they address. For instance, the expert group on the Economic and Societal Impact of Research (ESIR) distinguished between two broad categories of challenges: i) those that are potentially solvable and can therefore be relatively easily reduced to discrete or verifiable goals. Examples of this type are technological challenges or the development of the Ebola vaccine; ii) those addressing a challenge where solutions are unknown and the problems escape simple definition – wider societal problems such as sustainability or migration come into this category (ESIR, 2017). Another taxonomy of societal challenges is developed by Wanzenböck *et al* (2020). In their analysis, challenges' degree of wickedness varies with their level of contestation (diverging problem framings due to different claims, conflicts of interests, etc...), complexity (lack of clarity about responsibilities due to the multi-dimensional nature of the problem) and uncertainty (lack of or fragmented knowledge related to the problem).

To each of these two categories of challenges – that echoes Nelson's famous dichotomy between the 'Moon and the Ghetto' (Nelson, 1977) (Nelson, 2011) – corresponds different types of missions. Kuittinen, Polt. and Weber (2018) make a distinction between the missions aiming for faster scientific and technological advancement (accelerators) and those targeting societal challenges with implications for transformational changes (transformers). While missions of the 'accelerator type' try to give directions to scientific development and innovation in and for certain scientific and technological areas (e.g. accelerate treatment of diseases, development of specific technologies like batteries), 'transformer' type of missions aim at more systemic changes (often coinciding with 'wicked problems').

2.4.2. The scale and scope of missions

Another key parameter relates to the scale and scope of the challenge. Any challenge can be represented as a problem tree and governments can set their own objectives at any position in the tree. Positioning the challenge at a lower position in the problem tree narrows the scope of potential options for solving the broader challenge but makes the policy more concrete and feasible. For instance, some debate arouse in the UK Industrial Strategy Challenge Fund: why "*Smart sustainable plastic packaging*" was chosen, instead of "*Smart sustainable packaging*" in general? This is not without consequence as the first challenge excludes all the 'non plastic' solutions … This simple example emphasises how much mission definition is a political process, where different values and various interest must coalesce.

When selecting the challenge to be addressed, governments thus face a trade-off: the challenge must be broad enough to engage a broad set of actors across policy fields and sectors without 'picking winners' (i.e. be overly prescriptive in terms of potential solutions), but sufficiently concrete and well-defined so that it provides strong orientation and is 'actionable', *i.e.* it can be translated into and monitored against precise goals and expected deliverables.

2.4.3. Linking types of missions and types of MOIPs

Most typological work to date has focused on the type of grand challenges and missions, without drawing implications on the design of the policies that aim to address them.

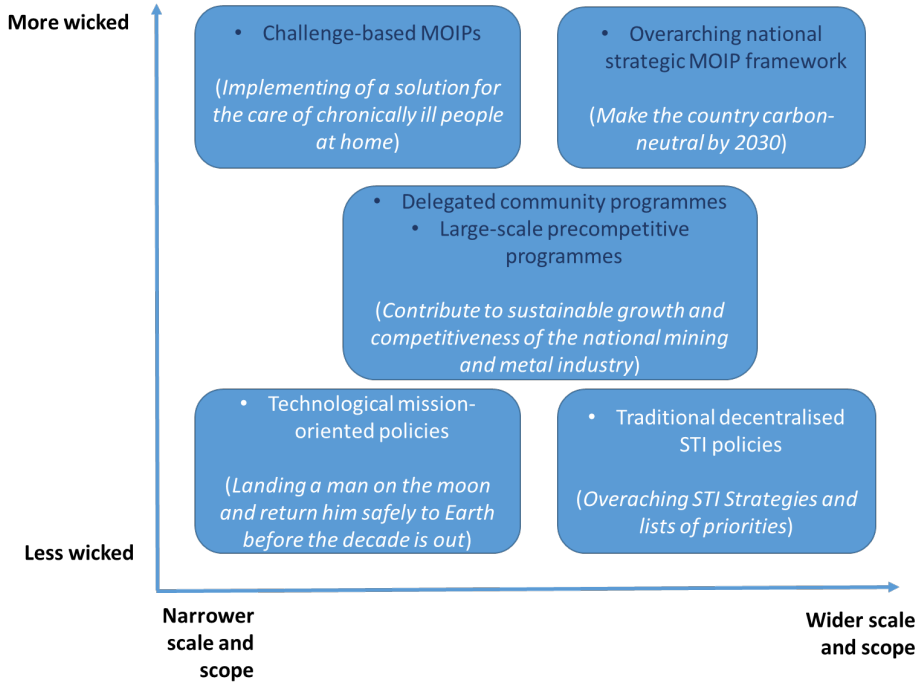
As an initial approach, one could argue that 'Overarching mission-oriented strategic frameworks' allow for more 'transformer' missions and the 'Challenge-based programmes' for 'accelerator' missions. However, these relations between types of policies and types of missions should be best considered as 'affinities', rather than as strict associations. A finer-grained analysis of cases reveals a more nuanced association. First of all, as explained by Kuittinen, Polt. and Weber (2018), various missions exist in different degrees on a scale between these two polar models. Secondly, the difference found between the types of MOIPs might be better understood as guiding alternative pathways to transformation, rather than pointing to an intrinsic difference between an accelerator or transformative potential. A voluminous literature on sustainable transition and transformation has shown that there can be different pathways for system transformation, that are more or less 'bottom-up' or 'top-down' (Geels and Schot, 2007). Depending on the cases, some transition might start with 'niche innovations' by small networks of actors which, if scaled up and diffused, might result in significant transformation of established socio-technical regimes. Other initiatives might directly intervene at the level of the socio-technical regime through conscious and planned efforts to transform it and make it more sustainable.

This is consistent with the findings of a recent study that examines four challenge-based MOIP initiatives[7] in order to assess the extent to which their design is conducive to transformative policy (Borras and Schwaag Serger, 2020). Overall, they found that, while none of the programs is entirely designed to be transformative, they have relevant transformative aspects at different levels of instrument design.

Figure 8 proposes a general correspondence between the types of challenges (in terms of their level of wickedness and scale and scope) to be addressed and the four types of MOIPs identified in this study. The underlying principles are as follows:

- The more complex, uncertain and multi-level ('wicked') the challenge is, the more focused and integrated the policy initiative should be, to enable a more 'joined-up' approach.
- The wider scale and scope of the challenge being pursued, the more encompassing the policy initiative should be. This either calls for a greater holistic co-ordination (in the case of wicked challenges) or a segmented policy system with less ex-ante and planned co-ordination aiming for different policy bodies fixing various market failures falling under their remit.

Figure 8. General correspondence between the types of challenges to be addressed and types of MOIPs



Building on the Accelerator/Transformer typology of missions, Wittmann *et al.* (2020a) propose a variant by focusing on both the nature of missions and the internal governance structure of the MOIPs that aim to implement them. In a nutshell, the most wicked missions involve a larger number of policy domains and actor, require various changes (regulatory, behavioural, etc.) and hence pose require more elaborated governance. The most 'demanding' missions in terms of co-ordination are those that call not only for scientific or technological progress but also for changes in individual and collective behaviours and norms (hence involving societal and institutional changes as well). The authors distinguish 2 sub types of missions for each Accelerator and Transformer missions, with variations in their respective levels of wickedness and associated need for co-ordinated policy. Accelerator Type 1 missions primarily seek to overcome a market failure and rely on scientific and/or technological innovation, while Accelerator Type 2 missions address not only market failures, but also requires structural adjustments, e.g. in the regulatory dimension. Transformer Type 1 missions are comparatively narrow in their scope as they possess a clearly defined agenda. In contrast, Transformer T2 missions are characterized by a considerable scope of the challenge and the absence of a promising solution.

This typology is applied to characterise the 12 missions of the High Tech Strategy 2025 (Table 3). The authors have identified the following as Transformer T2 missions:

- Ensure good living and working conditions in structurally weak and disadvantaged rural areas
- Preserve biological diversity and promote resilient ecosystems
- Substantially reducing plastic pollution of the environment:
- Develop safe, networked and clean mobility

On the other end of the 'wickedness spectrum', the 'Combatting cancer' mission, which aims to make research results quickly and widely available to increase the percentage of

early diagnosed, curable cancers is considered an Accelerator Type 1 mission, involving mainly scientific progress, but showing a clear accelerator dimension.

Table 3: Typology of missions and corresponding governance needs

	Accelerator Mission		Transformer Mission	
	Type 1	Type 2	Type 1	Type 2
Type of problem	Market failure	Market and structural failure	Transformational system failure	Transformational system failure
Type of solution	Scientific innovation	Technological/ regular. change	Transformation of system	Transformation of system (behavior)
Problem vs. goal oriented	Problem-oriented	Goal-oriented	Goal-oriented	Problem-oriented
Demand for governance	Low	Medium	High	Very high
Examples of missions	Combating cancer	AI, Battery cells, CO2 emissions, Intelligent medicine	Open knowledge, Circular economy	Mobility, Biodiversity, Good life, Plastic

Source: Wittmann *et al.*, 2020a

3. Learning from Mission-oriented innovation policy initiatives worldwide

3.1. Initiative case studies methodology

The MOIP initiative database includes about 20 MOIP initiatives at the early stage of this new policy approach. Each initiative has been characterised using a template directly based on the analytical framework presented in the previous chapter. Using the same structure, the information collected via the templates is available on the MOIP Online Toolkit.

This chapter is structured along the three MOIP dimensions and their relevant MOIP features, and to each of these features correspond a set of practical questions for guidance. For each question, a first section presents the added value of the MOIP approach with regards to the issue at stake. The second section presents the ways in which governments have tried to respond to this question in practice through different types of MOIPs (Table 4).

Table 4. Main questions addressed to analyse MOIP initiatives and corresponding MOIP features

MOIP dimension	Questions addressed	Corresponding features in the MOIP design principles
Strategic orientation	How to engage a wide group of stakeholders in the mission definition?	Legitimacy
	How to define missions in MOIPs?	Directionality, Intentionality and flexibility
Policy co-ordination	How to coordinate policy bodies across silos and levels of government in MOIPs?	Horizontality, Verticality and Intensity
	How to coordinate policy bodies to foster exploration and produce novel solutions?	Novelty
Policy implementation	How to integrate consistent bundles of instruments in MOIPs?	Policy mix consistency
	How to maximise the participation of public and private partners in MOIPs?	Fundability
	How to evaluate and learn from MOIPs' implementation?	Evaluability and Reflexivity

3.2. Main results: the opportunities and challenges of MOIP initiatives

What is usually claimed about public policies in general holds true for MOIPs: the costs (and issues in general) are immediate, while the benefits, in particular when it comes to transformative change, can only be observed in the long term. The knowledge of MOIP challenges is therefore at this stage more comprehensive than that of opportunities.

3.2.1. Main opportunities

The main expected benefits of MOIPs are embedded in their definition and, in more details, in the 12 MOIP 'design principles'. MOIPs can, in principle, enhance the legitimacy of policy interventions, their directionality and intentionality, allow for better horizontal and vertical coordination, etc. The investigations in the sample of MOIP initiatives considered in this study provide several examples of realisation of these expected benefits. However, as already mentioned, no MOIP 'ticks all boxes' of the design principles. Furthermore, there has been very few evaluations that could enrich this analysis with robust evidences

of the additionality of MOIPs compared to more traditional (less oriented, more fragmented) STI policies.

At a very generic level, some of the most frequently cited practices that have proved effective in the current early stage of many MOIPs are to:

- obtain high level political endorsement of the MOIP initiative and its mission;
- implement a gradual, hands-on and pragmatic approach, whereby the government and stakeholders improve incrementally the MOIP features of their initiative, starting with picking 'low-hanging fruits' and building on core groups of actors that are willing to commit;
- build upon existing structures of governance and institutions to redirect them towards collectively defined objectives;
- ensure that the MOIP initiative is complementary, not substitutive, to existing funding schemes;
- adopt a participatory and inclusive approach, with efforts dedicated to mobilise actors that risk being overshadowed by strong incumbents;
- implement management, monitoring and evaluation practices that are relevant to policy experimentation and learning, such as stage-gate funding of projects and formative evaluations.

3.2.2. Main challenges

A large number of interviews and thorough desk review allow to identify challenges more closely associated to the types of MOIP:

- *Overarching mission-oriented strategic frameworks* face problems of insufficient focus and integration. Wide consultations of various interest groups, including some powerful ones, can generate strong centrifugal forces during the mission definition stage and result in either of the following: broad, unclear and non-measurable missions; inflation of missions. Moreover, the co-ordination between the various policy bodies can be rather loose, limited to exchange of information or negative co-ordination (i.e. leading to strict division of labour rather than to collective action). Enhancing the level of focus and integration within these large scale and scope endeavours comes at a high transaction cost;
- *Challenge-based programmes* are more focused and less complex and costly. They however often face problem of articulation between the supply-side and demand-side policy instruments (including price mechanisms, regulations, public procurements, etc.). Moreover, those successful at delivering effective solutions to a well-defined problems are still a long way to contribute to solving societal challenges. To really 'make a difference', the developed local solutions need to be scaled up and widely diffused. This requires high level political decisions, financial resources and regulatory reforms that are often out of reach of these smaller scale initiatives;
- *Ecosystem-based mission programmes* are particularly subject to 'mission capture'. To be effective at developing consensual strategic agendas, they need to rely on established communities. These are often related to incumbents in key sectors which tend to avoid transformational agendas that involve a reshuffling of established economic positions;

- *Mission-oriented thematic programmes* strive to progress gradually on all mission-orientation fronts. Coming from a long tradition of thematic programmes, they need to improve directionality, holistic co-ordination while delivering concrete and useful solutions. They have to challenge long-established practices and communities of usual beneficiaries. Mission-orientation requires from these programmes that they venture outside of their 'comfort zone'.

However, MOIP challenges are shaped and influenced by a number of drivers beyond the type of MOIPs, not least country and thematic specificities. Table 5 provides an overview of the main challenges identified in the study, by MOIP dimension. The mention of the MOIP initiatives only indicates that the challenge was mentioned during interviews.

Table 5. Main challenges identified in mission-oriented policy initiatives

Strategic orientation	Policy coordination	Policy implementation
• Consultations of citizens (HE, MoT, KIRAS) • Enlisting new 'unusual' actors in agenda-setting (MTIP, SIP-SE, VisionH) • Creating a sense of ownership around the collective initiative (HTS2025, VisionH) • Defining neutral problems that do not exclude possible solutions, in particular those that involve behavioural and social changes rather than only technological progress (HTS2025, CDI, BoT) • Avoiding the inflation of missions or excessive broadening of missions (ISCF, MTIP, SIP-SE, LTP, HE) • Setting clear and measurable goals (particularly difficult for societal challenges), with milestones (ISCF, MTIP, BoT, MoT) • Avoiding piece-meal approach with small scale solutions to address large problems (CDI)	• Reducing co-ordination costs (ISCF, SIP-JP, MTIP, HTS2025, HE) • Avoiding mission silos (HTS2025, HE) • Strengthening and/or widening co-ordination (MoT, AAL, BoT, LTP, CLIMIT, KIRAS)	• Keeping the mission focus during the implementation (especially when decentralised implementation) (HTS2025) • Ensuring the funding of the missions (even when no central budget) (HTS2025) • Leveraging public funding (SIP-JP) • Connecting supply-side and demand-pull instruments, supporting market take up (PilotE, MTIP, CLIMIT, CDI, SIP-JP) • Broadening the policy mix toward non-STI policy instruments (regulations, price mechanisms, public procurement) (MTIP, CLIMIT)

Source: OECD MOIP Toolkit, https://stip.oecd.org/stip/moip/

As this policy approach is still new, very few studies have analysed in details the challenges and opportunities (and even less their results…) of MOIP initiative. One of these rare studies deals with the Dutch Mission-driven Topsector and Innovation Policy. Although this policy is still in its early days and the study looked into only two out of the 25 missions, findings have a wider. It sheds light upon some of the very characteristics of mission-oriented policies, notably the fact that they provide a specific orientation, governance and implementation framework co-created by the actors in the challenge area and adapted to the specific features of this challenge. It also shows the complexity and challenges of this approach.

Box 7. Early lessons-learned from the Dutch Mission-driven Topsector and Innovation Policy

The Ministry of Economic Affairs and Climate Policy (EZK) has commissioned in 2020 to the University of Utrecht a study into the governance and monitoring arrangements that are being developed for the Mission-driven Topsector and Innovation Policy (MTIP).

Strategic orientation

- The 25 missions have been developed by ministries outside the MTIP approach and were approved by the Cabinet. They have raised no contestation as they were the result of extensive consultations. The MTIP approach has been designed ex post to achieve these missions.
- Public authorities are acting as partners and facilitators, granting significant decision making authority to public-private structures. In this role, government officials have to balance between providing too much or too little guidance on the technology options. Some stakeholders consider that too many solution directions are being pursued simultaneously.

Policy co-ordination

- Governance brings together innovation missions, top sectors, and key enabling technologies. Its shape differs per mission, EZK providing a customizable blueprint. The design of the governance arrangements is still work in progress. It is generally considered as a rather complex process.
- The MTIP builds on the governance of the former generations of the Top Sector policy, adding an additional layer of coordination. However, the juxtaposition of the 'research and innovation governance' and 'mission-based governance' creates some challenges, which have not yet all been resolved (e.g. overlap and blurring of responsibilities of these structure, complexity).
- Governance brings 30 policy and funding partners together to cooperate voluntarily. The MTIP approach enables a gradual process of convergence of the agendas of research and innovation policy makers and of the 'challenge-owning' ministries.
- With the mission approach, line ministries are increasingly interacting closely with the ecosystem of business, research and civil society. This is appreciated by all stakeholders. Some, however, would welcome more steer from ministries, to indicate preferred options and thus, markets.
- Bringing users to the table provides a welcome interest in quick solutions, but it can be at the expense of systemic and long term thinking needed to prepare those innovative solutions. Long-term research within the mission is equally important.

Policy implementation

- Missions are implemented through many instruments, esp. to support the deployment: regulation (e.g. shifting from gas to electricity), subsidies for application, regional strategies etc. This helps to realise the missions but lining-up is a challenge.
- MTIP focusses on bringing closer existing funding instruments as well as other initiatives (e.g. platforms, agendas). Projects and teams moving from lower to higher TRLs have to qualify time and again (notably through competitive calls for proposal). This provides welcome checks and balances along the way - but also comes with transaction costs and delays. The execution of the Multi-annual Mission-oriented Innovation Programs is difficult to achieve when the mission teams are dependent on what proposals are submitted to competitive tenders.
- A new 'MOOI' instrument for some energy transition and sustainability missions is supporting broad projects uniting many parties that develop, implement and use innovations (or are affected by them). This could be extended to more missions. It could also be considered to support centres that run large programmatic projects stretching from lower to higher TRLs.

Source: Janssen M. (2020), *Post-commencement analysis of the Dutch 'Mission-driven Topsector and Innovation Policy' strategy*, Copernicus Institute of Sustainable Development, Utrecht University.

3.3. Lessons learned from strategic orientation in MOIPs

Directionality lies at the core of MOIPs and extends much further than simply setting a list of priorities or challenges to tackle. The main objective of this dimension of mission-orientation is to select specific societal challenge(s) along with their derived objectives, and strengthen the legitimacy of these choices in order to set the ground for focused intervention. It requires the involvement of a wide array of public and private stakeholders in the definition and selection of the specific societal challenge(s) to be addressed and the formation of a solid consensus among them.

3.3.1. How to engage a wide group of stakeholders in the mission definition?

Engaging stakeholders in the definition of MOIPs' around 'strong' orientations is the key to ensure that the intervention is considered as legitimate and to foster ownership across society. It is one of MOIP added value – at least in principle – to anchor the intervention into a wider social consensus and, even more, to try to engage the broad public toward inspirational challenges.

The specificities of MOIPs for stakeholder engagement

The case for stakeholder engagement in STI policy is well documented. It is as much about democracy (making sure that a broad range of interest and values are reflected in the orientations and that no communities are *a priori* excluded) and as it is about effectiveness (ensuring the buy-in of actors that will be instrumental for commitment and, therefore, success).

Stakeholder engagement is particularly crucial in MOIPs:

- *MOIPs lead to a significant degree of concentration of public resources (funds, time and efforts, political attention, etc.) towards the selected objectives.* It is part of the normal democratic process to make sure that a wider set of people (incl. citizen / tax payers) are not only aware of the choices made but also have participated in shaping those choices.
- *MOIPs involve, in several cases, some derogations to 'policy-as-usual' practices.* This includes, for instance, more direct contacts between the funding bodies and potential beneficiaries with a view to allow more directionality or collective action than what would have been the case with a purely competitive process. The acceptance of these practices significantly depends on the participation of stakeholders in the early stage of the design of the intervention.
- *Tackling societal challenges requires 'enlisting' and involving public and private actors well beyond the research and innovation arenas that are the traditional communities STI policy making bodies are in contact with*. These 'unusual suspects' represent different and sometimes unexpected interests, perspectives and values, and require gathering of various capabilities. These external stakeholders also have specific knowledge that is fundamental to dealing with complex "wicked" societal challenges.
- *Achieving some of the MOIPs' missions require societal transformation of which the potential social consequences may have large impacts on a host of actors*. They are also more likely to be highly visible and be more sensitive to societal acceptance, hence requiring more citizen engagement in the definition of a legitimate 'vision' (Chicot and Domini, 2018). More generally, the call for societal transformation has led new actors to join policy arenas and public debates,

"*transcending the scope and involvement of 'classical' innovation policy 'stakeholders'*" (Kuhlmann and Rip, 2018).

- *MOIPs cross many boundaries (sectors, disciplines, policy fields, etc.) and intend to foster some forms of collective action to achieve the commonly agreed objectives*. The participation of the relevant communities (or at least representatives of these) in the selection of these objectives is a way to mobilise them and increase their willingness to collaborate and invest in the implementation of the policy in later stages.
- *Most MOIPs, if not all, combine both societal and economic objectives.* Finding the right angle and balance between disrupting established modes of production and consumption (and therefore established positions of firms, sectors, research organisations, etc.) and enhancing competitiveness requires consultation of and negotiation among many different actors.

The practice of stakeholder engagement in MOIPs

MOIPs mainly builds on a mix of institutional and social legitimacy:[8]

- Institutional legitimacy can build upon international agreements, notably in the case of missions related to global warming, which goals often replicate the national commitments under the Paris Agreement. For instance, one of the Dutch mission under the Top Sectors Policy's Energy transition and sustainability theme aims for a 49% reduction of national greenhouse gas emissions by 2030, and 95% lower emissions by 2050 compared to 1990. Most initiatives are also embedded in a nested structure of strategic plans from the most overarching ones to more theme-specific ones. In turn, the legitimacy of these plans rely on how they have been developed and how they have been endorsed (e.g. by a Parliament, by a high-level committee headed by a Prime Minister, etc.).
- Social legitimacy requires an undertaking of specific consultation and dialogue activities, such as dedicated events or setup of governance bodies with large membership. It is common knowledge that allowing stakeholders to influence the setting of the orientations of an initiative is an effective way to ensure their buy-in and increase the likelihood of their participation in its implementation. One challenge of MOIPs in that regard is that they involve discriminant objectives that contrast with the traditional – and well-diffused – practice of making the priorities wide enough to satisfy all interest groups. How the process is conducted (transparency, fairness, etc.) is important to determine the acceptance of the final selection of objectives, and so is the availability of sufficient funding in order not to deplete the other areas.

Engaging and creating a consensus beyond traditional stakeholders and the first circles of potential beneficiaries of the intervention remains one of the main challenge for policy makers. It has improved in recent decades as a conjunction of several societal pressures (demand for more accountability and transparency, government openness, technology governance, people empowerment, etc.) but engagement and consultation tools are often limited to conferences, workshops and online consultations. The main ways to engage stakeholders in MOIPs are presented in Table 6 and discussed afterward.

Table 6. Main ways to engage stakeholders in MOIPs and selected examples of initiatives

Options	Examples of stakeholder engagement activities in MOIPs
Online consultations	• *AAL* and *HTS2025* – Dedicated electronic platforms • *Horizon* – Large web consultation on Horizon Europe's orientations • *All initiatives* – Various workshops and conferences
Consultation events	• *Horizon* – Dedicated co-design session on each mission areas during the 'Research and Innovation Days' • *ISCF* – 'Deep-dive' sessions • *HTS2025* – Decentralised Dialogue events
Dedicated MOIP body with consultation mandate	• *Horizon* – Mission Boards and Mission Assemblies • *HTS2025*– High Tech Forum • *ISCF* – Grand Challenge Review Panels • *SIP-JP* – SIP Governing Board • *Energie* – Five dedicated platforms for continuous dialogue with stakeholders, including civil society
Consultation via external body	• *PilotE* – 21-platforms • *MTIP* – Top Sectors and Top Teams
Organisational channels	• *PilotE* and *CLIMIT* – Agencies' consultations prior to calls
Non-technical communication activities	• *CDI* – Budget dedicated to communication activities for selected projects
Collective agenda setting and mission co-definition	• *SIP-SE* – Support to large communities of actors to develop and implement Strategic Innovation Agendas • *MTIP* – Development of Knowledge and Innovation Agendas - KIAs) in each of the 4 societal challenge areas by groups of Top Sectors • *VinnoP* – Co definition of two pilot missions using a method inspired by strategic design approach
Other	• *AAL*– Stakeholder mapping

Source: OECD MOIP Toolkit, *How to engage a wide group of stakeholders in the strategic choices of the MOIPs?* (Legitimacy), https://stip.oecd.org/stip/moip/questions/Q1!
Note: The list of MOIPs' acronyms is provided in Annex A.

Physical and online consultations

The most frequent tools to engage stakeholders are various types of consultations via electronic platforms or physical events. Almost all MOIP initiatives have undertaken consultations with various layers of stakeholders, from direct (potential or effective) beneficiaries to more distant actors conveying new perspectives and interests. In initiatives with broader societal objectives, a national or international scope and significant resources, these consultations extend to citizens at large. Following internal consultations among all Commission services, the European Commission collected 6806 responses on 20 questions related to Horizon Europe's orientation and content via a large web consultation opened to all interested respondents in 2019. It also organised three days of direct interactions between the Commission services and almost 4000 stakeholders, during the European Union Research and Innovation Days. During this event, 43 specific 'co-design sessions' were organised, including sessions dedicated to each of the five mission areas. These sessions brought together members of the corresponding Mission Board, the European Commission and a wide range of stakeholders.

Most initiatives do not rely exclusively on their own engagement activities and also take advantage of external channels and institutions. Those that include pre-existing instruments can use the consultation mechanisms already established by the policy bodies that operate them (for instance the consultations prior to the launch of a call for proposals by a funding agency or its general assembly and annual conference).

Governance bodies with consultation mandates

Dedicated governance bodies can play a significant role in strengthening the legitimacy of MOIP initiatives. In Germany, the High-Tech Forum (HTF) provides guidance and makes specific recommendations for implementing and advancing the High-Tech Strategy 2025. To perform this task, it involves a series of consultations with specific expert groups and other interest groups. The HTF has several sub-groups such as the 'social innovation group'. Besides consultations with specific expert groups, the Forum's agenda includes discussions of topical research and innovation policy issues. Its openness is somewhat genetically embedded in its composition since it has 21 experts from academia, business and society. Energiwende (Germany), due to the social implications of the transition towards a low-carbon energy system, has established an elaborate dialogue and stakeholder consultation infrastructure centred around five energy transition platforms (Energy Grids, Electricity market, Energy efficiency, Buildings, and Research and innovation).

Extensive consultations using already established channels such as sectoral or thematic public-private platforms are also an effective way to consult and enhance the buy-in from important actors. The scope of these consultations should however be wide enough to avoid the capture of the mission agenda by existing actors with their own vested interests because this can preclude the pursuit of disruptive innovation across sector boundaries.

Collective agenda setting and mission co-definition

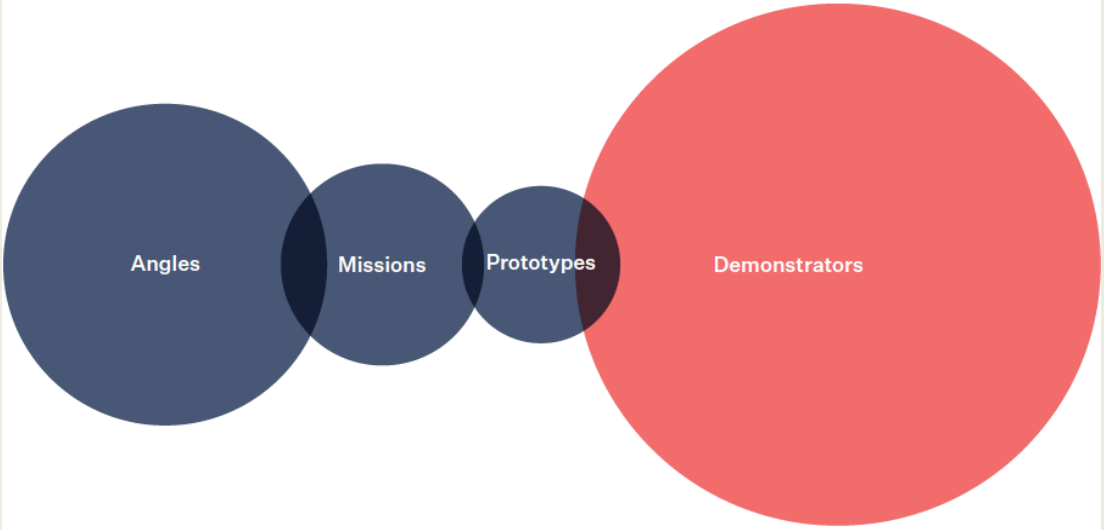
The co-definition of the mission with stakeholders or the delegation to emerging eco-systems of the authority for developing it proves particularly effective not only to improve its relevance but also to bolster a sense of ownership among the participants. The Swedish innovation, agency Vinnova adopted such 'delegated' approach in two Eco-system-based mission-oriented schemes, e.g. the Strategic Innovation Programmes (Box 6) and the Vision-driven innovation milieus. Vinnova also launched a pilot initiative to co-define missions with a variety of stakeholders at national and local levels. This process can start with a smaller set of actors that broadens as the initiative unfolds and gains more legitimacy. According to agency officials, it allowed to start rapidly and at small scale, managing risk whilst delivering change. Yet it has considerable potential for scaling 'built-in', whilst also forcing governance to be re-aligned around systems, and the everyday perspective of people and place, rather than legacy organisation (Box 8).

Box 8. An example of mission co-definition process: Vinnova's pilot missions

The Swedish innovation agency Vinnova has co-developed two pilot mission areas, with a variety of stakeholders at national and local levels: healthy sustainable mobility and healthy sustainable food. The latter for instance aims to ensure that every student in Sweden eats healthy, sustainable and tasty school food by 2025. It is using an open and iterative process to run a succession of cycles of diverse engagement and participation processes, across the country, ultimately leading to public prototypes and system demonstrators. Deriving insights from multidisciplinary formats colliding front-line actors across public, private and third sector, the engagement process produces various perspectives and opportunities for systemic change ("angles"). These are supplemented by desk research and bilateral meetings. Using systemic design methods, the angles are developed into coherent missions, again in collaboration with system actors. These missions address different perspectives on the systems implied in the overall mission theme. Prototypes are then co-designed and delivered, enabling a place-based innovation process, which tests different interventions in public, ensuring technologies are placed into socio-political contexts, whilst stimulating dialogue and participation. These

prototypes embody various interventions, exploring behaviour change, public sector capability-building, policy labs and regulatory sandboxes. If deemed successful, prototypes can be scaled into systems demonstrators. Interactive workshops gathering between 15-30 participants representing the diverse relevant communities implied by a mission theme (for instance, in the case of the 'healthy sustainable food' mission, a chef, a student, a sustainability data startup, the national food agency, a regulatory authority, etc.) are a key tool to co-design the missions and the portfolio of prototypes (Figure 9).

Figure 9. Overview of the design process of Vinnova's 'pilot missions' initiative



Source: Hill D., (2020), Mission-oriented pilot missions at the Swedish Innovation Systems agency Vinnova, *Online workshop series on 'Governing mission-oriented innovation policies', Scoping and agenda setting*, May 15th.

These workshop processes also help identify likely candidates for systems prototypes. Beside the innovative methods to arouse interactions (for instance, the collective insights produced by the 'systems canvas' to collect participants' views on possible system change options), one interesting feature of this initiative is to focus on a certain node of the system where actors have concrete leverage, as a way of iteratively building infrastructures, cultures and insights for wider societal transformation. For instance, following this 'place-based innovation' approach that partly draws on 'strategic design' methodologies, the healthy sustainable food mission focused on school food, as this represents half of all the meals served in Sweden every day and is a relatively well-regulated system, where inventive procurement and redesign could act as a 'lever' with which to progressively transform the entire food system. Similarly, the healthy sustainable mobility mission focused initially on existing city streets, which represent around 40,000km of space that can be addressed as a single system as well as being focal points where almost numerous key systems converge. Modular adaptive and scalable interventions were designed and deployed.

Source: Vinnova (2021); Information provided by Vinnova.

While there is no 'one best way' to get traction on a MOIP initiative, diversifying the interaction tools and channels to access different community of actors on various aspects of the challenges to be tackled minimises the risk of failure, as shown by the example of the ISCF in the UK (Box 9).

Box 9. Engaging with stakeholders through different means: the Industrial Strategy Challenge Fund (UK)

The selection of Industrial Strategy Challenge Fund (ISCF) challenges in each of the four Grand Challenges selected in the United Kingdom Industrial Strategy (UKIS) was based on a combination of priorities identified within government, the expertise of UKRI and through extensive external engagement with experts and stakeholders. The UKRI conducted stakeholder workshops, direct negotiations with industry based on wide consultations for ISCF challenge proposals and 'deep dive sessions' for consultations on the UK Industrial Strategy at large. UKRI also used Grand Challenge Review Panels for consultations.

The process for defining the first wave of ISCF challenges started in 2017 with a preselection of 8 areas by funding bodies and their networks of experts. These areas were then discussed in nine workshops held across 8 cities in the UK with teams of experts from Innovate UK, Research Councils and stakeholders in order to explore possible challenge areas and get a better understanding of relevant local issues. The workshops were further developed with 600+ experts to develop initial ideas into specific ISCF challenges. The participants rewrote the challenges, recombined or split them up, and identified whole new challenges, before prioritising them.

Industry actors were also mobilised through a bottom-up process. For the third wave of ISCF challenges, UKRI asked the industry to come forward with challenging ideas through a broad Expression of Interest (EoI) process. It was specified that each submission should be industry-led and aligned with one of the four Grand Challenges of the UK Industrial Strategy. The industry proposed 252 proposals following a normalised structure (productivity growth and market opportunity, UK competitive advantage, need for specific support, etc.). Grand Challenge Review Panels convened to ensure alignment of the proposals with wider policy objectives. An ISCF Wave 3 Review Panel, consisted of government officials and sector experts, worked on this basis to produce a shortlist of ISCF challenge proposals and made recommendations to BEIS Secretary of State. Finally, 10 ISCF challenges were taken forward to an industry negotiation phase to agree on respective commitments. The level of government funding available for each challenge conditioned to the success of these negotiations. The whole process for developing the third wave of ISCF challenges took about one year and a half.

The government also used series of 'deep-dive sessions' within challenge areas to scope key areas of interest from the industrial and academic community for cross-sector collaboration and to raise awareness on the forthcoming funding opportunities. These events included a mix of plenary session (presentations of the scheme and the challenge) and brainstorming and community-building breakout groups.

The Council for Science and Technology (CST), which advises the Prime Minister on science and technology strategic issues that cut across the responsibilities of individual government departments, also supported this process.

Note: More information available at https://stip.oecd.org/stip/moip/case-studies/12?answerId=A1-12

3.3.2. How to define missions in MOIPs?

Steering research and innovation activities – and the economic and social activities stemming from these – towards collectively designed and socially desirable objectives in order to pave the way for collective action is the main justification of mission-oriented innovation policies. It is however one of the most challenging tasks, both politically and practically.

The specificities of MOIPs for defining missions

In most cases, the traditional segmented and loosely coordinated innovation systems do not allow the initial strategic orientations to have the intended effects on the actual directions of STI activities, in particular when it comes to spurring transformations. Various barriers and conflicting signals interfere and blur the orientations conveyed by the host of strategies (overarching and thematic), roadmaps, lists of regularly renewed priorities and the like that can be found in most national innovation systems. As they cascade 'downward' into ministries' action plans, agencies' programmes, and, finally, public and private research performers' plans, the initial orientations are modified, with unintended concrete effects on the actual directions of STI activities. The 'chain of strategic orientations' is most often interrupted, altered and/or fragmented, reducing the ability of steering STI activities towards socially desirable goals. Moreover, as shown in many reviews of innovation systems, the initial priorities themselves are often ill-conceived (often too widespread and all-inclusive to set any discriminant orientations) and/or inconsistent (multiple priorities from different components of the system overlap and sometimes contradict each other). As claimed by Kuhlmann and Rip, "*directionality claims 'towards transformation' exceed the classical setting of government and stakeholder actors and agenda-setting routines*" (2018).

Different types of mission-oriented innovation policies – which revolve around joined action towards clear, ambitious and long term goals – are in principle a way to alleviate directional failures that preclude transformational change. On top of the traditional rationales of public intervention in terms of market failures and system failures, directional failures reflect the inability of modern institutions (culture, markets, public authorities, firms, networks, national and sectoral systems, etc.) supported by traditional policies to set particular directions of transformative change to respond to societal challenges (Weber and Rohracher, 2012; Robinson and Mazzucato, 2019). Due to the inherent complexity of these challenges (often cross-disciplinary, cross-sectoral and multi-level), different types of public intervention with stronger strategic orientation are needed to help these institutions set the path towards the necessary transformation of innovation, production and consumption systems. By setting clear objectives related to a societal challenge and translating these into goals that can be evaluated, and setting governance mechanisms that bind relevant actors around the realisation of these objectives, mission-oriented innovation policies are designed to go against the 'dilution' or 'perversion' of orientations.

The practice of mission definition in MOIPs

There has been to date very little work on the process for setting missions in practice. Box 10 provides some elements drawn from some of the very few authors who have ventured into studying the operational procedures that could be used for selecting challenges.

Box 10. Steps for selecting challenges in Mission-oriented innovation policies

Arnold *et al.* (2019) in a recent report delivered to the Research Council of Norway (RCN) proposed some steps for selecting challenges. These steps are particularly relevant for the National overarching mission-frameworks in which broad challenges to be addressed are selected at the highest level of policy making following consultations, and formalised in missions, plans and agendas.

- *Consultation* - A broad consultation, spanning citizens, business, the state and the research community to identify a set of societal challenges that could be tackled and to ensure the social legitimacy of including them among possible candidates;
- *First selection* - A selection process reducing the number of challenges to be considered to, perhaps, half a dozen;
- *Foresight* - A foresight exercise, involving panels of informed citizens and stakeholders in creating desirable scenarios involving intervention, setting out the expected impacts and explicitly identifying the unique contributions the country could make and the benefits to this country (in business as well as social terms) of doing so;
- *Final selection* - A final selection process which assesses the proposed scenarios and selects perhaps three for implementation based primarily on the amount of economic benefit thought likely to accrue to the country;
- *Communication* - The government has to own the selection process and its results and devote considerable effort to communicating the results of its process back to the citizens, showing how this connects with the original consultation.

Source: (Arnold et al., 2019)

There is a wide diversity of ways for setting directions, even within the same type of MOIPs. Orientations can be embedded in different 'vehicles' (for instance in national or thematic strategies and plans, missions, calls for proposals, project proposals) with various actors playing leading roles in the process. Table 7 provides an overview of the different ways in which directions are set in MOIPs, with some corresponding examples of initiatives.

Table 7. Main ways to set directions in MOIPs and selected examples of initiatives

Options	Examples of directional mechanisms in MOIPs
Directions set by the government / high level committee with consultations	• *HTS2025* – Selection/design of the strategy missions by Government • *Energie* – Setting of the overall objective by Government • *MTIP* – Selection/design of the policy missions by Government • *UKIS* – Selection/design of the Grand Challenges by Government • *ISCF* – Selection of the challenges by Government
Directions set by project partners	• *PilotE* – Objectives set in project proposals, in line with calls' orientations designed by group of three agencies • *CDI* – Challenges in project proposals responding to open calls
Directions set by (thematic) communities of actors	• *SIP-SE* – Co-design of the Strategic Innovation Agendas by selected SIA partners • *Vision* – Co-design of 'Milieus' visions by selected ecosystem partners • *MTIP* – Development of the Integrated Innovation and Knowledge Agendas by groups of Top Sectors • *VinnoPM* – Co-design of the mission by workshop participants and a diverse set of participating stakeholders
Directions set or recommended by MOIP governance bodies	• *Horizon* – Selection/design of the Missions in each mission area by Mission Boards, supported by Mission Assembly and Mission sub-groups in the Shadow Programme Committee (all composed of experts and various stakeholders) • *SIP-JP* – Selection of the challenge areas and SIP programme areas by high level CSTI and SIP Governing Board (overall) and SIP Promotion Committee (in each SIP)

	• *Moonshot* – Setting vision and proposing Moonshot Goals by Visionary Council; Setting Moonshot goals by CSTI and the Headquater for Healthcare Policy

Source: OECD MOIP Toolkit, *How to set clear orientations and strategic guidance for developing appropriate MOIPs?* (Directionality), https://stip.oecd.org/stip/moip/questions/Q2, OECD MOIP Toolkit, *How to translate broad MOIP objectives in specific goals and targets, with clear timeline and milestones?* (Intentionality), https://stip.oecd.org/stip/moip/questions/Q4,
Note: The list of MOIPs' acronyms is provided in Annex A.

Foresight can be instrumental to generate and discuss desirable scenarios when defining missions. A very few number of MOIPs have been preceded by, or have included, a foresight exercise. One exception is the programme Mobility for the Future which benefited from a foresight exercise conducted in cooperation with six different ministries. The exercise aimed at contributing to set up the foundations for a research and innovation policy roadmap for the future development of mobility research and innovation.

Public authorities find a new role in several MOIPs as brokers or 'ecosystem architects' to support the process of mission definition. In particular in Ecosystem-based mission programmes, the state orchestrates the process of co-creation of the strategic agenda with little intervention in the actual directional decisions. This apparent 'neutral' role should however not lead to underestimate the importance of public authorities: they intervene i) before and during the call for proposals in the process to stimulate, steer and mobilise actors. When it comes to addressing new challenges where new communities of actors (or ecosystems) are not yet in place, the key role of public authorities is to support the process of emergence of these communities; ii) through the selection of proposals in which they still play a role as a last resort based on experts and peers assessment. Intervening upstream, they act not only as broker but at times also as 'ecosystem architects', proposing to merge some groups and networks in the making or recommending some redirections to keep in line with national priorities. This is in line with the shifting role of public organisations like funding agencies to help address grand challenges as 'assemblers' rather than 'builders' (Kuhlmann and Rip, 2018).

Box 11. Examples of proactive role played by public authorities in Mission-oriented innovation policies

Several MOIP initiatives in particular those falling under the Ecosystem-based mission programme type provide examples of hands-on processes led by public authorities, most often agencies. For instance, in the Swedish SIP initiatives, applicants of several rejected Strategic Innovation Agenda proposals in the same area (forestry) were asked to consider resubmitting them after taking into account the existence of overlapping proposals. They eventually submitted a combined proposal.

When selecting communities' proposals, public authorities can set directions but also fine-tune the scope of the 'problem-solution' space covered by the different selected proposals. The Vision-driven Milieu in the health area, also in Sweden, deliberately selected some overlapping proposals to test different visions and the willingness of different (nascent) ecosystems to engage in the scheme. One key lesson from this new scheme was that the best way to ignite the process was to start with some groups of motivated actors – even if small-scale and not covering all the components of the system to build – and expand on this basis, rather than postpone the process until a wide consensus has been achieved, including with the 'big players'. Prior to calls, this requires significant contacts to raise awareness and interest, and 'test' some potential actors that could become supporters of the whole process.

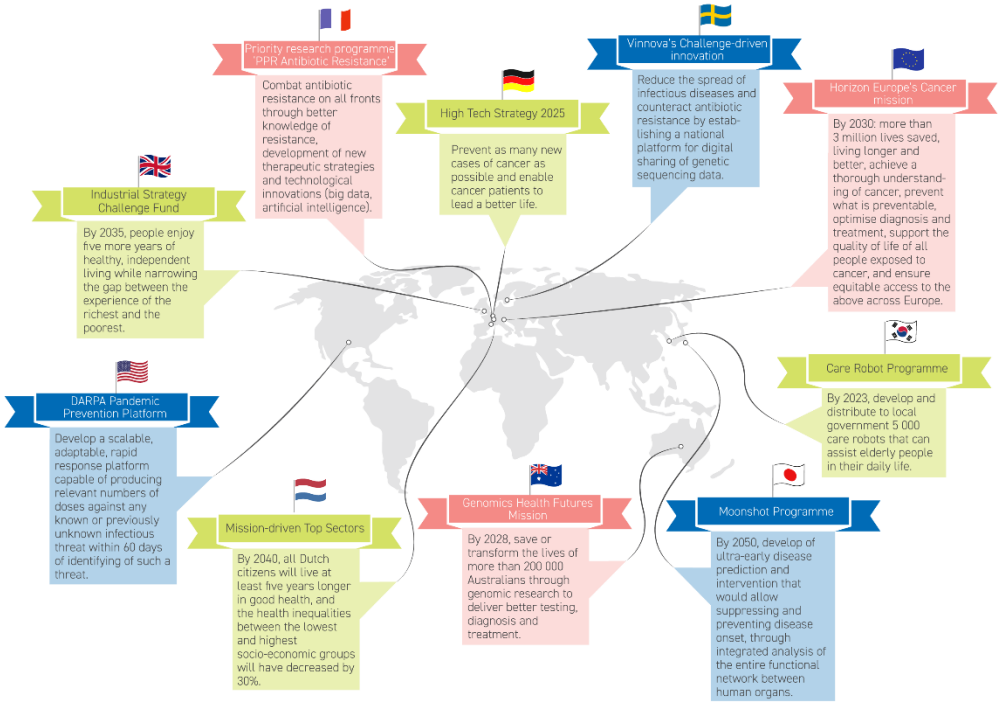
Public authorities have also played a hands-on role in some challenge-based programmes such as Pilot-E in Norway. Given the level of ambition of the calls and the particular nature of the integrated scheme, the three collaborating agencies performed some preparatory work ahead of the calls to mobilise potential partners and explain the specificities of Pilot-E. They encouraged different companies to cooperate when relevant and without hindering the competition process. These interactions were meant to avoid costly trial and error processes during the application stage, and allow a greater alignment between the agencies' strategic plans and the partners' proposals.

The strong need to ensure the legitimacy of MOIPs and the complexity of the challenges to be addressed exclude initiatives where governments take the decision in isolation. All cases included in the MOIP database have involved a significant degree of consultations in the definition of their 'mission' (see previous section). However, the intensity and scope of the collective decision-making process vary sensibly across initiatives. This holds true on the side of public authorities (which can involve a broader number of ministries and agencies, for instance, the Norwegian multi-agency initiatives CLIMIT and Pilot-E) and on the side of stakeholders (from individual project partners in the Swedish CDI to broad sectors or ecosystems as for the Dutch Mission-oriented Topsector and Innovation Policy).

Few of the MOIP initiatives have set objectives that have the expected mission characteristics: *clear, bold and inspirational, with wide societal relevance, ambitious but realistic, targeted, measurable, time-bound and solution neutral* (European Commission, 2018). Most MOIPs have set 'challenge areas' or 'mission areas', not missions, and the precise goals are set by applicants in their project proposals. When formal missions have been defined, several of them remain vague and are yet to have defined targets or milestones. Many are qualitative statements turned into a mission format and are not very different from traditional thematic programme objectives or even industry targeting policies. Missions range, for instance, from "*save or transform the lives of more than 200,000 Australians through genomic research to deliver better testing, diagnosis and treatment by 2030*" to "*Develop the next generation of affordable, light-weight composite materials*" (UKISCF) and "*Build up a battery cell production in Germany*" (HTS2025).

These features reflect the fact that putting more directionality in STI policies is a very sensitive issue in many respects (political, technological, operational, etc.). The well-known injunction for policy makers to 'pick problems, not solutions' is at the core of MOIPs (Mazzucato, 2017), but it proves difficult to implement practically. MOIPs provide a learning space for policy makers and stakeholders to co-design the specific orientation setting process that best fits the thematic and national context, and can evolve. Figure 10 presents a selection of mission statements in the health and healthcare area.

Figure 10. International map of selected missions in the health and healthcare challenge area

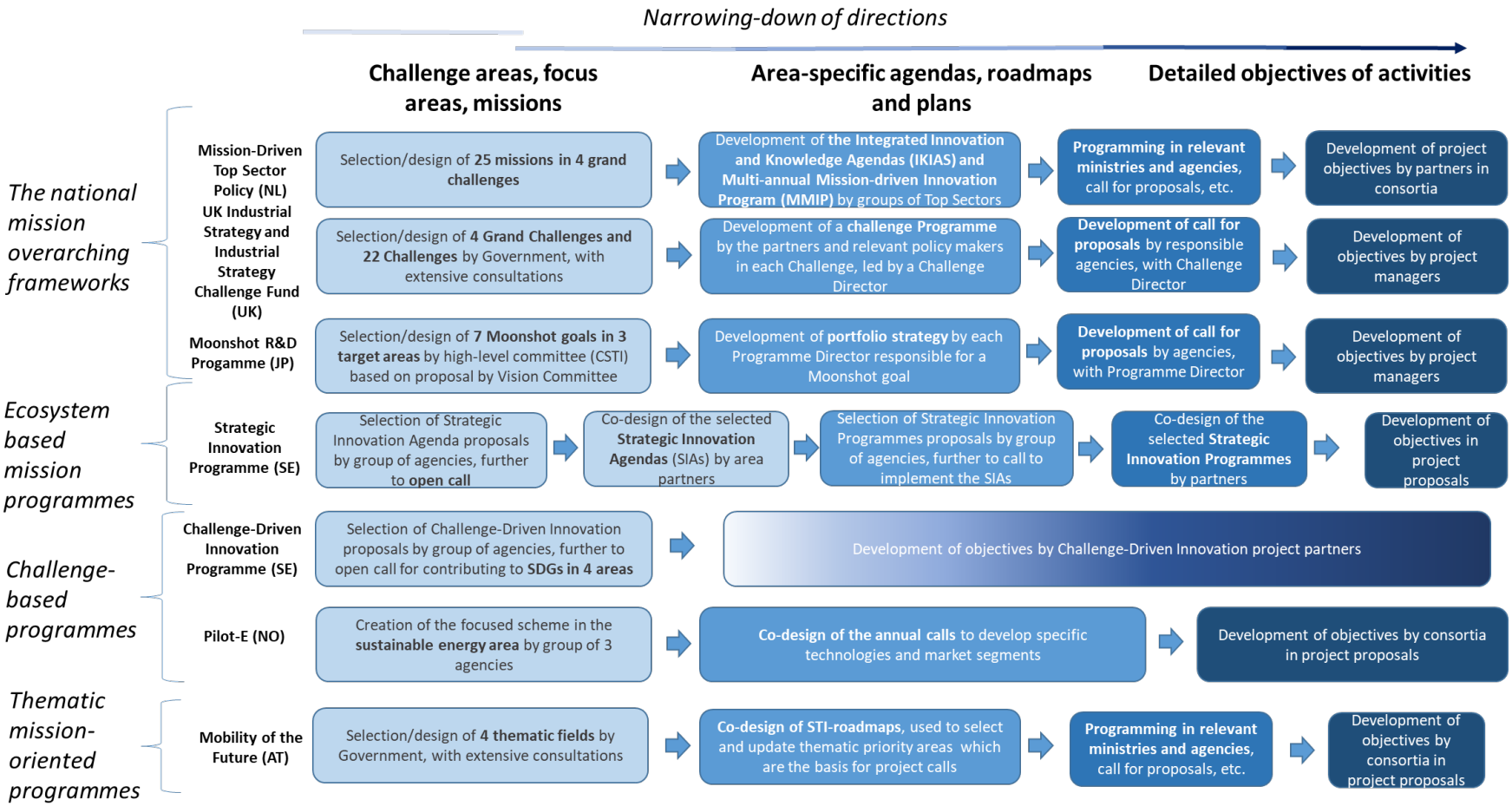


Source: OECD (2021)

Setting orientations is a very gradual and inclusive process, through which the scope of objectives is progressively narrowed down from broad challenges and missions to objectives set in projects (Figure 11). One implication is that that the typical classification of policies as 'top-down' or 'bottom-up' is largely irrelevant in the case of MOIPs: the orientation process unfolds as a succession of top-down and bottom-up phases, opening and reducing the space of potential options through a mix of concertation and selection stages.[9]

MOIPs mix societal and economic objectives, which can generate some mismatch in terms of geographic scope of the policy intervention needed to address these different objectives. While societal objectives would in most cases require international policy cooperation (not least in the case of global public goods such as climate), the objective of raising competitiveness severely hinders going beyond national borders.

Figure 11. Main stages of strategic orientation in selected examples of MOIPs, by type of MOIPs



3.4. Lessons learned from policy co-ordination in MOIPs

Policy co-ordination aims to ensure the alignment of public interventions implemented by policymaking institutions covering different policy fields and/or levels of government.

3.4.1. How to coordinate policy bodies across silos and levels of government in MOIPs?

The specificities of MOIPs for coordinating policy bodies

Policy co-ordination allows in principle to:

- Avoid, reduce or mitigate mutual adverse consequences of interventions designed and implemented between different policy actors;
- Avoid gaps resulting in unattended needs from potential beneficiaries;
- Pool financial resources, share risks and bring together information and expertise in order to be more effective in understanding and dealing with problems of common interest.

Although these benefits are well documented in the literature, policy co-ordination is one of the oldest and most prevalent challenge for governments, as demonstrated in OECD Innovation Policy Reviews. This concern has become even more pressing since the 1980s with the diffusion of the New Public Management doctrine that promoted 'agencification' and the creation of individual programmes. STI policies and instruments have become more differentiated, addressing specific failures from the support to basic 'free' research and social entrepreneurship, to the promotion of international collaborative research or the provision of problem-solving expertise to low tech SMEs, to name only a few. As these specific instruments interact, it is essential to ensure their consistency. More generally, co-ordination is needed to alleviate the resulting fragmentation of policy landscapes. This has called for more elaborated governance arrangements to ensure the alignment of decentralised governance and policy systems.

The particular features of MOIPs make the policy co-ordination imperative even stronger:

- *MOIPs intend to cover the entire innovation chain* – The linear view of the innovation process, although still deeply anchored in a number of national innovation systems, has become increasingly challenged. There is no natural flow of knowledge and technology that transforms 'intrinsically good ideas' in relevant research, valuable innovation and economic and social impact. The innovation chain needs a variety of backward and forward linkages, which need to be properly coordinated to be effective;
- *MOIPs expand beyond the realm of STI policies* – The 'wicked' nature of societal challenges have made the need for a 'joined-up government' even more necessary. As stated by Peters, '*attempting to deal with a problem such as climate change or sustainable development requires the involvement of much of government, and hence co-ordination*' (Peters, 2018). More generally, the implementation of societal challenges as formalised in SDGs requires governments "*to work across policy silos and set ambitious and interrelated economic, social and environmental objectives that go beyond short-term political cycles*" (OECD, 2019);
- *MOIPs are systemic policies supporting systemic innovation to solve systemic issues* – societal challenges involve complex and interconnected issues requiring a combination of complementary innovations. MOIPs mix market mechanisms and

different policy tools to plan, produce and articulate these innovations under an integrated strategic and governance structures (OECD, 2015).

Against this backdrop, different types of co-ordination co-exist. Horizontal co-ordination relates to the arrangements aiming to increase the coherence of decisions between different policy fields across political and administrative silos. The boundaries between different policy fields usually correspond to various interventions implemented to support sectors (agriculture, industry, digital affairs, etc.) or stages in the innovation chain (basic research, applied research, innovation, demonstration). Vertical co-ordination aims to shore up the consistency of policy actions across levels of government. This has raised concern among countries due to an increasing devolution of competences and resources for supporting research and innovation to sub-national authorities (OECD, 2011).

The COVID-19 crisis is a striking demonstration of how much proactive and intentional co-ordination can enhance responses to the pandemic by limiting the duplication of efforts, ensuring a sufficient scale of efforts, enabling a wider and more sustainable exploration of potential solutions, and by providing greater visibility to initiatives that offer funding for COVID-19 (OECD, 2020b).

The practice of co-ordination of policy bodies in MOIPs

By definition, all MOIP initiatives include more elaborate governance structures that would be the case in more traditional policy schemes. Some initiatives, especially in the case of National overarching mission frameworks, have various 'nested' multi-level governance bodies that intend to collectively make different strategic, programming and operational decisions. The HTS2025, for instance, add layers of governance at the level of the overall strategy, of the missions and of some of the activities (Box 3). The governance structure can also be multi-polar, with different bodies having authority on various parts or functions of the whole initiative. The Mission-Driven Top Sectors Policy for instance is one of the initiatives with the most elaborate structure of co-ordination, crossing several sectors and societal challenges areas with their respective missions. Both sectors (Top Teams) and Challenge areas (Thema teams) have their own governance bodies, which meet and interact (Box 1).

Table 7 provides an overview of the modes of horizontal and vertical co-ordination in MOIPs.

Table 8. Main modes of horizontal and vertical co-ordination in MOIPs and selected examples of initiatives

	Options	Examples of co-ordination mechanisms in MOIPs
Governance at overall initiative level	High-level committee composed on various policies bodies and experts/stakeholders	• *MTIP* – Steering Committee, gathering about 40 policy makers and partners • *CLIMIT* – Programme Board reporting to two agencies • *SIP-SE* – Steering group with three agencies • *SIP-JP* – CSTI (headed by PM, with various ministers) and SIP Governing Board (with CSTI executive members) • *UKIS and ISCF* – Economic and Industrial Committee (10 Secretaries of State, headed by PM)
	Other formal co-ordination mechanisms	• *HTS2025* – Roundtable of State Secretaries for HTS2025 • *LTP* – Ministerial Cabinet Meeting
Governance at thematic / mission level	Various governance bodies in the initiatives' thematic components	• *MTIP* – Top Teams and Thematteams (stakeholders mainly but meet with relevant policy bodies) • *HTS2025* – Specific governance bodies in missions (strategy committee etc.) with relevant policy makers and stakeholders • *PilotE* – Steering Board gathering representatives of the three agencies • *SIP-SE* – Dedicated governance bodies in each SIP

		• *KIRAS* – Steering Committee with all relevant ministries and agencies • *LTP* – Interdepartmental groups in each of the Plan's thematic priorities
Governance at operational level	Various operational committees and working groups	• *MTIP* – Coreteams • *HTS2025* – Interministerial committee of the federal government and regular interministerial meetings • *PilotE* – Working Group (with representatives of three agencies) • *SIP-SE* – Programme Office in each SIP
	Decision maker with strong leadership	• *PilotE* – Programme Secretary (paid by the three agencies) • *SIP-JP* – Programme Director in each SIP • *Moonshot* – Programme Director responsible for each Moonshot goal and project manager for each project • *UKIS and ISCF* – Challenge Director

Source: OECD MOIP Toolkit, *How to ensure join up action of different policy bodies across silos in MOIPs?* (Horizontality), https://stip.oecd.org/stip/moip/questions/Q6
Notes: PM: Prime Minister; The list of MOIPs' acronyms is provided in Annex A.

The main specificities of MOIP governance relatively to traditional STI strategies and policies are:

- *The scope and intensity of cross-ministerial co-ordination* – As previously mentioned, holistic co-ordination is one of the pillars of MOIPs due to the level of ambition, complexity and scope of societal challenges. In some initiatives such as the HTS2025 and SIP-JP, the need for interministerial co-ordination was one of the criteria used to select, respectively, the missions and SIP programme areas;
- *The tailor-made governance structure* – MOIPs function as 'mini-system of innovation', each of them with their own structure of governance that fits the specific need and characteristics of their missions. These have strong implications in terms of the demand for co-ordination, as previously mentioned (see Section 2.4). In a nutshell, the more wicked the challenge, the higher the demand for co-ordination will be, hence requiring a more elaborate governance structure. Energiwende, the strategy that aims at transforming the German energy sector towards low-carbon energy system based on developing renewable energy and improving energy efficiency, has numerous governance bodies and platforms at federal and lander levels. The Governance at thematic level (see Table 7) is therefore fundamental for successful implementation, while the 'whole-of-initiative' governance ensures the relevance of the high level orientations and the legitimacy of the intervention.
- *The co-ordination function of powerful managers* – the goal-oriented nature of MOIPs lends itself to focused management embodied in managers with strong delegation of power, as per the DARPA model (Box 3). These persons with a rare mix of substantive and transversal skills prove to be also instrumental for supporting interrelationships between policy bodies across administrative silos. In the Japanese SIP, the powerful Programme Directors in each programme act as chairs of their respective Promotion Committees and are deemed essential for the promotion and smooth operation of interministerial co-ordination and science-industry cooperation. In Pilot-E, the programme manager is in charge of the secretariat of the steering group that gathers the three partner agencies.

One of policy makers' deterrents to engagement in MOIPs is the concern over lack of leadership and unclear responsibilities regarding the success and failure of coordinated initiatives. This is a highly context-dependent issue that has no ready-made solution. Some MOIPs have designated leaders for whole or part of the MOIP initiatives on top of the collegial structure of governance. In Horizon Europe, while it is expected that the implementation of missions will involve several directorates (as it has been the case during

the previous phase of mission definition), each mission will be led by specific directorates. In challenge-based initiative, the powerful programme managers are accountable for the results of their mission.

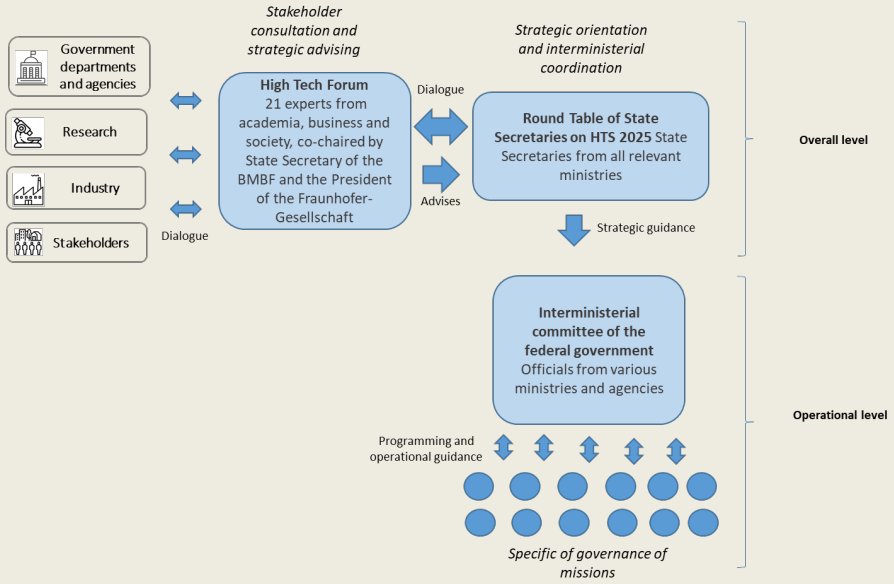
Although difficult to estimate, co-ordination costs can be significant in some of the largest MOIPs. The Challenge-based programmes, just like the DARPA model they emulate to a greater of lesser extent, have lower transaction costs in general, due to a lean and flat structure. Interviews undertaken for instance with decision makers of the Pilot-E scheme confirm that the results are deemed exceeding the additional costs. The Steering Board who decides upon the overall plan for the scheme as well as the theme and content of the calls, meets twice a year. The Working group meets about 10 to 15 times per year in a small setting (the Pilot-E secretary and one representative from each of the three agencies). In contrast, Overarching national mission framework with a more elaborate and multi-level structure of governance can be very demanding in terms of meetings sometimes in a large setting and with high-level representatives. The Dutch Top Sectors and Innovation policy, which had been in the past criticised for being too bureaucratic, crosses since 2018 the sectoral and challenge dimensions. This implies additional 'meetings of various governance bodies gathering a wide range of stakeholders (Steering Committee, and in each of the nine Top Sectors one Top team and several Top consortium for Knowledge and Innovation (TKIs); in each challenge area there is one Thematteam and possibly several Core or Mission teams). Its higher cost should however be considered together with the scope of the initiative, which encompasses the whole national innovation system.

Box 12. Multi-level governance in the High-Tech Strategy 2025

Following several reports and evaluation emphasising the deficit of holistic co-ordination, the High Tech Strategy was initially designed in 2006 with a view to alleviate policy silos at landers and federal levels. Although it noted progress, the Commission of Experts for Research and Innovation (EFI) in its Annual Report 2017 noted that it still saw "*room for improvement – above all, the inter-departmental co-ordination of R&I policy should be significantly speeded up during the next legislative period*". It notably recommended the establishment of a Federal Committee of State Secretaries for the next HTS. Such committee was created to improve holistic co-ordination of the HTS 2025 launched in 2018. Another significant change consisted in the addition of 12 missions beside horizontal reforms was a further attempt to strengthen interdepartmental co-ordination. Even more, the main criterion for the selection of the missions was that they had to be established in "*fields where it is necessary for all relevant players to unite forces behind a common goal in order to achieve further progress*". The Strategy itself stipulates that its success depends on "*a common awareness of problems, a clear distribution of tasks, transparent participation processes, and functioning co-ordination mechanisms*". This includes "*closer interdepartmental cooperation at the political level so that the various policy areas can work together even more effectively*".

Practically, several governance bodies ensure holistic co-ordination, at overall level and at the level of specific missions.

Figure 12. Structure of governance of the HTS2025



The strategy is coordinated through the so-called 'Round Table of State Secretaries on HTS 2025'. This new intra-governmental co-ordination mechanism is tasked with defining, steering and shaping various ministries' innovation policy agendas along the priorities of the HTS 2025. The Round Table benefits from recommendations and expertise from the High-Tech Forum (HTF), the Strategy's central advisory council. While it has no decision power, the Forum systematically passes on its deliberations to the Round Table of State Secretaries. This establishes a constant dialogue between policy makers and the HTF. This link is also ensured by the shared chairmanship of the HTF by the Federal Government and the Fraunhofer-Gesellschaft.

At operational level, the implementation and advancement of the HTS is monitored and supported by an interministerial committee of the federal government in which the Federal Chancellery and all the ministries are represented.

Also regular interministerial meetings are held to develop missions' strategic work programmes and advance their implementation. In the Combating cancer mission for instance, the Strategy Committee is composed of 17 experts who meet twice a year.

Although it was still too early to assess the results of the new governance structure of the HTS2025, the EFI Commission stressed that the missions of the HTS 2025 represented positive starting points for intensified inter-departmental cooperation.

Source: https://stip.oecd.org/stip/moip/case-studies/1

3.4.2. How to coordinate policy bodies to foster exploration and produce novel solutions?

In order to serve a transformational agenda, MOIPs are meant to solve an apparent paradox, *i.e.* being more directional while leaving the range of potential solutions wide open. To do so they coordinate the undertaking of exploratory activities, in close interaction with science.

The specificities of MOIPs for fostering coordinated exploration

MOIPs promote interdisciplinary research, which is key to unravel novel solutions to address societal challenges – as widely documented, breakthroughs often occur at the frontiers between different disciplines. This is particularly true when addressing societal challenges of unprecedented scale and scope that in turn call for new combinations of knowledge. MOIPs "*pick the problem*", which starks a clear contrast with vertical and discipline-based policies that target selected sectors, technologies or disciplines. The challenge-based approach that underpins MOIPs creates a 'pull effect' that is more effective at stimulating multiple sectors and multiple forms of cross-actor collaborations (European Commission, 2018).

MOIPs can enable wider exploration through the implementation of coordinated portfolio strategies – In a context of high uncertainty regarding the potential effects of different potential solutions, scientific and technological efforts can converge too rapidly towards a small set of solutions that demonstrate early encouraging results at the expense of alternative options with possible greater potential impact. The co-ordination among different funders within MOIPs allows in principle to avoid this problem of 'early lock-in' as the partners can collectively manage the traditional choice between the "*exploration of new opportunities and the exploitation of old certainty*" (March, 1991). Practically, MOIPs can achieve this by adopting a deliberate option portfolio approach whereby several potential solutions to the same problem are experimented in parallel until sufficient information is collected regarding their respective merits. This helps select and invest more massively in the development and demonstration of one single option. Several precompetitive research consortia implemented in the United-States and Japan in the 1990s and 2000s have also adopted such an approach for developing environmental technologies (e.g. advanced batteries, electric vehicles, fuel cells) (Larrue, 2003; Larrue and Harayama, 2009).

The practice of coordinated exploration in MOIPs

The analysis of various MOIP initiatives leads to the identification of two main types of connections between mission-oriented policies and various scientific communities: Mission-embedded science and Mission-oriented science:

- Mission-embedded science: The research communities not only contribute to projects funded by these initiatives, as one could expect given the importance of scientific knowledge for breakthrough and transformation, but they also participate in MOIPs' structure of governance. This is generally the case for Overarching mission-oriented frameworks, Ecosystem-based mission programmes and mission-oriented thematic programmes. Research organisations participate, for instance, in the HTS2025 High Tech Forum, KIRAS Scientific Advisory Board and CLIMIT Programme Board. In these initiatives, scientific organisations contribute to the orientation and co-ordination of these initiatives while at the same time being influenced by them as research performers. As active partners in these systemic policy initiatives, research performers are embedded in a highly directional setting. They directly interact with policy makers, business leaders and various stakeholders to solve concrete problems. Especially, Research Technology Organisations play a pivotal role in many MOIPs (even leading some programme in the SIP-SE or SIP-JP initiatives). The 'hybrid' and 'bridging' profiles of these organisations (between disciplines, between research and industry, between the government and research performers) make them particularly instrumental as innovation eco-system orchestrators and integrators in a mission-oriented approach (EARTO, 2020);
- Mission-oriented science: the connection to science is more indirect in some MOIPs, and it is particularly the case for Challenge-based programmes where research contributes at the level of projects and via the research agencies that have specific channels for interacting with scientific communities, depending on the mission's objectives. This is the case for Pilot-E where RCN ensures the link to science in the design of the calls and through its own structure of governance.

MOIPs allow defining collectively the level of ambition ('depth' of exploration) for each mission as part of their strategic agendas. Provided this process is not captured by actors with shorter term strategic agendas, collective action is generally conducive to higher risk higher reward missions. Some initiatives like the Moonshot R&D Programme in Japan aim to promote challenging R&D based on revolutionary concepts. It builds on previous experience of high-risk high reward programmes like FIRST and ImPACT to realise seven very ambitious and long term (2040 or 2050) Moonshot goals. This contrasts with another Japanese MOIP, the SIP, which aims to produce incremental innovation by focusing on demonstration and commercialisation. Within this initiative itself, different programmes are more science-based than others (for instance the SIP on 'Materials Integration' for revolutionary design system of structural materials involves significant basic research).

'Key' or 'transversal' technologies are of paramount importance for the success of many endeavours undertaken in MOIPs but these are in most cases not formally embedded in these initiatives. The Mission-Driven Top Sectors is one of the very few initiatives that have formally embedded the support to key technologies. A Knowledge and Innovation Agenda produced collectively by several Top Sectors is dedicated to key enabling technologies to sustain the efforts to realise the 25 missions (Box 1).

MOIPs use various types of portfolio strategies which differ according to whether they explore alternative technological options, socio-technical options, components of the value-chain or different generations of technologies (Table 9).

Table 9. Main modes of implementation of a coordinated portfolio strategy in MOIPs and selected examples of initiatives

Options	Examples of co-ordination mechanisms in MOIPs
Systematic R&D on competing technological options to achieve the same goals	• *PilotE* - The first call for proposal funded 15 consortia, covering different low-emission technologies for the same goal (including battery-powered and hybrid hydrogen/battery ferries) and different market segments, from different types of passenger vessels (urban water vessels and others) to cargos and ferries of different sizes. The second call was purposively broad in order to cover various emission-free land-based transportation segments (light and heavy duty freight transport; Zero-emission construction machinery; Zero-emission public transportation) • *Moonshot* – The initiative has formalised and reflected in its management structure a dedicated portfolio strategy (Box 13) • *Horizon* - Non-prescriptive 'mission calls' and dual assessment of project proposals, at the level of the intrinsic quality of individual project (e.g. excellence and expected impact) and at the level of the portfolio (portfolio fit)
Experimentation of different socio-technical options (including usage patterns, acceptance, etc.)	• *MoF* - Five Mobility Labs located in four urban areas search for new mobility solutions by combining ideas of users, citizen and local innovators with new methodologies and tools like design thinking or co-creation.
Coverage of different components of the value-chain	• *SIP-SE* and *Vision-Driven health* – MOIPs that aim to support the emergence of ecosytems to address societal challenge provide seed funding for the development of collective strategic agendas or visions that cover different value chain segments
Experimentation of different generations of technologies, with increasing level of ambition	• *CLIMIT* – The Programme Plan developed by the Programme Board and two cooperating agencies include performance goals corresponding to three 'focus areas' with different time horizons (short, mid and long term): Early full-scale CCS value chain in Europe (demonstration, until 2022); Large-scale storage of CO2 on the Norwegian shelf in the North Sea (dissemination until 2025); Future solutions for CCS (until 2035 and beyond). • *PilotE* – The successive (annual) calls for proposal have set increasingly ambitious goals, calling for more elaborated technology solutions

Source: OECD MOIP Toolkit, *How to coordinate MOIPs to cover various potential options with different levels of risks and rewards to fulfil the objectives?* (Novelty), https://stip.oecd.org/stip/moip/questions/Q8
Note: The list of MOIPs' acronyms is provided in Annex A.

Some MOIP initiatives have reflected their portfolio strategies in their design and governance. This is the case of the Moonshot R&D Programme which aims to create disruptive innovations and promote challenging R&D based on revolutionary concepts. It has formalised an innovative dual management structure with Programme Directors (responsible for a portfolio of project aiming to achieve one given goal) and Project Managers (responsible for one project) in order to maximise the chance of realising each of its seven ambitious goals (Box 13). This is more generally the case of initiatives inspired by the DARPA model.

Implementing a portfolio approach requires changes to the modes of project selection and evaluation. In Horizon Europe, the European Commission envisages implementing a portfolio approach at the level of each of its missions. One important novelty of the 'mission calls' concerns the evaluation process which will combine a traditional assessment of the intrinsic quality of individual proposals with their potential contribution to a consistent portfolio of activities geared towards the achievement of the missions. One option envisaged is to perform two-stage calls: firstly, an evaluation of the intrinsic quality of each proposal submitted; and secondly, the identification of high-quality proposals that go together in a way that maximises the expected impact of the portfolio as a whole. The evaluation committees will be provided with more flexibility to adapt to a mission-oriented approach. For instance, the Article 26 of the Regulation stipulates that the evaluation committee may rank the proposals having passed the applicable thresholds according to their contribution to the achievement of specific policy objectives, and may also propose

any substantial adjustments to the proposals in as far as needed for the consistency of the portfolio.

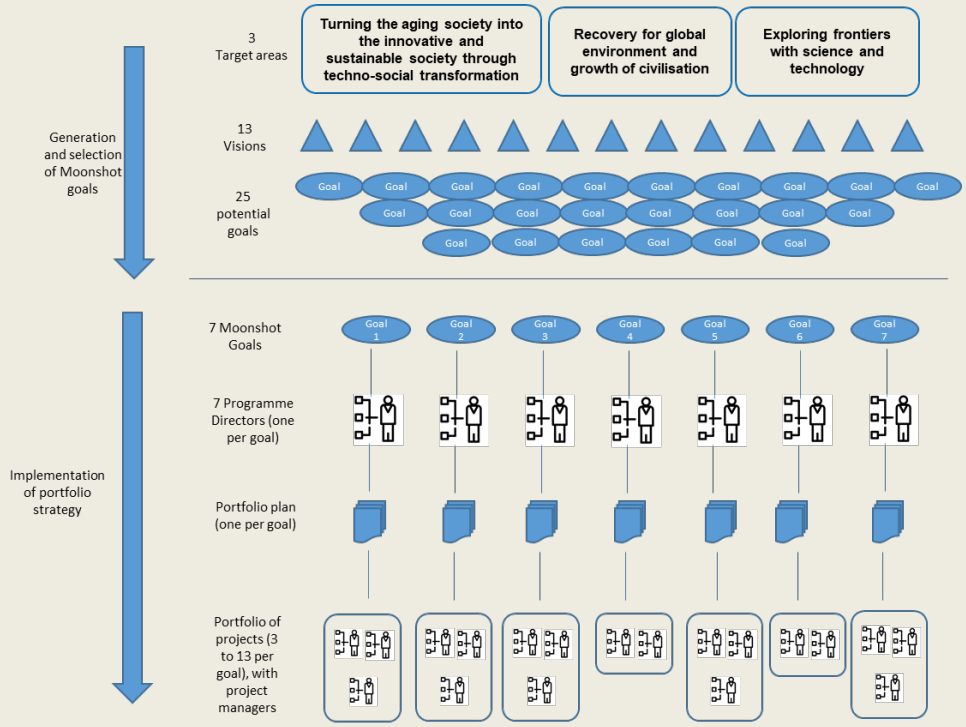
Box 13. Portfolio strategy in the Moonshot R&D Programme

The Moonshot R&D Programme has set seven very ambitious Moonshot goals such as the "*realisation of a society in which human beings can be free from limitations of body, brain, space, and time by 2050*".

In each project, it funds frontier research focused on the achievement of these goals. At the level of each goal, it also implements a portfolio approach to manage the high risk of failure of projects. The main idea is to create an R&D portfolio system as a package of projects for each Moonshot Goal and evaluate the possibility of achieving a goal at the level of this package, not at the level of each individual project. Between 3 and 13 projects were selected for each of the seven goals. This strategy is reflected in the design of the programme. A Programme Director is appointed specifically at the level of each of the Moonshot goal and is tasked with the development and implementation of a Portfolio Plan. Programme Directors are asked to choose projects that try out different paths and methods to meet their respective Moonshot goals.

More generally, the Moonshot R&D Programme implemented an exploratory approach at all stages, from the selection of goals through brainstorming and consultations (starting from 3 target areas to open up to 13 visions and 25 potential goals, in order to finally select 7 goals) to the implementation of a portfolio strategy by Programme Directors.

Figure 13. Exploration of potential problems and solutions in the Moonshot R&D Programme



Source: https://stip.oecd.org/stip/moip/case-studies/16

3.5. Lessons learned from policy implementation in MOIPs

In the end, MOIPs come down to the implementation of a consistent coordinated package of instruments, articulated and mobilised to achieve the mission. Analysing policy implementation in MOIPs is challenging due to the diversity of instruments mobilised and the importance of practical contingencies on successful implementation, which make any generalisation somewhat hazardous. It requires a lot of detailed information that are not easily available.

3.5.1. How to integrate consistent bundles of instruments in MOIPs?

The specificities of bundling policy instruments in MOIPs

In contrast with a voluminous body of work that focuses on emergent policy mix, MOIPs are deliberately designed policy mixes, tailored to achieve the specified mission. A significant literature has analysed the positive and negative mutual effects of multiple policy interventions which goals and operational modalities may contradict or reinforce each other within national or thematic policy mixes (Edler *et al.*, 2013; OECD, 2010). More recently, some scholars have sought to identify the types of policy mixes that are more conducive of sustainability transitions (Rogge and Reichardt, 2016; Edmondson *et al.*, 2019). While these policy mixes include a more pronounced purposive dimension (notably via the long term strategies within which they might be embedded or any policy actions to destabilise the established regime), they remain largely desegregated or, at best, loosely connected.

The coordination arrangements and enhanced dialogue between policy makers within a MOIP can, in principle, enhance the positive interactions and reduce the unintended impact of negative interactions between policy instruments:

- higher effectiveness of the implementation of an integrated set of complementary instruments, for instance, covering different needs or stages of the innovation cycle for the same target groups;
- better control of various types of interactions that exist between instruments for the same or different target groups, technologies, sectors, societal issues or, for instance, at different levels of governance;
- reduction of overlaps between instruments and avoidance of gaps that may leave some support needs unattended;
- greater sharing of data and information between policy bodies, which can improve the instruments' effectiveness and efficiency (for instance through better targeting and deterrence of opportunistic behaviours; sharing of monitoring data);
- economies due to a better division of labour between the different instruments' operators.

The practice of bundling policy instruments in MOIPs

The bulk of MOIPs build upon the existing policy instruments operated by the participating ministries and agencies. Reflecting the characteristics of the overall national policy mixes, the instruments mobilised in MOIPs are mainly direct interventions, ranging from various types of grants, subsidies and loans to public procurement but also some technical support for upskilling or training. The strengths, weaknesses and, possibly, gaps within underlying national policy mixes therefore greatly condition the possible design of MOIPs. While most initiatives have developed new mechanisms and governance bodies at the level of strategic

orientation and policy co-ordination, very few have established new modes of intervention. This is true for instance for the MTIP which focused on the coordination arrangements that allow organisations to make better use of available instruments. One exception being the Mission-oriented research, development and innovation (MOOI) scheme. This instrument provides support to multidisciplinary consortia that develop proposals that combine various technological and non-technological sub-solutions, including also activities concerning the commercialisation and societal acceptance of the projects (Janssen, 2020).

MOIPs are generally less integrated at implementation level than at orientation and co-ordination levels. In many cases, the funding and implementation of activities belong to specific agencies which use their own portfolio of instruments, along the orientations and guidance decided at the upper governance level. However, there are some valuable insights to be learned from mechanisms and processes established to provide a consistent and effective framework for the 'decentralised' implementation of activities aiming to achieve the common goals (Table 10).

Table 10. Main modes of integration of policy instruments in MOIPs

Options	Examples of bundling mechanisms and processes in MOIPs
Operational integration via specific body	• *PilotE* –Participation of the various instrument 'owners' in common operational working groups where they can coordinate their plans and exchange practical information. • *SIP-SE* – Programme Office in each SIP.
Operational integration via commonly defined action plans	• *MTIP* - Within each Knowledge and Innovation Agenda (KIA) and for each mission, the missions' targets are translated into concrete Multi-year mission-driven innovation programs (MMIPs) covering the entire knowledge and innovation chain. These MMIPs make explicit the precise knowledge and innovation challenges to tackle in the short term, and the knowledge and innovation activities needed along the whole innovation chain. MMIPs also set out the expected contributions from the different actors (including from different Top Sectors).There can be more than one MMIP for a given mission. • *Moonshot and SIP-JP*: the programme directors (for each goal in Moonshot; for each programme in SIP-JP) draft concrete R&D Plans that set out the objectives and activities to be carried out. The plans are revised every year and validated by upper level governance bodies. • *Horizon*: based on the Mission Boards' advices, the Horizon Europe Strategic Plan will contain not only the missions objectives but also information on the portfolio of research and innovation activities needed to achieve each of them. Further information on missions' implementation will be presented in the various work programmes.
Operational integration via common processes	• *PilotE* – Integrated calls for proposal, including all project stages from applied research to market deployment ('one-stop-shop'). • *CLIMIT* – multiple connections and information exchanges between CLIMIT R&D (run by RCN) and CLIMIT DEMO (run by Gassnova). • MTIP: Integrated monitoring system including data on all aspects of realisation of the 'Energy' KIA.

Source: OECD MOIP Toolkit, *How to package together different policy instruments to achieve common objectives?* (policy mix consistency), https://stip.oecd.org/stip/moip/questions/Q11
Note: The list of MOIPs' acronyms is provided in Annex A.

The analysis of policy mixes in various MOIPs demonstrates that the range of policy instruments jointly mobilised for any given challenge has expanded. As the focus on wide-scoping societal challenge intensifies, the new policy organisations 'enlisted' in a policy initiative bring with them their modes of intervention. This was the case following the 'mission-driven reform' of the Top Sectors policy in 2018 when the new policy makers joined the policy circle, committing resources and adding to the policy and regulatory toolbox available in order to achieve the targeted missions.[10]

MOIPs greatly differ according to not only the width and diversity of the policy mix they encompass but also to the level integration of these instruments:

- Overarching mission-oriented strategic frameworks are in general more 'distributed', with however significant variations. Some are designed as 'policy umbrellas', embedding a wide set of instruments in a unifying high level governance structure (for agenda setting and programming), sometimes supplemented by operational working groups. For instance, Overarching mission-oriented strategic frameworks that have the nature of 'strategies' or 'policies', like the HTS2025, the LTP and, to a lesser extent, the MTIP, are more distributed than those that are designed as stand-alone programmes such as the SIP-JP. A few of them have developed integrated data systems or common administrative procedures such as cross-ministerial/cross agency cost categories, expenditure and other accountability reports, harmonisation of calls, common application manuals, and profiles of managers. ImPACT, SIP-JP and Moonshot in Japan, and the EU missions belong to this category.
- Challenge-based programmes are more integrated. Some of them attempt to appear as one integrated scheme for target groups and partners. Pilot-E in Norway aims to provide a 'one-stop-shop' for public support to public and private applicants. This necessitates to overcome operational issues related for instance to IT and reporting system, and the alignment of processes (Box 14).
- The level of integration varies in mission-oriented thematic programmes. In Norway, the CLIMIT provides a slightly less integrated project pipeline with two distinct entry points for the two programme components CLIMIT R&D and CLIMIT DEMO. The two agencies that manage their respective component voluntarily maintain some overlap between their instruments supporting experimental development in order to let the companies choose the scheme that is most suited to their plans at this pivotal stage.

One key added value of MOIPs is to enable the adaptation of the instrument portfolio to each mission. The UK Industrial Strategy Challenge Fund, for instance, mobilises a specific range of instruments to reach its objectives from the allocation of grants to the establishment of excellence centers or demonstration programmes. Each ISCF has a dedicated budget to conduct its activities during its four years. For instance, the 'Audience of the Future challenge' is implemented via the Future Demonstrators Programme, the Design Foundations Competition, the Production Innovation for Immersive Content Competition, an immersive technology investment accelerator and the support to a national centre of excellence for immersive storytelling. Similarly, in Horizon Europe, each mission board report recommend the combination of a specific bundle of funding instruments and actions (including regulations, policies, investments, procurements, etc.), to be supported by a range of activities at European, national and local levels.

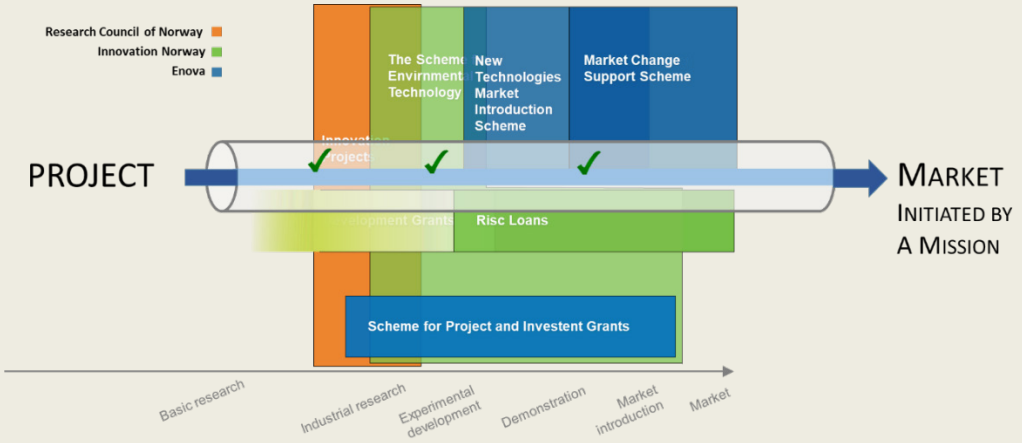
MOIPs gather a critical mass of expertise and funding towards selected objectives, which allows supporting broader and/or ambitious activities. RCN reports that within Pilot-E the funded consortia are larger and address more challenging goals that it is generally the case in its other support programmes.

Box 14. The integration of the instruments portfolio of three agencies in Pilot-E

The three agencies Research Council of Norway, Innovation Norway and Enova that collectively run Pilot-E combine their respective portfolio of instruments and areas of expertise to provide comprehensive and continuous support to selected industry-led consortia from the stages of applied research to market deployment. The main objective of such integrated 'seamless' project pipeline is to fast-track projects across the stages of the innovation chain.

Together, the three agencies cover all stages of the innovation process: the scope of the Research Council of Norway includes research and research-based innovation, Innovation Norway covers the innovation and experimental development while Enova focuses on the later stages, including demonstration and market deployment. RCN provides different types of research grants for consortia's projects; Innovation Norway offers innovation subsidies, development grants, and risk loans for companies in the consortia; Enova provides investment aids for demonstration and market deployment. The partners maintain also interactions with regulators as needed.

Figure 14. Fast-tracking projects across stages of the innovation cycle in Pilot-E



While the orientation and co-ordination tasks are deemed as very effective by the partners, the integration of support activities faces practical hurdles, for instance, in relation to EU state aid rules that limit the possible harmonisation of instruments for different categories of activities and beneficiaries.

Since there cannot be any market support commitment before the solution of any consortia is validated (and its costs are known), the relative integration of the funding process includes RCN and Innovation Norway's policy instruments, while Enova's support is conditional to the success of the projects in previous stages. Although all applications must include a strategy and plan for market deployment, the funding decision only covers the innovation stage prior to market introduction.

The integration of the whole process from research to market deployment is consolidated by contracts between the consortia partners and with the agency representatives.

Sources: https://stip.oecd.org/stip/moip/case-studies/2?answerId=A11-2; Volla R., "Pilot-E Norwegian cross-agency scheme for transport and energy solutions", presentation at the Joint OECD/BMVIT Workshop "Mission-Oriented Policies: Moving from guiding principles to implementation" Vienna, 27 September 2019 – BMVIT, https://community.oecd.org/community/cstp/mission-oriented-policies.

3.5.2. How to maximise the commitment of public and private partners in MOIPs?

The specificities of MOIPs for enhancing commitment of public and private partners

Like other forms of cooperation, MOIPs are, in theory, a way to internalise some of the potential spillovers that characterise research and innovation, thus restoring part of the incentives of private firms to conduct these types of activities. Due to the weak appropriability and high uncertainty of research and innovation outputs, firms are often reluctant to engage in R&D, in particular towards long-term and ambitious goals. This situation results in the well-known problem of private under-investment in research. Theory holds that gathering partners and even competitors in collaborative programmes can alleviate this reluctance through the establishment of arrangements (IP rules, budget sharing, etc.) regarding the division of labour and sharing of risks and results between the partners. This allows for the internalisation of some of the potential spillovers, thus restoring part of firms' incentives to conduct R&D. This was one of the main expected effects of R&D cooperation on firm R&D spending (together with economies of scale and scope, and learning) in research consortia (Branstetter and Sakakibara, 2002). Co-financing by public authorities complements these incentives and reduces the risks associated with R&D. The supervision of public authorities, which play a prominent role in MOIPs, can also help control for power asymmetries and opportunistic behaviors between partners.

The endorsement and endowment of a strategic agenda by public authorities, sometimes with intervention from the highest political level, enhance trust and limit the risks that deter private investment. Economic rationales that underpin MOIPs go therefore beyond the traditional arguments in terms of internalisation of spillover externalities. Some scholars had already suggested that the launch of a large-scale cooperative R&D initiative supported by public authorities draw the attention of potential industry partners on the importance of the areas in which the initiative is conducted, hence promoting private engagement in this endeavor (Sakakibara, 1997). The expected high visibility of missions could arguably make this so-called 'signaling effect' even stronger than in traditional STI interventions. The long-term timescale of several MOIPs (with mission timescale extending as far as 2050 in some of them like the Japanese Moonshot R&D Programme) also strengthens trust in the stability of public support toward selected challenges across policy shifts of ruling parties.

The participation of users and bodies influencing the demand (e.g. regulatory authorities, public procurement authorities, etc.) in MOIPs reduces to some extent market uncertainty. The articulation of the demand, most often neglected not only in traditional innovation policies but also in challenge-based policies, is essential to include the concerns and values of user or citizen in defining the problem. Their involvement allows for collective learning opportunities and reduces the risk of interventions that do not match the preferences of targeted users or fail to influence them as needed to achieve the objectives (Edler and Boon, 2018).

The practice of enhancing commitment of public and private partners in MOIPs

Although it varies with the proximity of the initiative with development and commercialisation, industry partners are strongly engaged in MOIPs. MOIP initiatives have employed different ways of enhancing and securing industry partners' commitments (Table 11).

Table 11. Main modes of promoting partners' commitment in MOIPs

Options	Examples of modes of promoting partners' commitment in MOIPs
Overarching contractual arrangement	• *MTIP* – The Knowledge and Innovation Covenant (KIC) forms the agreement between public authorities, businesses, knowledge institutions and potentially civil society organisations on their respective expected commitments for the next 4 years, in line with the Grand Challenges and mission's strategic agenda. • *UKIS* – Sector Deals are partnerships between the government and industry sectors to deliver a programme of investment over a period of time on sector-specific issues that are in line with the UK Industrial Strategy and its Grand Challenges.
Engagement of partners in governance	• *CLIMIT* – The Programme Board members originate from industry, universities and research institutes and are appointed by the Ministry of Petroleum and Energy. They develop the CLIMIT 6 years Programme Plan. • *HTS2025* – Public and private partners are involved in the High Level Forum and, more broadly, are consulted in several occasions.
Engagement of users in project	• *PilotE*: Applications must include a market plan. Furthermore, it is required that potential users of the solutions to be developed are on-board the project from the application phase. • *PilotE* and *CLIMIT* – Intense dialogue with applicants during calls for proposals. • *MoF* and *KIRAS* – Mandatory participation of potential users in projects.
Engagement of partners in the definition of the missions	• *MTIP* – The Top Sectors and mission groups which develop the challenge agendas are industry-led • *SIP-SE* – The SIP programmes include public and private partners that represent all the chain of actors relevant to a particular objective/challenge • *VIsion* – The projects include a whole emergent eco-system, gathered around a common 'Vision'

Source: OECD MOIP Toolkit, *How to maximise the involvement of public and private stakeholders involved in MOIPs?* (Fundability), https://stip.oecd.org/stip/moip/questions/Q8
Note: The list of MOIPs' acronyms is provided in Annex A.

In some MOIPs, the government and partners have signed formal multi-year agreements that formalise their respective commitments to achieve the missions. In The Netherlands, the Knowledge and Innovation Covenant (KIC) is an agreement between public authorities (national and regional), businesses, knowledge institutions and potentially civil society organisations on their respective expected commitments for the next four-year period. The KIC aims to ensure that private and public knowledge institutions and the authorities invest jointly in R&D and innovation to achieve the Integral Knowledge and Innovation Agendas. The KIC 2020-2023 was signed by about 30 partners. It includes commitment indications for a total value of EUR 4.9 billion each year during the first 2 years of the period, of which the EUR 2.05 billion will come from private sources and EUR 2.85 billion from public fund.

In the United Kingdom, Sector Deals are partnerships between the government and industry (represented by sectoral associations) to deliver a programme of investment over a period of time on sector-specific issues in line with the UK Industrial Strategy and its Grand Challenges. Sector Deals are initiated through calls for sectors to set out proposals to raise productivity in their respective areas. The government then works with leadership in each sector to ensure that the proposal is robust and consistent with the objectives of the Strategy. In 2020, more than 10 Sector Deals had been signed, accounting for significant industry investment alongside the government. The first Life Science deal included close to GBP 500m of government support for major new research programmes and over GBP 1bn of new industry investment.

Users play a crucial role to enhance the chance of success and the willingness of developers to engage in riskier projects. In some MOIPs, the participation of users is mandatory and it is taken into account in the proposal evaluation in several others. In Pilot-E, partners' applications must include a plan for the development of pathways leading to market introduction with milestones. At this early stage, this plan developed with potential

users is more like a type of 'letter of intent' than a binding contract since it remains conditional to the success of the project. It is also required that potential users of the solutions to be developed are on-board the project from the application phase. In the AAL/benefit programme in Austria, projects were able to successfully involve end users such as care and support providers, with higher intensity than in other STI funding schemes in Austria. This programme contributed to intensifying networks between stakeholder groups, better understanding of end-user needs and requirements, and increasing cooperation between research performers and providers of services of general interest.

The proximity between public authorities and partners generates a higher level of trust, which in turn is beneficial to the level of private firms' engagement. Partners often participate in some of the MOIP governance bodies or, notably in the Ecosystem-based mission programmes but not only, in the definition of the strategic agenda which will guide their activities. In the ISCF, industry is participating in all stages of the challenge definition. During the selection of the challenges, direct interactions with industry allow not only to better specify the proposed challenge but also to test the challenge 'business case' in a dedicated 'industry negotiation phase'. Before the final approval, the government works directly with industry and partners to find co-investment alongside the public money. Once challenges have been selected and adopted, industry plays a very strong role within each ISCF challenge and are expected to commit significant resources to the Challenge's activities. A senior industry leader appointed in each challenge is helping UKRI secure investment from industry and refine the vision for the challenge.

Technical support to teams during the calls for proposal and all along the project duration, in addition to funding, enhances their engagement and impact. As already mentioned the hands-on approach of public authorities is a key feature of many MOIP initiatives. As part of the Science Foundation Ireland (SFI) Future Innovator Prize, funded research teams are guided by so-called 'Challenge Research Managers'. In a model similar to that used by DARPA, they lead on the management of specific challenges under this programme and provide support for funded research teams advising them on the process, coordinating training and creating opportunities for teams to connect with stakeholders in the wider innovation ecosystem. A key feature of the SFI Future Innovator Prize is that training is provided for funded research teams to develop skills in a range of areas relevant to accelerating the impact of their work. These areas include entrepreneurship, communications and design-thinking. The Challenge Research Managers oversee this process to ensure that teams receive appropriate support and remain focused on their objectives.

Finally, public funding, in MOIPs as in any other type of policy, is an important incentive that reduce the level of risk and leverage private investment. Unsurprisingly, the amount of funding made available to support the activities (research, innovation and beyond) varies importantly according to the scale, scope and type of MOIP (Table 12).

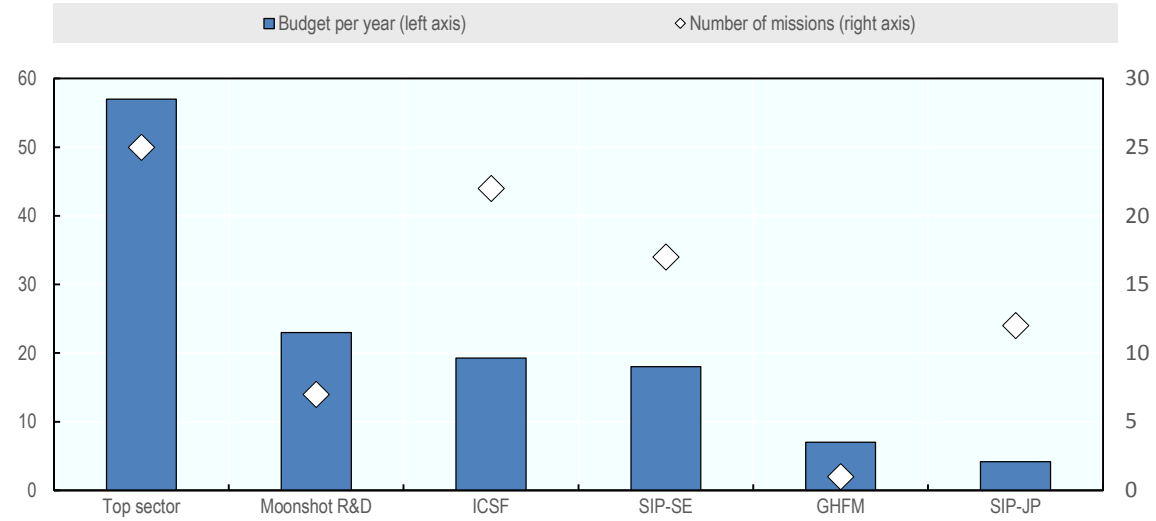
Table 12. Amount of public funding awarded per MOIP initiative, by type of MOIP

MOIP type and MOIP initiative	Amount of public funding awarded per year
National MO strategic framework	
Top Sectors (NL	**About EUR 1.43bn per year -** EUR 2.85bn (2020 and 2021) (25 missions)
Horizon Europe (EU)	**About max EUR 7bn per year** (5 missions) No specific budget for missions, but capped to a maximum of 10% of the annual budget of Pillar II during the first three years of the programme
SIP-JP (JP)	**About EUR 220m per year** – JPY 28bn in 2018 (12 programmes) Individual SIP programmes receive between EUR 12 and 32m per year - JPY 1.5 and 4bn per year
Moonshot (JP)	**About EUR 184m per year -** JPY 115bn for 5 years (7 moonshots)
The Genomics Health Future's Mission (GHFM) (AU)	**About EUR 7m per year** – AUD 106m for 9 years
Challenge-based programmes	
Pilot-E (NO)	**About EUR 11m per year** - NOK 120m (2018) -
CLIMIT (NO)	**About EUR 18m per year** NOK 200m per year
ISCF (UK)	**About EUR 1.3bn per year (whole scheme) -** GBP 4,7bn over 4 years (**About max EUR 19.3m per year** - Challenge 'Driving the electric revolution' (pending matching fund)
Thematic mission Programmes	
KIRAS (AT)	**About EUR 12m per year** – EUR 110m for 2005-2013
Building of Tomorrow (AT)	**EUR 6 to 10m per year**
Ecosystem-based mission programmes	
SIP-SE (SE)	**About EUR 72m per year** – SEK 750m per year during 2021-2023 (17 programmes)
Vision-Driven Health (SE)	**About EUR 100K per year per project** – SEK 5m for 5 years per project –
Growth Engines (FI)	**EUR 30m per year**

Source: OECD MOIP Toolkit, https://stip.oecd.org/stip/moip/

Within an initiative itself, the budget per 'main objective' can also vary sensibly, which is consistent with the 'tailor-made' arrangements for each mission. Using a simple average based on the data provided in Table 12, Figure 15 provides an estimate of the average public funding allocated per year and per 'mission' (or challenge or programme) for 6 initiatives. In some cases, funding data are indicative as they are based on appropriations (not expenditures) and can be pending funding by private partners.

Figure 15. Budget per year (in million Euros) and per mission, and number of mission for selected MOIP initiatives



Source: OECD MOIP Toolkit, https://stip.oecd.org/stip/moip/
Note: Mission refers here to individual missions, challenges or programmes, depending on the terminology in use in each initiative.

The higher level of integration of MOIPs often allows them to have a dedicated, although 'virtual', budget which is cross-ministerial or cross-agency and multiannual. The funds allocated to MOIP initiatives often originate from different entities (and government funds), in relation to either the thematic area of intervention or functional responsibilities (e.g. support to research / support to innovation). This can be done either by earmarking funds in budgets of different organisations, in the larger and more decentralised initiatives, or by contributing to a 'central pot'. In Japan for instance, the SIP is financed via a 4% 'haircut' on the STI budget of different participating ministries. Even in the most decentralised Overarching strategic mission frameworks, there can be mechanisms to ensure the financial commitments (including from stakeholders) such as the previously mentioned Sector deals to finance the UK Industrial Strategy or the Dutch KIC.

3.5.3. How to evaluate and learn from MOIP implementation?

The specificities of MOIP evaluation

Evaluation tools and techniques for MOIPs remain those developed for the evaluation of individual programme and schemes although there has been a clear trend towards systemic policies (Smits and Kuhlman, 2004; OECD, 2015).

The lack of system-wide evaluation methods is due in no small part to the complexity of systemic policies whose scale and scope, nested structure, as well as multi-dimensional and multi-level design make the causal-effect relation non-linear and therefore difficult to be measured in a detailed and robust way (Stern *et al.*, 2012). Other reasons might lie in a certain risk aversion of policy makers that hinders the development and application of new evaluation methods (Arnold *et al.,* 2018), and, more generally, in the pressure for accountability which calls for clear-cut, quantitative, results. Systemic policies led themselves better to formative evaluations that are focused more on learning and improvement than to summative evaluation (Arnold, 2004). However, there are some signs of improvement. If none of them came close to fully-fledged systemic evaluation, a review

of STI evaluations conducted in 2016 brought to light different types of 'comprehensive' evaluations, i.e. evaluations that go beyond individual policy instruments. Among the main types were the grouped evaluations (evaluation of 50 R&D support schemes in one exercise), evaluations of STI function (e.g. evaluation of SME policy), evaluations of STI system components (e.g. evaluation of national research performance) and evaluation of entire STI system (EC- or OECD-led reviews of national systems) (OECD, 2016c).

The countries with the most advanced practices of holistic evaluation are also those that have pushed the furthest the reflection on and implementation of MOIPs. Borrás and Laatsit (2019) have performed a survey of evaluation practices in EU28 member states vis-a-vis an ideal-type of what they defined as 'system oriented innovation policy evaluation'. The latter is defined by four main attributes: the coverage (policy instruments, policy mixes, socio-economic performance assessment), the systemic perspective (system-wide evaluation), temporality (regularity in the evaluation) and the diversity of expertise mobilised. Whereas this definition is somewhat remote from what could be the evaluation of MOIPs, it provides valuable insights on the general interest and capacity of countries to perform such evaluation. The study finds that EU-28 countries with the most advanced practices of holistic evaluation are among those at the forefront of mission-oriented policies: Austria, Finland, Germany, Ireland, the Netherlands and Sweden.

The high degree of intentionality of MOIPs should, in principle, make their evaluation easier. As pointed out by the High Level Group on Maximising EU R&I Impact chaired by Pascal Lamy "*it should be possible, within the appropriate timeframe, to ascertain to what extent the mission has been accomplished*" (European Commission, 2017). Should a clear and measurable mission statement have been defined, the evaluation could use it as a starting point to define the 'MOIP theory' that displays how the policy has tried to achieve this goal and what explains the result of the MOIP vis-à-vis the mission through attribution and contribution analysis (Janssen, 2020). In any case, and especially during the early stage of the MOIP approach, the learning dimension should be prominent in their evaluation.

However future MOIP evaluations should not only consider their success and failure in absolute terms but also their additionality with regards to traditional policy. As previously explained, MOIPs often include additional governance layer which translates into supplementary co-ordination costs (and also some savings). Their evaluation should seek to assess the effects and costs of this additional layer.

The practice of MOIP monitoring and evaluation

Very few MOIPs have developed the evaluation plan and methods early in the policy process, whereas this is widely accepted as good evaluation practice. Furthermore, most MOIPs are too recent to have gone through an evaluation yet. Only some of the oldest MOIP initiatives have already been evaluated. However, these evaluations are the furthest from the ideal-type of the MOIP definition and their evaluation has remained traditional, without specificities related to any mission-oriented feature.

Challenge-based programmes and schemes should be the simplest to evaluate. They should however take into account the specificities of such mission-oriented schemes, notably the extent to which the greater integration of the policy instrument portfolio of different agencies has had positive effects on the projects' success. Particular attention could be dedicated to the articulation between these portfolio, above all at the 'junction' between the supply-push and the 'demand-pull' instruments. The evaluation of Pilot-E in 2021 will be a first of its kind and could bring some interesting insights on these issues.

Overarching mission-oriented frameworks, are more challenging to evaluate due to their scale, scope and nested structure (system, sub-system, projects). The less integrated ones

are evaluated at the level of their main policies and instruments. The HTS2025 for instance plans to conduct an evaluation of the main individual programmes and instruments, but there is no evaluation planned of the overall strategy. The former generation of Top Sectors policy has been evaluated, using a dedicated framework taking into account the specificities of this policy but no method has yet been developed to apprehend the new mission-driven design. Horizon Europe's missions will be evaluated in 2023, with the main focus being put on the achievement of the 5 missions. Some missions with insufficient results could be phased out or redirected at this occasion, as stipulated in the Programme's Regulation. The evaluation assessment will include the analysis of their selection process and of their governance, budget, focus and progress to date. It should be eased by the fact that they by nature include target-oriented and measurable objectives, within a clear timeframe. Given their systemic nature, the performance of mission-oriented investments will be assessed using a wide set of measures, such as the creation of public value and their 'additionality', i.e. the extent to which they have been successful at catalysing activity that otherwise would not have been possible.

Due to the difficulty of the task, which requires more than an one-off exercise commissioned to an external service provider, some initiatives have set up dedicated governance body with an evaluation mandate. The evaluation of the UK Industrial Strategy is under the responsibility of the Industrial Strategy Council. It will also be tasked with the development and improvement of specific monitoring indicators and evaluation tools and methodology. It produces an annual progress report and has delivered several studies, including a metrics framework and a methodology of evaluation of the 'Sector Deals' (see 3.5.2). The Council has no-time limit and is independent of the Government, to which it addresses its regular monitoring reports. The Japanese programme SIP has developed an elaborated evaluation framework. It is evaluated at the level of the whole initiative and at the level of each programme. Both are supervised by the SIP Governing Board (Box 15). This is consistent with the Technopolis recommendation that a dedicated evaluation platform (that is distinct from and does not report to the initiative implementation body) should be set up to evaluate a complex and systemic initiative (Arnold *et al.*, 2018).

Box 15. The evaluation framework of the Cross-ministerial Strategic Innovation Promotion Program (SIP)

Evaluation of the whole SIP initiative

A first final evaluation of the whole initiative, covering the 1st phase, was undertaken in 2019. The results of this evaluation helped define the second term. In addition to more traditional criteria (management of the budget, research-industry cooperation), the evaluation criteria also included the level of cooperation between the different ministries

Evaluation of each SIP programme

The Governing Board and selected peer-reviewers evaluate each SIP programme at the end of every fiscal year. The most important annual evaluations are those carried out in year 1, 3 and the last year.

Each SIP programme has a dedicated Evaluation Committee composed of the Governing Board and external specialists. They perform their evaluation on the basis of their own judgement and the results of the programme self-assessment undertaken by the Programme Director and the whole structure of leadership.

The evaluation criteria for each programme can vary but they generally follow the 2016 "General guideline for National R&D evaluation":

- Significance of and conformity to the purpose of the SIP system;
- Validity of the goal (particularly the outcome goal), including the degree of achievement of the project in the targeted time schedule;
- Checking whether appropriate management has been performed, with particular focus on the effectiveness of cross-ministerial collaboration;
- The strategies and degree of progress toward commercialization;
- The expected effects and 'ripple' effect (e.g. unintended impacts) at the final evaluation and after completion, checking whether the follow-up methods are clearly and appropriately defined.

The allocation of the budget in the following year reflects how each programme fares. The evaluation can lead to significant change in the programme R&D Plan, governance or management.

Source: https://stip.oecd.org/stip/moip/case-studies/15?answerId=A13-15

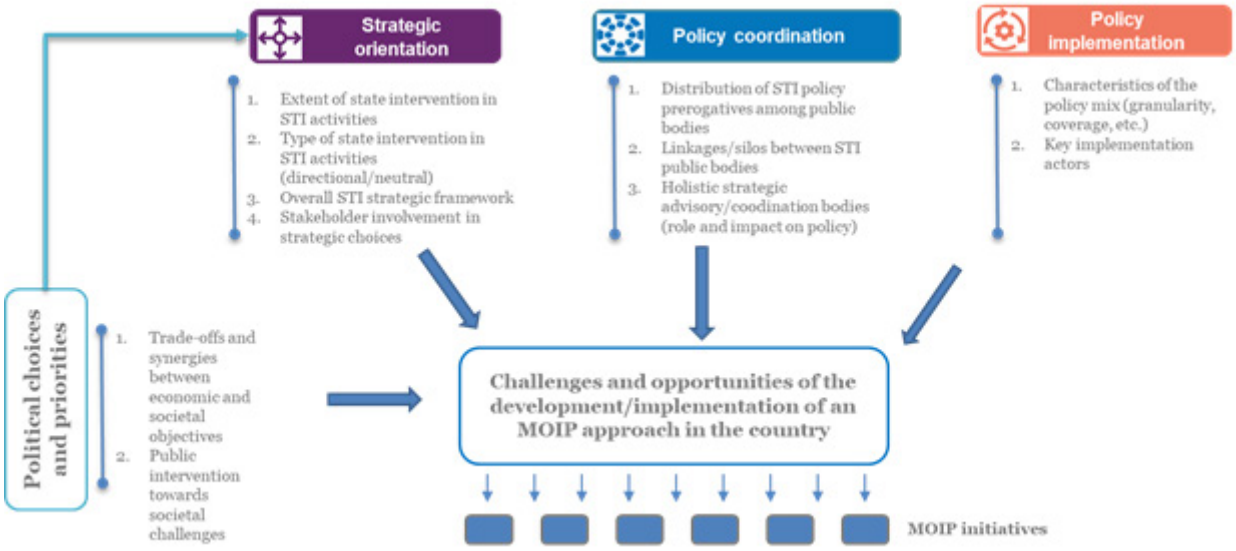
4. Advancing national Mission-oriented innovation policy trajectories

4.1. National case study methodology

The analysis of mission-oriented policy at national level aims to gain a better understanding of the dynamics of mission-orientation in different national contexts.

It draws on a cross-comparison of the main findings and conclusions of four in-depth case studies: Austria, Japan, Korea and Norway.[11] Each of them included many interviews and a thorough desk review. National case studies are structured around the MOIP 'framework conditions', *i.e.* the national factors that influence the ability of governments to design, fund and implement MOIPs (Figure 16).

Figure 16. The national MOIP 'framework conditions'



Since the number of cases is limited to a handful of countries and – even if the analysis is enlarged by taking up also findings from current empirical work on other countries[12] – the analysis does not lend itself to overarching generalisations. However, the countries' respective policy approaches can – in some instances – be seen as representative for specific policy approaches towards MOIP and a potential source for policy learning.

4.2. Main results: the evolutionary nature of mission-orientation

The cross-comparative analysis shows that the forms and types of MOIPs implemented in a given country can only be understood within the national institutional setting in which they are embedded and that determines to a great extent what is politically and socially feasible at one point in time. These specificities have shaped MOIP policy trajectories that unfold and move forward through experimentation, negotiation and learning.

4.2.1. National institutional settings define specific MOIP trajectories

MOIPs are the latest stage of the well-documented trend towards stronger directionality (Kuhlmann and Rip, 2018). Austria, Japan, Korea and Norway have implemented schemes or programmes that have – to a greater or lesser extent - some mission-oriented policy features, as defined in the MOIP 'design principles':

- Japan has launched Overarching mission-oriented strategic framework led by CSTI: SIP, Moonshot and, slightly more distant from the ideal-type and closer to a high-risk high reward impact programme, ImPACT;
- The main research and innovation agencies in Norway have teamed up to implement some Challenge-based schemes that cover the different stages of the innovation cycle in order to accelerate the development of solutions to targeted issues;
- Austria builds on its tradition of thematic programs to implement some Large-scale 'mission-oriented' programs like Building of Tomorrow, Mobility of the Future, KIRAS and BENEFIT;
- Korea's approach to STI strategic orientation and coordination has varied significantly between successive governments. It has recently a massive whole of government 'post-COVID' recovery plan in the form of a decentralised umbrella that adopts several of the MOIP design principles.

The MOIP initiatives experimented in the four countries and beyond are particularly influenced by the national institutional settings in which they are embedded. Different 'framework conditions for MOIPs' lend themselves more or less to some types of MOIP. Countries differ for instance in their capabilities to steer, fund and implement systemic policies.

Each country has a specific historical background of state intervention in the STI field and beyond. Japan has a long history of state intervention and steering on the strategic policy level stemming from the 'catch-up' phase, but it has seen the government's share in STI funding shrinking considerably in the past decades. In addition, - and in contrast to e.g. the post-war period - the emphasis of government funding has shifted in the 1990s towards measures that are not thematically-oriented (like tax measures). This is different in Austria and Norway, where the share of government funding of business R&D (and hence the potential leverage and steering capacity of policy) is higher. Also, in both countries, the role of agencies in innovation policy (among others RCN in Norway and FFG in Austria) is greater vis-à-vis the centre of government and ministries than in Japan. Austria and Norway differ however in terms of the extent to which government support to research and innovation is thematically oriented. It is considerably higher in Norway while in Austria the non-oriented measure occupies the lion's share of the country's STI portfolio.

Against this backdrop, the notion of 'policy trajectory' reflects the idea that the efforts to become more directional and better coordinated do not involve a complete overhaul of the STI policy system. Rather, they build on existing structures to constitute an additional layer of orientation and co-ordination to existing policy tools, instruments and institutions, sometimes involving their reform. Above all, they are a constant source of learning, feeding different generations of MOIPs with incremental improvements along the three dimensions of mission-orientation. Hence, the MOIP approaches are evolutionary (sometimes involving experiments) rather than revolutionary.

4.2.2. MOIPs at the cross-roads

The deployment of these MOIP trajectories to date has already provided important lessons learned in their respective countries with regards to the challenges and opportunities of mission-orientation, and helped set the basis for a 'culture of mission-orientation', sometimes including high-level policy decision makers.

However, the MOIP initiatives, although deeply rooted in firmly established national settings, are still experimental in many respects. The countries who have pushed the farthest

these experimentations are now reaching a crucial point regarding the next stage in their MOIP trajectory, based on the experience acquired during the previous stages. 5 tentative options of the way forward for the 4 MOIP trajectories are identified and presented in a last section drawing on the MOIP country case studies and observations of policy developments in other countries: Streamlining mission orientation; Focusing mission orientation; deepening mission orientation; Scaling-up mission orientation; and Elevating mission orientation.

4.3. Four national MOIP trajectories

Among the countries covered in this study, one can discern four types of MOIP trajectories, taking into consideration the institutions that are leading the national 'mission-orientation agenda':

- *Centre-of-government led* (Type 1) – Japan focuses on strengthening the role of centre-of-government in identifying, steering and implementing MOIP. Recently, there were even attempts to extend this role of central government also into the sphere of implementation of policies. Also, Korea seems to fall into the category of countries that put more emphasis on establishing 'whole-of-government' approaches by increasing the co-ordination between different ministries, however with greater variations in this trend according to political shifts.
- *Overarching and decentralised* (Type 2) – Countries like Germany and the Netherlands have set up overarching strategic frameworks (the High Tech Strategy and the Top Sectors policy) that serve as an umbrella for a large portion of STI policies. These frameworks include a number of missions. In the United Kingdom, the Industrial Strategy is an important framework that covers 22 challenges.
- *Thematic ministry-led* (Type 3) – Austria has implemented a model with rather limited interministerial coordination, where a single ministry together with implementation agencies have gradually reformed traditional thematic programmes to shore up their directionality and coverage of several stages of the research and innovation process.
- *Agency-led* (Type 4) – Norway's MOIP approach is led by independent agencies under increasingly flexible mandates provided by a wide range of ministries. These agencies are implementing joint MOIP initiatives. Based on their important strategic advising role, they are also are pushing for the adoption of a mission-oriented policy agenda at national level. A somewhat similar pattern can be found in Sweden and Finland.

Box 16. Insights on mission-orientation in Korea

This box presents some early insights drawn from desk review conducted in the context of the Korean MOIP case study. An interview campaigns and further analysis will deepen these results and allow a better understanding of the 'Korean MOIP trajectory'.

Strategic orientation

Since the beginning of Korea's rapid industrialisation process in the 1960s, STI policy has been a key instrument of the national economic development strategy, mainly guided by and serving the achievement of the five-year economic development plans. While it still served the purpose of raising the country's national competitiveness and catching-up with Japan and Western

economies, STI policy became increasingly driven by the objective of technology self-reliance through the development of strong endogenous research and innovation capabilities in the 1980s.

The 1990s marked a significant shift in that regard with the Ministry of Science and Technology (MOST; currently Ministry of Science and ICT, MSIT) being granted more administrative power to oversee the direction of STI policy development, which allowed for a more independent policy-making in the STI field. The STI Council under the Presidential Advisory Council on Science and Technology (PACST) is currently the central advisory and deliberative body, chaired by the President himself. It was first established as an advisory body in 1989 and became permanent in 1991.

In line with this trend towards a more prominent role of STI that is not only subordinate to economic development, Science and Technology Basic Plans (hereafter Basic Plans) developed by MSIT provide a mid-term vision and set the main objectives of STI policies since 2001. The 4th Basic Plan sets out a vision of 'improving the quality of people's lives and contributing to the development of human society through science and technology', thereby transitioning the role of STI to address social challenges.

Basic Plans also mark the government's first attempt to integrate and organise an interministerial STI strategy. This trend toward a more holistic strategic orientation was recently reinforced when, in 2018, the deliberative function was added to PACST on top of the advisory function to the President.

Another gradual change has taken place in the early 2000s as Korea was faced with social issues such as population ageing, food safety and all those related to environment and energy. This fundamentally altered the traditional role of science and technology as a driver for economic growth. Moreover, there has been increasing call from stakeholders and civil society to reorient the scientific development with more transparency and social governance. However, despite a relative shift towards tackling societal challenges in strategic documents, industrial competitiveness issues still dominate the national priorities, especially when it comes to actual implementation.

Policy co-ordination

Policy co-ordination has long been regarded as one of the weakness of Korea's policy-making process, and the national R&D projects are still carried out in a rather fragmented manner by sectoral ministries. Nevertheless, there have been attempts to bring structural changes to transform and integrate the STI policy governance structure since 2017. First, the Science, Technology and Innovation Office (hereafter STI Office) under MSIT conducts general policy co-ordination in the STI field, budget deliberation and adjustment for national R&D projects as well as performance evaluation. It was created in 2004 but remained inactive for nearly 15 years before being revived in 2018. The authorities to conduct feasibility studies on large government R&D projects and to coordinate budgets for government-funded research organisations were moved from Ministry of Economy and Finance (MoEF) to MSIT in order to bolster its authority vis-a-vis individual ministries with regards the definition of a central STI budget.

Also, the Ministerial Meeting on Science and Technology (hereafter, ST Ministerial Meeting), created in 1997, was revived in 2018 to reinforce its mandate as a horizontal STI co-ordination platform. The Meeting is held on an *ad hoc* basis in order to foster holistic dialogue in putting forward with interministerial R&D projects. The Conference convenes every month at ministerial level, headed by the Prime Minister (PM), with the Minister of MSIT as the Vice-Chair and 12 ministers, and at operational level. It reports to the PACST twice a year: at ministerial level, headed by the Prime Minister (PM), with the Minister of MSIT as the Vice-Chair and 12 ministers; and at operational level.

Policy implementation

Building on a long tradition of voluntarist state policies, Korea has recently shown a significant interest in mission-oriented policies. This was reinforced by the imperative to face the COVID 19 pandemic and its social and economic repercussions.

The Alchemist Programme is a seven year high-risk high-reward programme that encourages since 2018 the development of disruptive technologies that can tackle some specific challenges and, if successful, will form the technological base for future industries. 10 challenge areas were defined by a Grand Challenge Committee in May2020. The Programme starts with a competitive phase during which multiple (around 3) research organisations are selected and funded for two years. After this period one is selected based on its results and funded for the next five years with around KRW 25 billion (US$ 21 million). The Programme starts with a competitive phase during which multiple (around 3) research organisations are selected and funded for two years. After this period one is selected based on its results and funded for the next five years with around KRW 25 billion (US$ 21 million).

Since 2019, the 'Smart Care Robot Technology and Service Development Model Development Programme' (hereafter Care Robot Programme) is a joint-ministerial programme between MOTIE and Ministry of Health and Welfare (MOHW) to use the newly developed technologies in developing care robots in the care industry. In 2018, the two ministries have combined their efforts, and in March the same year, the 'Smart Care Robot Council' was founded in order to launch a cooperative research programme of the two ministries.

The PM 2.5 Programme is also a joint-ministerial programme. It aims to tackle the challenge of fine dust (PM 2.5) which is considered one of the most critical environmental issues in Korea. The effort dates back to 2016 when the government announced the Special Measures for Fine Dust Management calling for actions of several related ministries. It is underpinned by the 2016 Science and Technology-Based Strategy to Respond to Fine Dust, which aims to halve the fine dust emission in business establishments and contribute to creating the new markets related to fine dust management. The Programme has a dedicated governance structure (Advisory Committee) and a Secretariat directly reporting to the Project Leader. The 1st Phase of research started in September, 2017. The 2nd Phase followed in May, 2018, and the Project changed its name to PM 2.5 Pan-Ministerial National Strategic Project. The 3rd Phase started in February, 2019.

The Korean New Deal Programme, launched by the centre-of-government in response to the COVID pandemic, is composed of 10 core projects (including 'Smart Healthcare', 'Smart and Green Industrial Complexes' and 'Green energy'), selected from an initial list of 28 through interactive consultations among the National Assembly, government and the public. Each project has mission-like objectives and concrete targets for 2025. Through this programme, the Korean government intends to meet its 2030 target for GHG emissions reduction and the goal to have renewables account for 20% of the country's generation capacity by 2030. Furthermore, it attempts to use low-carbon and decentralised energy while considering the regions and social groups that are lagging.

4.3.1. The agency-led MOIP trajectory in Norway

Several studies, including the OECD Innovation Policy Review (OECD, 2017[2]), have characterised the Norwegian STI systems as better suited to support well-established sectors rather than new areas for diversification (Table 5). The agency-led MOIP approach (Type 4) adopted by Norway is very consistent with this pattern. A MOIP approach building on pilot policies currently experimented and the long experience of Norway in large-scale and scope research programmes could be instrumental in promoting a more transformation agenda.

Table 13. Main challenges and opportunities of Norway for mission-oriented policies

	Strategic orientation	Policy coordination	Policy implementation
Opportunities	• A widely acknowledged need for a transition beside O&G, towards societal challenges • Active role of STI policy in Norway's past and current development, high level of government support to STI activities • The 2014 Long-Term Plan as a first step towards high level, cross-ministerial STI prioritisation, although the priorities remain widespread and 'unsurprising' • "21-Strategies" are sectoral platforms that gather firms and stakeholders to advise the government on STI priorities in their area	• The size of the country favours exchange of information and multiple interactions even in absence of formal mechanisms • No high level strategic council for holistic coordination but several mechanisms support cross-ministerial and cross-agency coordination • Coordination of research and research-based innovation interventions of different ministries by using one single research council (RCN), with a common governance system led by MER • Many examples of sectoral strategies involving several ministries • Several ministries involved in research and innovation; stronger ownership of STI policy in their own 'sector'	• A comprehensive STI instrument policy portfolio • An increase of indirect instruments but still significant resources for 'oriented instruments' – possibility to leverage complementarities between mission-oriented and neutral instruments • Pilot MOIP initiatives at programme/scheme levels on which to learn and build • Significant efforts to implement a strategic portfolio approach to programme management at RCN, based on stronger autonomy given to the Agency • Numerous initiatives to promote interdisciplinary and cross-sectoral research and innovation collaborations
Challenges	• No strong agenda-setting mechanism/ at the highest level of the STI system • 2018 revision of the Long-Term Plan was not used to establish more precise priorities and targets • No cross-sectoral platforms for joint action to address societal challenges (but some voice in industry calls for a 'super 21-Forum')	• Highly sectoral governance structure ("sector principle") that gives authorities to each ministry to implement its own STI interventions in its area • Rather weak coordination between ministries in charge of research policy and innovation policy	• Still limited offer of demand-side policy instruments and disconnection from the supply side instruments • Fragmented business innovation policy support landscape as shown by recent review of business related policy mix • Challenging for RCN to work strategically due to both strong interest groups and in practice little room for manoeuvre.

Strategic Orientation in Norway

Norway has a long history of state intervention in guiding the country's knowledge-based development of priority areas. The national effort to support research and innovation has been in recent years increasingly directed towards the acknowledged need for the country to both diversify its economy away from oil and gas and solve pressing societal challenges. However, contrary to other countries where the state has played an important role in the national technological catch-up to leadership in key areas, Norway has not established strong priority-setting body or process to guide these gradual shifts in STI orientations.

Notwithstanding its limitations, the Long-Term Plan for Research and Higher Education 2015-2024 (LTP) 2015-2024, launched in 2014 and revised in 2018, succeeded in establishing a more holistic approach toward building increased commitment for some broad priorities across the government, including societal challenges.

In key sectors, the 21-Forums are large sectoral platforms that gather public and private actors to advise ministries on how research and development can contribute to a certain thematic area, what should be the priorities and how initiatives can best be organised and

supported. However, their thematic boundaries make some of them not the best vehicle to drive transformative societal changes that needs for cross-sectorial and open-ended approach. Recently, a call for better cross-ministerial co-ordination with support from the Center of Government in the energy area was accompanied by the idea to create a "super 21 Forum" that would allow cross-sectoral co-ordination to better address societal challenges.

Policy co-ordination in Norway

The co-ordination involving various policy bodies and stakeholders in Norway builds upon a strong tradition of consultation and consensus-building, as well as a remarkable level of trust in Government. It is however hindered by a highly sectoral governance structure. The so-called "sector principle" gives no less than 15 individual Norwegian ministries a high degree of autonomy to formulate and execute STI policy measures in their respective fields. Although this principle strengthens the level of engagement and ownership of several ministries in research and innovation in their own 'sector', it comes at the expense of cross-ministerial action.

Some inter-ministerial co-ordination mechanisms "soften" the practice of the sector principle, notably the Cabinet meetings and some mechanisms related to the LTP, when the latter is being developed or revised as well as for its implementation and monitoring. Furthermore, in the absence of strong co-ordination bodies at the highest level of policy making, agencies have taken up a strong co-ordination role.

Policy implementation in Norway

The Norwegian policy mix is comprehensive but, like in many countries, the weakest point lies in the take-up of demand-side instruments. Most instruments follow the linear and supply-push, research and innovation model. Moreover, non-thematic instruments account for an increasing share of the total public support to business R&D. A noticeable exception is Innovation Norway's Public-Private Innovation Partnership Programme (PPIP), a new innovative procurement instrument introduced in 2017 to tackle societal challenges via close collaboration partnerships between public institutions and private companies

There are however some positive trends that bode well for the future with regards to the adoption of challenge-oriented, cross-sectoral and interdisciplinary policy approaches:

- Despite a high share of indirect 'neutral' funding, a large portion of the government appropriations dedicated to R&D in Norway is 'thematically oriented';
- There is an increasing number of initiatives that aim to promote cross-thematic collaboration;
- RCN has in recent years been given more flexibility by some of its main principals to implement a portfolio approach and combine different demands rather than respond to different ministries' requests by setting individual programmes or schemes.

These trends leave more room for policy innovations, unconventional approaches and cross-cutting activities that are at the core of MOIPs. The cooperation between agencies as part of the Pilot-E mission-oriented initiative and CLIMIT programmes can be seen as resulting from such more holistic approaches to policy implementation.

4.3.2. The thematic ministry-led MOIP trajectory in Austria

In Austria, the main thrust of STI policy in recent decades was on generic measures to improve the research and innovation system (tax measures, institutional changes in research institutions, industry-science relations …). At the same time, there are several long-standing thematically oriented programmes, which have evolved over time to include more of the features of MOIPs. These programmes, which were mostly of the 'accelerator' type of missions together with the needs to align to missions defined on the level of the European Union, are a good basis for the further development of full-fledged MOIP. Several studies (OECD, 2018; Polt *et al*., 2020) have pointed to the need and potential to develop MOIP through a more strategically oriented policy approach (Table 14):

Establishing clearer priorities in the overall innovation system and effecting more concerted action among ministries. An opportunity exists to better articulate many of Austria's public STI policies with societal challenges. Focusing on societal challenges (and "missions") is a way to achieve higher impact from STI investments by producing more spillovers from individual research and innovation activities and by better transforming research results into economic activity and social practice. For a small country, an important challenge is the limited number of large actors in the business sector that could take up policy initiatives and transfer them into economic results.

Table 14. Main challenges and opportunities of Austria for mission-oriented policies

	Strategic orientation	Policy coordination	Policy implementation
Opportunities	• High R&D intensity, strong policy priority on STI • Tradition of and experience with thematic orientation towards 'grand challenges' since 1990ies	• Need of policy co-ordination even beyond STI well acknowledged • Interministerial co-ordination forum established to monitor and coordinate the implementation of the 2011 STI strategy • New 'post 2020' STI strategy being developed by end 2020 – likely with reference to increased role of 'Mission-Oriented Policy'	• A comprehensive STI instrument policy portfolio and institutions (agencies) • Set of thematic programs run by agencies, including. some 'mission-oriented' programs like Building of Tomorrow, Mobility of the Future, KIRAS and BENEFIT) • Strong tradition of monitoring and evaluation (but remains confined to individual evaluations)
Challenges	• Priority is still predominantly on generic, non-thematic, improvement of the STI system • Still mostly 'input-oriented' policy approach • Develop processes that allow for a good 'alignment' of national STI priorities in EU contexts	• Weak co-ordination on the strategic level, limited to flow of mutual information, not acting as a mechanism for joint strategic priority setting • Co-ordination between STI ministries so far being mostly informal and non-binding • Only piecemeal co-ordination with sectoral ministries	• Shift of the balance of instrument portfolio toward non-oriented instruments in the recent past • Lack of emphasis on the use of demand-side instruments • Fragmented policy mix, little co-ordination of instruments

Strategic Orientation in Austria

Over the past decades, Austria has seen an increasing R&D intensity which has made it one of the most R&D intensive countries in Europe. As the share of public funding is a bit higher than in other OECD countries and the share of public support to business R&D is also (considerably) higher than the OECD average, Austria would, in principle, have the financial means and the institutions in place to develop effective policy interventions to orient research and innovation actors towards societal challenges.

While the main thrust of STI policy was predominantly geared towards an improvement of the overall research and innovation system in the 2011 STI strategy, the need to develop a strategic policy approach to address 'grand societal challenges' like climate change, security, aging societies and resource and energy supply was explicitly recognised. This thematic orientation towards 'grand challenges' was also to some extent driven by the EU Framework Programs.

Building on thematic programs (some of which already established in the 1990s), Austria has gained long-standing experience with thematically-oriented policy which could form the basis for a broadening and widening of the mission-oriented approach in the country. Although these programmes had some 'transformative' elements in so far as they sometimes addressed necessary system changes, they were predominantly of the 'accelerator' type of programmes. The next step of development of these programmes would be to put them into larger contexts (climate change, changes in transport and energy systems at large, etc.) and address the need for changes in these contexts as well.

Policy co-ordination in Austria

In the aftermath of the agreement on the STI strategy of 2011, a co-ordination forum was established to monitor and coordinate the implementation of the strategy. The so-called 'Task Force STI' comprised of the major ministries deemed relevant for the task. The assessments of the implementation of the strategies concluded that the co-ordination measures were exploited mainly to facilitate the flow of information but not as a mechanism for joint strategic priority setting. Thus, it amounted more to 'negative coordination' (the delineation of areas of what not to do) and hardly to the positive one needed for the implementation of real mission-oriented policy. Against this background, the OECD Innovation Policy Review from 2018 re-stated and reinforced the need for changes in governance and funding, especially in policy co-ordination spanning across policy areas.

At the level of individual thematically-oriented programmes, co-ordination between actors (ministries, agencies, stakeholders) seems to work well as can be seen in the mission-oriented programmes covers like Building of Tomorrow, Mobility of Tomorrow, KIRAS or BENEFIT/AAL. An 'external' source for thematic policy co-ordination could come from the European Union (with the new Framework Program 'Horizon Europe', the Green Deal and the IPCEI) as Austria is trying to align its policies with these initiatives.

Policy implementation in Austria

Assessments of the STI policy mix consistently find a comprehensive set of STI policy instruments available. The portfolio of these instruments has shifted to non-oriented instruments in the recent past which limits the public capabilities to steer thematically. The downside of the instruments' toolbox is the lack of emphasis on the use of demand-side instruments. They have been developed conceptually but have not yet been adopted to a great extent and impact.

Another feature of the policy mix is that the plethora of instruments are rarely co-ordinated and hardly take into account the effects of other measures. On the level of the individual measures, stakeholder involvement as well as close interaction between policy makers and implementing agencies are apparently working well. However, the overall co-ordination of instruments remains a formidable challenge. On the level of implementing institutions and their capacities with respect to thematically-oriented programs, there are distributed competences between agencies, which have been operating in a concerted way in a number of mission-oriented programmes.

Assessments, monitoring and evaluations are a well-established practice in Austria. As they are almost exclusively performed on the level of the individual measures and not in a 'systems' or 'portfolio' perspective, a more wide-spread adoption of mission-oriented policies would necessitate the changes in the evaluation practices and approaches.

4.3.3. The Centre of government-led MOIP trajectory in Japan

Throughout the last 25 years, the Japanese STI policy model has evolved, gradually adopting features that are consistent with – and paved the way for – a MOIP approach (Table 15). Along these changes, the governance of the Japanese STI system has become more challenge-oriented, centrally-led and coordinated top-down as well as being increasingly precise and 'hands-on'. The adoption of fully-fledged mission-oriented programmes orchestrated by the Cabinet office is the last and certainly the most significant step in that direction. This is in line with a recent trend of strengthening the institutional and financial capacity of centres of government to support SDG implementation in several countries. The main reasons for this trends lie in the policy neutrality of CoG, its convening power vis-à-vis sectoral ministries, its authority and leadership (hence allowing for more ambitious consensus), its co-ordination expertise to drive cross-disciplinary policies (OECD, 2019).

Table 15. Main challenges and opportunities of innovation systems in Japan for adopting mission-oriented policies

	Strategic orientation	Policy coordination	Policy implementation
Opportunities	• Significant top down directionality provided in the Basic S&T Plans and, in particular, the annual action plans (Comprehensive / Integrated STI strategies) • Priorities are increasingly issue-based, replacing the former industry targeting practices. Issue based priorities are complemented by disciplinary priorities to enhance the underpinning scientific knowledge base. • Gradual strengthening of the role of center-of-government bodies, in particular the Cabinet Office and the successive 'STI control towers' (CSTP, CSTI, the Integrated Innovation Strategy Promotion Council and the thematic headquarters).	• Long tradition of STI interministerial co-ordination to enhance collaboration, notably between METI and MEXT • Gradual strengthening of the holistic co-ordination mandate and power of CSTP then CSTI • Recent initiative to expand the range of co-ordination to better include 'sectoral' policy bodies (ministries but also central thematic 'headquarters') beyond those directly in charge of research and innovation. • Interministerial co-ordination at the core of the SIP programme	• Research consortia during the catch-up period had several MOIP features • Fully-fledged mission-oriented programmes led by CSTI: SIP, Moonshot and ImPACT
Challenges	• Limited or formal consultations of stakeholder beyond the 'usual suspects'	• Attempt to set a holistic STI budget formation process led by CSTI, however with mixed results • Growing complexity of the governance system in involving ministries, the STI control tower (CSTI), the thematic headquarters and the new council to coordinate all these actors	• The hands-on role of the CSTI in the implementation of MOIPs overshadows the other functions of this committee in strategic orientation and coordinatrion

Strategic Orientation in Japan

As Japan strived to catch-up with western economies until the 1980s, public authorities played a key role in strategically steering industrial and innovation activities. The 'industry-targeting' model became less effective at the end of the 1980s as Japan was no longer

followed the frontrunner countries. Also, it became difficult for the government to support a wide consensus on the way forward and drive the corresponding joint efforts not only among different ministries, companies, stakeholders, but also in the society at large.

Since 1996, Science and Technology Basic Plans have become a very important strategic framework for STI activities. Since the second one (2001–2005), Basic Plans feature priorities which have become increasingly issue-based. The Fifth Basic Plan (2016-2021), inspired by the 'Society 5.0' vision, marked another significant step towards prioritising societal issues.

The reforms led by the new government of ABE Shinzō in 2013 and 2014 is another step towards the transition to a stronger and more impactful strategic steering of STI policies. An important change was the development of annual action plans – the so-called Comprehensive Science, Technology and Innovation Strategies – to refine the priorities for the coming year in line with the 5-year Basic Plans. They have become the 'Integrated Innovation Strategies' which reflect the willingness of the government to widen the scope of STI policy co-ordination to include all policy fields beyond those directly in charge of research and innovation (health, agriculture, information technologies, etc.).

Another major trend in the last 20 years concerns the strengthening of the Centre-of-Government in the strategic orientation of the Japanese STI system. The Council for Science and Technology Policy (CSTP) was established in January 2001 and the government progressively took actions to bolster its role as STI 'Headquarter'. The Council for Science, Technology and Innovation (CSTI) was founded by the new political majority in 2014 with even wider prerogatives.

Policy co-ordination in Japan

Inter-ministerial policy co-ordination has been a long-standing priority in Japan. In the face of persistent silos and the growing decentralisation and compartmentalisation of STI policy due to the liberalisation of economy, the government has gradually strengthened and extended the mandate of the high-level STI advisory councils.

There have also been several attempts in the last decades to coordinate not only ministries' strategic plans but also their respective STI budgets, with only mixed results. CSTI currently retains an advisory role in the budget formation process. In the same vein, PRISM is a new co-ordination mechanism led by CSTI to encourage ministries to increase their R&D investment in certain areas considered as national priorities.

In parallel with the strengthened role of CSTP and, later on, CSTI, the government created several 'thematic headquarters' under the Cabinet Secretariat and Cabinet Office (in health, IT, ocean, space, etc.). The multiplication of these headquarters in areas with strong relevance to STI policy has made the governance of the STI system more complex and burdensome.

Policy implementation in Japan

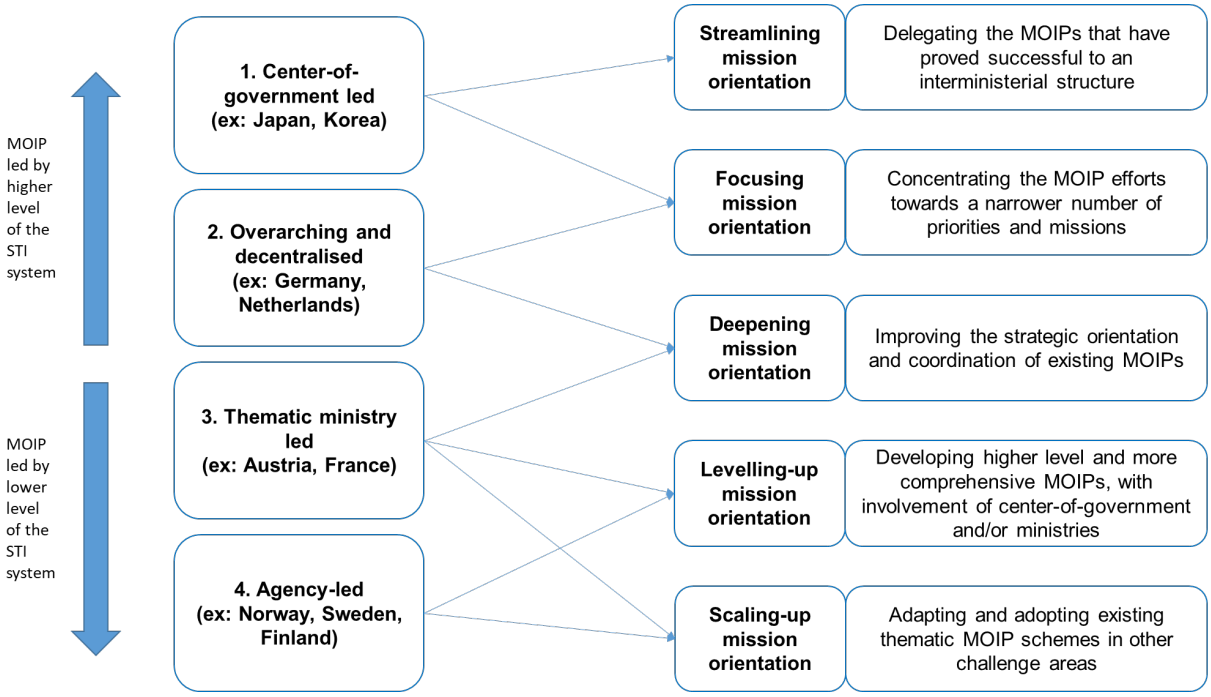
During the catch-up period, the government implemented a voluntarist policy whereby it differentiated its mode of intervention according to each designated area in order to steer industrial activities in the most promising directions. To do so, the government often led consultations to develop a "Vision", followed by the creation of a research consortium to realise the Vision. Although confined to a given industry, research consortia had several features of MOIPs, coming close to the 'Pre-competitive programmes and schemes' type. When Japan reached the technological frontier in the 1980s, research consortia were considered by many as no longer needed.

Following the 2012 elections, the new government tried to reinforce significantly the central power vis-à-vis the individual ministries and agencies by providing CSTI with a large budget to operate its own STI programmes (notably the SIP-JP and Moonshot R&D programme) rather than only trying to coordinate ministries' policies. This major step raised some debates from different parts of the policy sphere since this shift challenges the generally accepted 'good governance' principle that consists in separating the functions of orientation and co-ordination on the one side from policy implementation on the other side.

4.4. The way forward for Mission-oriented innovation policies

Figure 17 depicts potential pathways towards the development and implementation of MOIPs for the four types of MOIP trajectories. These observations on current developments and potential ways forward should not be read as evaluations or policy prescriptions but rather as food for thoughts in domestic debates on mission-oriented policies. These go beyond the specific case of each country, presenting a range of options for improvement that all countries can, if deemed relevant, consider, adapt, combine and adopt.

Figure 17. National MOIP trajectories and tentative options of way forward



4.4.1. Streamlining mission orientation

Centres of government can foster a culture of innovation and experimentation by supporting a shift from traditional policy tools toward those that require a less risk-averse approach (OECD, 2019). This general property of central policy institutions is backed by the experience in Japan where the Cabinet Office has acted as an effective ground for experimentation to launch, test and improve mission-oriented policies which require stronger orientation and co-ordination (Type 1). If this approach is successful, it could allow for tackling great, 'transformative', missions (Moonshot R&D Programme) as well as accelerator missions (SIP-JP).

However, future development of MOIPs in this context – especially when it comes to 'transformative' types of missions - might require a broader involvement of society at large, and it would also call for supplementary set-ups of policy processes. The problems of the lack of flexibility often associated with this type of approach can somewhat be mitigated (e.g. through the powerful role of the Program Manager/Director in Japan and the rather short planning cycles).

Furthermore, this top-down and centre-of-government led MOIP trajectory draws significantly on the resources of centralised body therefore runs the risk of becoming somewhat isolated from ministries' own strategies and programmes. The top-down 'whole-of-government' approach with its wide-ranging and multi-faceted efforts for co-ordination also faces the problem of intrinsic complexities and substantial co-ordination costs.

The 'Streamlining' option consists of better integrating the implementation of MOIPs in the sectorial policy structure, notably through transferring well-established MOIP initiatives to a set of inter-connected ministries (either interministerial programmes; or a programme led by a ministry with participation of other ministries) under a formal setting which will differ across countries.

4.4.2. Focusing mission orientation

Focusing mission-orientation, *i.e.* aiming for greater directionality by setting clearer and bolder goals is a challenge for the largest and highest level MOIP initiatives (mainly Type 1 and Type 2). As previously discussed, MOIPs use different processes and mechanisms to progressively narrow down their objectives. All of them involve consultation with various layers of stakeholders, reaching down to citizens for the more transformative missions, as these are the ones that entail the greater transfer of public funds and may have the strongest impact on production and consumption modes.

4.4.3. Deepening mission orientation

Another way forward discernible in current MOIP development is the one that entails a gradual modification of existing overarching strategic programmes toward including more mission-oriented features. The examples in case are Germany and the Netherlands with the High-tech Strategy and the Top-sector mission approach respectively. Here, the 'umbrella' of an overarching strategic programme is used to develop MOIPs.

The challenge for this approach in the future will be to fully realise the potential of synergies between the different parts of these strategic programmes, which would require more intense co-ordination between ministries and stakeholders in respective areas.

The 'Deepening' option is also a possible way to continue the thematic and continuous trajectory of countries like Austria or France (Type 3). Starting from a more decentralised approach, they strive to make their traditional thematic programmes more targeted and better coordinated across ministries.

4.4.4. Elevating mission orientation

The 'Elevating' option consists of bringing agency-led MOIP initiatives (Type 4) up to the level of ministries and centre of government.

This would allow countries like Norway to aim for more transformative missions. The Norwegian policy approach seems to be less complex and more straightforward to implement than many other MOIPs, even if it also involves quite a number of stakeholders (business, communities, …) and instruments (e.g. regulation, demand side instruments, …) to support larger and more ambitious projects. In this country, most of current MOIP related

programs and initiatives seem to be pertaining to the 'accelerator' type missions, and the implementation is deemed effective.

At the same time, this approach might put limits on the capabilities of a policy system when it comes to tackling large-scale, transformative challenges if these initiatives remain confined to the level of agencies. Their scope and visibility is naturally limited and, moreover they run the risk of becoming conservative if the stakeholders involved are dominated by incumbents.

The governance structures in such country might benefit from the establishment of a strategic process to set up and monitor the implementation of bolder national missions in order to improve orientation and co-ordination at national level in a more top down way. To do so, useful lessons could be drawn from countries that have set up Overarching mission-oriented strategic frameworks. This option is more challenging since it entails a strong direct involvement of higher level public bodies in the strategic and co-ordination process. While political leaders may already be sensitised to the concept of mission-oriented policies thanks to agencies' past and present MOIP initiatives, it proves more difficult to make the case for larger and more 'transformer' missions than for the 'accelerator' type. Here again, finding the relevant framework and 'vehicle' to host a higher level and more top-down mission-oriented policy initiative is key. In Norway, the next revision of the Long-Term Plan for Research and Higher Education could present an effective opportunity if relevant policy ministries agree on structuring the plan around (or include within it) some clear and selective missions.

This is also a way forward for countries having adopted a more thematic and continuous MOIP approach (Type 3). In France, a large and well-established umbrella programme like the Programme d'investissements d'avenir (PIA) could serve as a vehicle for this way forward, provided that it reforms its governance to allow for stronger orientation and coordination. In Austria, the national STI strategy could be such 'mission device' if it is supplemented by the appropriate interministerial governance structure and focused on clear and bold missions.

4.4.5. Scaling-up mission orientation

A last option consists in expanding the range and scope of the current agency-based mission-oriented policies (Type 4) and mission-oriented thematic programmes (Type 3). This can be done in two main ways:

i. enlarging the existing MOIP schemes with more budget and a wider scope. However, one of the strengths of these schemes relies upon their focused and targeted scope to genuinely have an accelerator effect, based on dense and 'qualitative' interactions and heightened trust between the public and private partners. Any scale-up of these initiatives should not come at the expense of this advantage.

ii. systematising the existing MOIP schemes. Agencies can replicate such schemes in other areas. This is already the case in Norway. Pilot-E has been adapted to and adopted in the transport area (Pilot-T), and will probably soon be incorporated into the health (Pilot-H) or bio-economy (Pilot-B) areas. The key question relates to the domain of relevance of such schemes, i.e. in which challenge areas they could be useful and effective. They are most effective when i) the industry is well-established and already benefits from a strong competitive position; ii) when the country covers almost the whole value chain, including the users/buyers of the product or service. An inventory of MOIP initiative suggests that this type of

'accelerator' mission-oriented scheme works better in established fields, and certainly performs less well in new emerging areas (European Commission, 2018).

5. Conclusion

5.1. MOIP concept and practice

Confronted with the emergence of a policy approach with ill-defined borders and content, the first task in this study consisted in setting out a definition that is both consensual (*i.e.* aligned with the existing literature) and functional (enabling an identification and characterisation of the different forms of this policy approach). Based on this definition, a set of 12 design principles pertaining to three dimensions was defined in order to allow for a finer-grained characterisation of MOIPs initiatives.

A systematic scan of policy landscapes worldwide resulted in the identification of about 40 policy initiatives as MOIPs at this stage. However none of these initiatives fully matches the design principles, which constitutes an ideal-type of MOIP. However, the intention of this project was not to label initiatives as 'MOIPs', but to learn from the most interesting experiences worldwide what are the main opportunities and challenges of the different types of mission-oriented policies, in different thematic and national contexts.

The set of MOIP design principles also has a conceptual and practical added value. It provides an "under the hood" overview of the mission-orientation concept, showing that none of its constituent is new to scholars, analysts or decision makers. The benefit of a strategic and challenge-based approach, of the engagement of various stakeholders, including citizens when relevant, or, for instance, of holistic coordination and of a consistent policy mix have been discussed in the academic and grey literature for a long time, even decades for some of the corresponding design principles. The main added value of mission-oriented policy is that it bundles together and institutionalises these expected policy features in one integrated concept. From a practical perspective, the design principles can be used as a tool to characterise MOIP initiatives and identify possible ways to adopt or improve them in order to better address complex societal challenges.

5.2. MOIP opportunities and challenges

At the most general level, based on detailed information on 20 MOIP initiative case studies and 4 MOIP country case studies (in Austria, Japan, Korea, and Norway), the main opportunity of MOIPs lies in their ability to assemble and implement consistently different ways to engage stakeholders, align various policy bodies' plans towards common goals, coordinate a wide range of instruments, increase and secure commitments of public and private resources, manage the interactions between policy instruments, etc. They also provide a coordinated space that is adapted to each challenge and allows for collective decision making on some of the most crucial 'points of tension' of STI policy. Among these tensions are the allocation of efforts between shorter- and longer-term objectives, the balance between economic and societal objectives, the design of an orientation process that is both inclusive and directional, the setting of strong directions without picking particular solutions and winners, the laying of a coordination structure that is holistic while allowing for strong leadership, the deliberate implementation of a policy mix that meshes supply-push and demand-led instruments.

The recurring challenges across all types of MOIPs are: the engagement of citizens in the mission definition; the design of an orientation process that is inclusive but without leading to an inflation, broadening or dilution of ambitions; leaving some space for non-technological solutions; the active involvement of sectoral ministries that are directly related to the societal challenges; the practical articulation of supply-push and demand-led policy instruments; pursuing disruptive scenarios while relying on some established

institutions and communities; the development of evaluation procedures and methodologies that are suited for systemic policies.

Although they are difficult to estimate, MOIPs involve additional costs, mainly related to their dedicated strategic, programming and operational governance bodies. However, there have been only a few evaluations that could shed light on the costs and benefits of MOIPs and, more fundamentally, on their additionality with regards to more traditional (less oriented, more fragmented) STI policies. The initiatives that are the closest to the MOIP ideal-case are the most recently established and their implementation is only starting now.

5.3. The national embeddedness of MOIPs

The design of MOIPs is significantly influenced by the specificities of the national institutional setting in which they are embedded. No MOIP initiative was started from scratch; they all build on previous policies implemented in the country. They result from a gradual process with dedicated effort to make the existing policies better oriented and coordinated, either 'from the inside' (e.g. improvement of a scheme to make it more challenge-oriented and cross-sectoral) or 'from the outside' (most often by adding a governance layer to coordinate various existing interventions);

MOIPs are therefore the result of a gradual and country-specific process. National 'MOIP trajectories' unfold and move forward through experimentation, negotiation and learning in an evolutionary way, building on existing policy settings and instruments. Four types of MOIP trajectories are identified, taking into consideration the institutions that lead the national 'mission-orientation agenda': Centre-of-government-led; Overarching and decentralised; Thematic ministry-led; Agency-led.

The MOIP initiatives, although deeply rooted in firmly established national settings, are still experimental in many respects. The countries who have pushed the farthest these experimentations are now reaching a crucial point regarding the next steps of this approach, based on the experience acquired during the previous stages. This study identifies five possible ways forward for the four MOIP trajectories: Streamlining; Focusing; Deepening; Scaling-up; and Elevating mission orientation.

5.4. Lessons-learned by MOIP dimension

The early stage of this policy approach does not lend itself to overall conclusions and universal recommendations, and there is no single MOIP 'silver bullet' to be simply replicated. Still, some valuable results can be put forward for each of the three MOIP dimensions that have structured this study.

MOIP orientation

- Most MOIPs follow an open and non-prescriptive approach whereby they 'pick problems, not solutions'. However, as the organisations promoting and leading this approach are mainly from the science and technology policy fields, few of them consider social innovation.
- Few of MOIP initiatives have set objectives that have the expected mission characteristics: clear, bold and inspirational, with wide societal relevance, ambitious but realistic, targeted, measurable, time-bound and solution neutral.
- Missions are generally not set at the inception of MOIP initiatives, but are a result of very gradual and inclusive process, through which the scope of objectives is

progressively narrowed down from large challenges and missions to precise objectives and targets set in projects.

- Almost all MOIP initiatives mix societal and economic objectives. This can generate some mismatch in terms of the geographic scope of the policy intervention needed to fulfil these different objectives.

MOIP coordination

- All MOIPs are steered and governed through elaborated multi-level governance structure, e.g. 'nested', multi-polar and cross-ministerial / cross-agency governance structure.
- MOIPs function as 'mini-system of innovation', each of them with their own structure of governance that fits the specific need and characteristics of their missions.
- One of policy makers' deterrents to engagement in MOIPs is the concern over lack of leadership and unclear responsibilities regarding the success and failure of coordinated initiatives.
- The implementation of a portfolio approach within MOIPS allows a coordinated exploration of the different options to a given challenge.

MOIP implementation

- Each MOIPs aims to form a deliberately designed and integrated policy mix. One key added value of MOIPs is to enable the adaptation of the instrument portfolio to each mission.
- Although the level of integration of policy mixes vary from one initiatives to the other, they are generally less integrated at implementation level than at orientation and co-ordination levels. The implementation is often decentralised in the various policy execution bodies, while still guided by their common mission and coordinated through various structure of governance.
- The bulk of MOIPs build upon the existing policy instruments operated by the participating ministries and agencies. they therefore reflect the characteristics of the overall national policy context in which they are embedded, the instruments mobilised in MOIPs are mainly direct interventions, ranging from various types of grants, subsidies and loans to public procurement but also some technical support for upskilling or training.
- Firms' engagement, including in riskier projects, is strengthened in MOIPs by
  - The participation of users and bodies influencing the demand (e.g. regulatory authorities, public procurement authorities, etc.), which help reduce market uncertainty;
  - The proximity between public authorities and partners in MOIPs, which generates a higher level of trust.
  - The hand-on approach of public authorities, providing support to and interacting with teams during the mission definition stage and all along the project duration, in addition to funding.
- There are very few evaluations of MOIPs to date and almost all of them still rely on traditional (non-systemic) evaluation tools and methods.

5.5. Barriers to mission-orientation

- Several countries that have experimented MOIPs are now confronted with the difficulty to scale them up and integrate them in the broader strategic and policy framework. This requires not only a capacity to learn from these experiments and reflect this knowledge into existing or new initiatives (reflexivity), but also a high level political commitment.
- An important future step will consist in transferring the leadership of some of the MOIPs from the public bodies in charge of STI policies, which most often initiated them, to relevant line ministries.

One important policy implication to draw from these conclusions is that mission-oriented policies are not confined to countries with the most advanced national innovation systems. There are various types of MOIPs, with different scales, scopes and levels of ambition, at different stages of development. Following a pragmatic and gradual approach, a first step for adopting a MOIP approach consists in identifying in the existing system:

- the 'seeds and sparks of mission-orientation' (a priority-setting mechanism, an interministerial programme or scheme, etc.), which could be used as a stepping stone;
- the actors who could support such approach, in order to form a 'coalition of the willing' and launch a first pilot MOIP, from which it will be possible to learn from and engage other actors

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Annex A. MOIP initiative acronyms and links to the MOIP Online toolkit

Initiative acronyms (Country ISO code)	Name of the initiative	MOIP Online toolkit link
AAL (AT)	Ambient Assisted Living / the benefit programme	https://stip.oecd.org/stip/moip/case-studies/8
BoT (AT)	Building of Tomorrow	https://stip.oecd.org/stip/moip/case-studies/9
CDI (SE)	Challenge Driven Innovation Initiative	https://stip.oecd.org/stip/moip/case-studies/10
CLIMIT (NO)	CLIMIT	https://stip.oecd.org/stip/moip/case-studies/4
Energie	Energiewende	https://stip.oecd.org/stip/moip/case-studies/24
Horizon (UE)	Horizon Europe's missions	https://stip.oecd.org/stip/moip/case-studies/13
HTS2025 (DE)	Hightech Strategy 2025	https://stip.oecd.org/stip/moip/case-studies/1
ImPACT (JP)	Impulsing Paradigm Change through Disruptive Technologies Program	https://stip.oecd.org/stip/moip/case-studies/17
ISCF (UK)	Industrial Strategy Challenge Fund	https://stip.oecd.org/stip/moip/case-studies/12
KIRAS (AT)	KIRAS	https://stip.oecd.org/stip/moip/case-studies/7
LTP (NO)	Long-term plan for Research and Higher Education	https://stip.oecd.org/stip/moip/case-studies/5
MoF (AT)	Mobility of the Future	https://stip.oecd.org/stip/moip/case-studies/6
Moonshot (JP)	Moonshot Research and Development Programme	https://stip.oecd.org/stip/moip/case-studies/16
PilotE (NO)	Pilot-E	https://stip.oecd.org/stip/moip/case-studies/2
SIP-JP (JP)	Cross-ministerial Strategic Innovation Promotion Program	https://stip.oecd.org/stip/moip/case-studies/15
SIP-SE (SE)	Strategic Innovation Programmes	https://stip.oecd.org/stip/moip/case-studies/11
MTIP (NL)	Mission-driven Topsector and Innovation Policy'	https://stip.oecd.org/stip/moip/case-studies/3
UKIS (UK)	United Kingdom Industrial Strategy	https://stip.oecd.org/stip/moip/case-studies/14
Vision (SE)	Vision Driven Health Milieus	Forthcoming

Endnotes

[1] Borras and Laatsit (2018) recourse to an ideal-type to define the concept of 'system-oriented innovation policy evaluation'. They stress that one should not expect to find them in their 'purity' or 'entirety' in the real world: "*they are abstractions, and may not necessarily to be found 100% replicated in the empirical complexity of social phenomena*".

[2] For convenience, this study refers to complete initiatives (for instance, simply 'Horizon Europe'). However, it should be kept in mind that the focus is on the 'mission component' of these initiatives.

[3] Other US agencies draw on this model to a lesser or greater extent: IARPA (the National Intelligence Agency's ARPA), ARPA-E (the Department of Energy's ARPA.), BARDA (Biomedical Advanced Research and Development Authority), etc.

[4] See the agency's website: https://www.sprind.org/en/.

[5] A pilot of this agency was created as part of the Horizon 2020 programme, under the name of Enhanced European Innovation Council (EIC) pilot (https://ec.europa.eu/research/eic/index.cfm). The lessons of this pilot will lead to full implementation in Horizon Europe during the period 2021-2027.

[6] https://sciencebusiness.net/news/eu-create-new-biomedical-research-agency-modelled-barda.

[7] "Grand Solutions" (Denmark), the "Flagship" (Finland), the "Pilot-E" (Norway), and the "Challenge-driven innovation" (Sweden).

[8] The traditional distinction between input and output legitimacy is also instrumental to shed light upon the importance of stakeholder engagement in the determination of the mission to be pursued (Edler and Borras, 2014). The input legitimacy of a policy is defined as the social acceptance of the process by which goals and instruments are defined. This includes notably the consultation and negotiation process and the mechanism for taking decision on this basis. The output legitimacy is the acceptance of the mission or challenge itself as it results from the consultation process.

[9] The DARPA model for instance involves multiple levels of "top-down problem generation" by the Programme Manager and "bottom-up solution generation" by the consulted experts, partners and stakeholders (Reinhardt, 2020).

[10] The new policy bodies are: the Minister of Justice and Security (participates in the 'Security' KIA), the Minister of the Interior and Kingdom Relations (participates in the 'Energy Transition and Sustainability' KIA), the State Secretary for Social Affairs and Employment (participates in the 'Health and Long-term Care' KIA).

[11] The full case studies are available in stand-alone reports. The Korean MOIP case study is not finalised at the time of the writing of this report. Only intermediary results are included.

[12] Notably Australia, Germany, Denmark, Finland, the Netherlands, Sweden, and the UK.