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Do mission-oriented policies for net-zero deliver on their many promises?

Lessons for tackling
complex and systemic
societal challenges

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Lessons for tackling complex and systemic societal challenges



OECD Green Growth and Sustainable Development Forum

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Executive summary

The large emissions reductions needed to meet national net-zero pledges and the objectives of the Paris agreement require rapid and systemic transformation. Coordination across multiple policy areas and change in multiple “systems” (e.g. energy, transport, buildings) is needed to deliver this system-wide transformation.

Mission-oriented innovation approaches (or MOIPs) can help to promote such systemic change because of their integrated nature. MOIPs, which are increasingly adopted by countries to address a wide variety of societal challenges, are expected to improve coordination over traditional innovation policies through the collective development of a strategic agenda, the setting of a dedicated governance structure, and the implementation of a tailor-made and integrated policy mix.

This issue paper analyses existing mission-oriented innovation approaches for net-zero to evaluate whether they could accelerate green science and innovation relative to traditional STI policy mixes and transform existing socio-technical systems. A theory of change is presented in this paper and used to analyse the key features and results of existing net-zero missions.

The results show that net-zero missions are characterised by *stronger orientation of innovation systems*, with clearer objectives related to Greenhouse Gas (GHG) emissions reduction. In addition, they lead to better *coordination* across policy and administrative silos, and better *integration* of policy instruments across the different stages of the innovation chain (from support to research to the technology deployment).

However, two challenges remain for missions to deliver their transformative impact for net-zero. First, missions for net-zero need to move beyond the ‘*STI only trap*’. Albeit displaying some systemic features, net-zero missions remain for the most part focused on support to research and innovation, and are led and funded by STI authorities. Secondly, existing missions have shown key improvements over traditional STI policies in the definition of strategic agendas and in setting up governance structures but evidence of joined up implementation for the net-zero transition remain scarce.

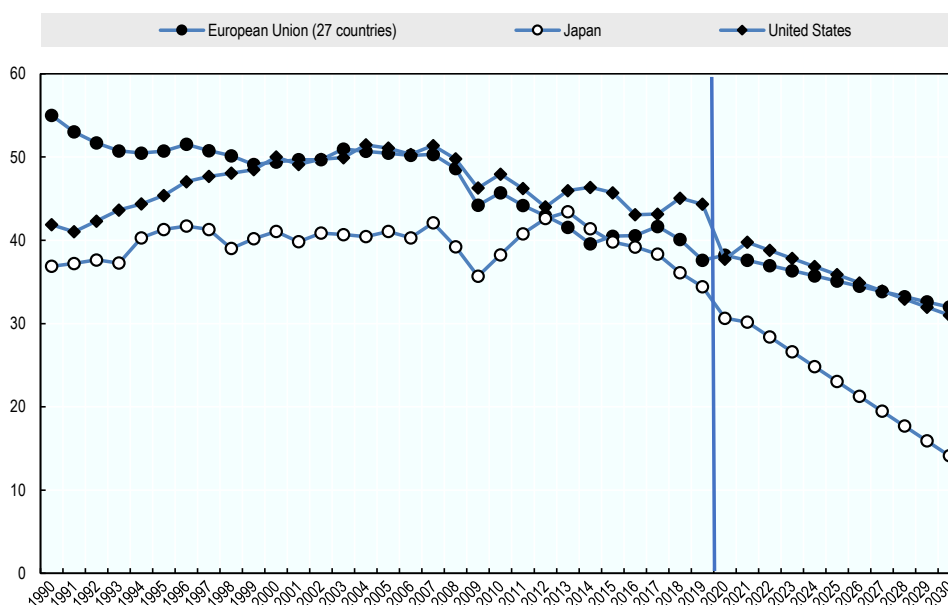
1. Introduction: Why are mission-oriented policies needed?

Mounting societal challenges call for new STI governance and policy frameworks

1. It has become increasingly clear and consensual in recent years for policymakers and policy analysts and that ‘change-as-usual’ is no longer an option to tackle the systemic societal challenges posed by climate change. Unabated climate change will have tremendous impact on people’s life and well-being in the not too distant future for both developed and developing countries. Despite technological progress drove the costs of low carbon technologies down and increased their performance in areas such as buildings and transportation (IPCC, Climate Change 2022 - Mitigation of Climate Change - Summary for policy makers, 2022), countries are not on the path to meet their international commitments for 2030 and 2050 at the current rate of emission reduction (Figure 1).¹ This is particularly critical since recent state-of-the-art research shows that important tipping points are already “possible” at current levels of warming and may become “likely” within the Paris Agreement range of 1.5 to 2°C warming (OECD, 2022). These tipping points could have cascading effects that affect the Earth system as well as socio-economic and ecological systems over short timeframes.

Figure 1. Annual difference between GHG emissions and nationally determined contributions target for 2030 for selected countries – 1990-2020 and linear projections 2021-2030

In percentage of GHG emissions



Note: 1/ Projections made based on the trends observed during the last 5 years for each series of data; 2/ The emission data for China – rapidly increasing – are not regular enough to allow for projections.

Source: UNFCCC National Inventory Submissions. Information last updated and processed on 3rd March 2022 (retrieved on the Climate Action Dashboard of the International Programme for Action on Climate, <https://www.oecd.org/climate-action/ipac/>).

2. **Efforts to translate net-zero commitments into concrete actions** (Jeudy-Hugo, Lo Re, & Falduto, 2021) **to date fall significantly short of what would be needed to achieve these targets** (World

¹ 33 countries and the European Union have set net-zero targets for, in most cases 2030 and 2050 in order to contribute to in limit global warming to 1.5°C by the end of the century.

Resources Institute, 2020). UNEP analysis shows that if all countries would implement their 2030 pledges and continue at the same pace, global warming is likely to reach between 2.4 and 2.6° by 2100 (UNEP, 2022). IEA data demonstrates a clear flattening of RD&D public expenditures for low-carbon technologies as a percentage of GDP since around 2010 (IEA, 2022). This trend coincides with a slowdown of patenting in low-carbon technologies (OECD, 2022). A simple review of the net-zero initiatives on the STIP Compass net-zero portal shows that the bulk of reported initiatives pertain to strategies and plans and more than half of them have no reserved budget (OECD, 2022), which tends to indicate that these strategies are less directly linked to policy implementation. More generally, according to the most recent estimates, achieving the net-zero goals will require a tripling in spending on clean energy and infrastructure to 2030 (IEA, 2022).

3. **Still available pathways to limit global warming to 1.5° do not rely on individual ‘silver bullet’ solutions or technological breakthroughs but imply changes on multiple dimensions.** These pathways correspond to various mitigation approaches, with different mix and timing of development and diffusion of social and technological innovations (IPCC, 2018). Both the diffusion of currently available technologies and new advances and scale-up of technologies that are still in laboratories or at the demonstration stage are needed to achieve the 2030 emission reductions targets. Furthermore, these scientific and technological progresses will need to be combined with behavioural, regulatory, political and social changes. Changes in a wide range of domains, involving different communities on multiple levels, needs to co-evolve in a coherent way and towards similar objectives to achieve the sustainability transitions.

Traditional policy landscapes are not fit to achieve net-zero

4. **In past decades, the increasing specialisation of individual policy instruments resulted in fragmented policy and governance frameworks.** Numerous policy initiatives address specific market failures (Mazzucato, 2016), for instance raising the level of private R&D, supporting feasibility or strengthening the knowledge base with specific emphasis on certain disciplines, sectors or stages of the innovation process. Furthermore, STI policy mixes implemented today are characterised by an increasing use of indirect incentives such as R&D tax credit that, despite some experimentations of ‘green R&D tax credit’ (OECD, 2022), cannot be easily leveraged to strategically orientate research STI activities towards priorities.

5. **The systemic change required to address climate change raises 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 systemic issues such as climate change or aging, interventions supporting technological innovations will have to be embedded in a wider set of interlinked social, economic and political changes contributing to a genuine socio-technical transformation (Geels & Schot, 2007); (Schot & Steinmueller, 2018). Without a framework to coordinate different modes of intervention, these dispersed policy mixes are ill-suited to bring about the systemic changes needed to ensure the transition to net-zero (OECD, 2021).

6. **Tackling challenges of this unprecedented scale and scope therefore requires better strategic orientation and holistic co-ordination of Science, Technology and Innovation (STI) interventions.** More recently, the COVID-19 pandemic has demonstrated how effective good frameworks of collective action towards common and well-defined objectives can be to tackle complex challenges (OECD, 2020).

A wealth of mission-oriented policy experimentations to learn from

7. **Recently, and in particular in the last five years, Mission-oriented innovation policies (MOIPs) have attracted a great deal of attention.** Originating from the space and military areas (e.g. Manhattan or Apollo programmes), the content and domain of application of the concept of mission-

orientation gradually shifted from large-scale and ambitious beyond-the-frontier technological endeavours towards systemic intervention aiming to address societal challenges. MOIPs are defined by OECD 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 (Larrue, 2021).

8. **An increasing number of countries have turned to these policy approaches, often through different pilots and experiments.** It is difficult to draw a strict line between the mission-oriented policies and the other more traditional approaches since there is a continuum of policy frameworks that differ in how targeted they are on particular objectives, how coordinated are the plans and actions of the different relevant actors and how integrated are the different interventions to realise these objectives. However, a systematic scan of policy landscapes worldwide by OECD in 2019-20 allowed to identify to date about 40 policy initiatives that match the MOIP definition outlined above to a *significant* extent. More recently, focusing on MOIPs for realising net-zero objectives, the OECD identified 29 MOIP initiatives 'nurturing' 74 missions that aim directly or indirectly to reduce GHG emissions.

9. **While most MOIP initiatives are just entering the implementation stage and it is too early to assess their impact, the evidence base has sufficient scale and scope to validate the policy approach. More precisely, their analysis offer a range of lessons-learned on multiple issues, ranging from how to co-develop a strategic agenda to the different ways to integrate policy instruments across administrative silos.** An overwhelming majority of these initiatives have been launched between 2018 and 2020 and are therefore still in their infancy. Furthermore, the 'early' MOIPs, which were developed even before the policy concept itself gained salience, are not only less numerous but also more remote from the 'ideal' type of MOIP presented in the definition.

Objectives and content of the issue paper

10. **This issue paper aims to present the conceptual framework and results of the work that has been conducted at OECD since 2019 under the aegis of the CSTP to analyse mission-oriented policies and their additionality² to address climate change.** Following this introduction, a second section sets out the definition, design principles and typology of MOIPs, as well as their strengths and weaknesses. The third section presents the theory of change used to analyse net zero missions and the key results of the analysis of net-zero missions using this framework. A conclusive section lists the remaining knowledge gaps and resulting priorities for future work on missions.

² Additionality is generally defined as the extent to which something happens as a result of an intervention that would not have occurred in the absence of the intervention. In the present case, the baseline scenario consist of traditional STI policy approaches.

2. What are mission-oriented policies? Common principles and diversity of this policy approach

11. This section presents the analytical framework that has formed the basis of the CSTP work on missions over the last four years. This framework is incrementally enhanced and improved, notably to derive action-oriented tools to help countries implement missions.

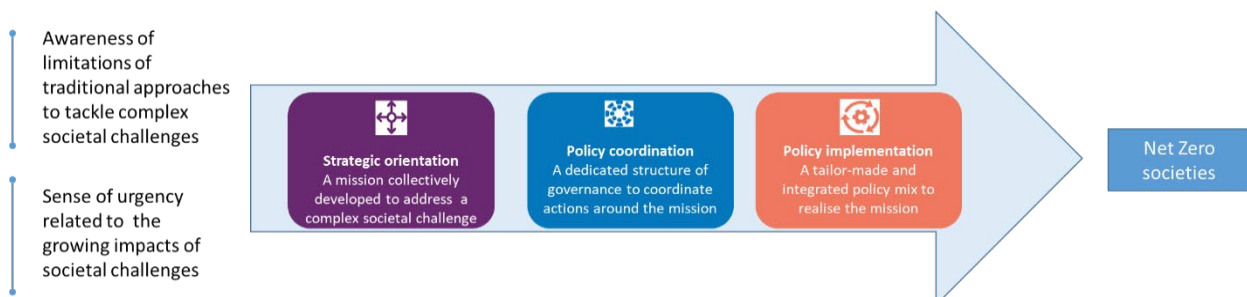
The three building blocks of mission-orientation

12. **The OECD definition of MOIPs relates to an ideal-type that can be broken down into three building-blocks: Strategic orientation, policy coordination and policy implementation:**

- *Strategic orientation* – the main objective of mission-oriented policies is to develop and set well-accepted objectives regarding a complex challenge to be addressed, with a view to setting the ground for targeted and coordinated collective action. While mission-oriented policies are still often characterised as top-down, the definition of their objectives requires the involvement of a wide array of public and private stakeholders and the formation of a solid consensus among them.
- *Policy coordination* – MOIPs coordinate the strategies and plans of various public authorities that are in charge of different components (e.g. knowledge, technologies, funding, skills, regulations, markets) essential to achieve collectively agreed objectives. These public authorities belong to different policy fields (research, innovation and different sectors that own the societal challenges, e.g. energy, mobility, health, etc.) and different levels of governance. Coordination arrangements are negotiated and found in different types of governance bodies at various levels (strategic and operational, at the level of the overall initiative and at the level of specific missions).
- *Policy implementation* – MOIPs are implemented via a comprehensive mix of policy interventions and various initiatives to support a range of activities, from research to market launch and the formation of required skills, deliberately designed to achieve the objectives of each mission. For the most part, these policies do not substitute, but build upon and coordinate pre-existing policy interventions, in order to tackle a specific challenge.

13. **All national innovation systems include multiple components that perform diverse functions pertaining to these three dimensions. The main novelty of the mission-oriented policy approach resides in the proactive and intentional integration of these components within a dedicated common institutional framework to tackle a selected challenge.** Concretely, a mission-oriented policy is a 'proactive platform for collective actions' articulating, for each selected challenge, a collectively developed agenda, a dedicated structure of governance to take and monitor the effects of common or mutually consistent decisions and, finally, a tailor-made and integrated policy mix (Figure 2).

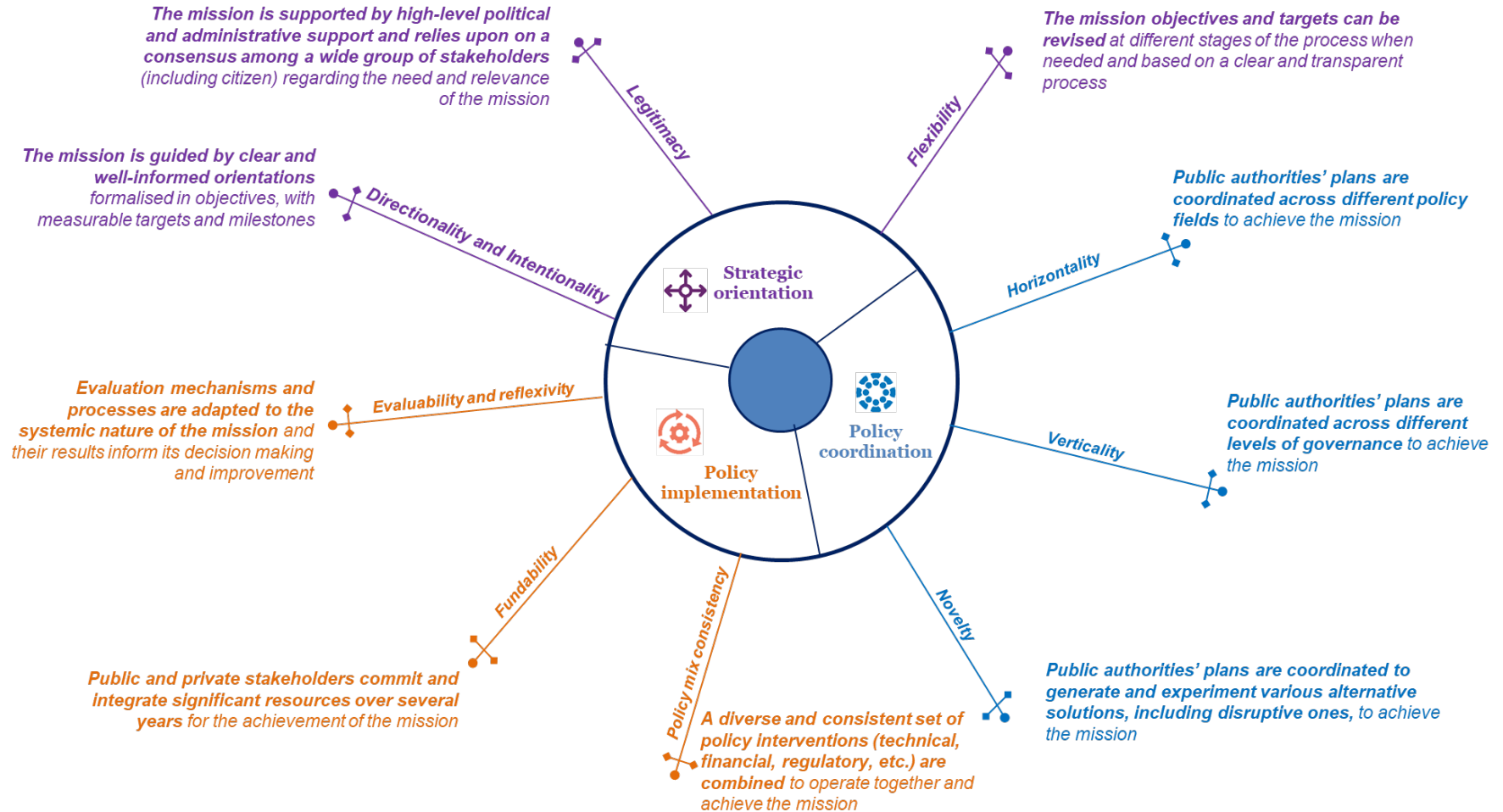
Figure 2. MOIPs as an integrated framework to steer, coordinate and implement collective action toward net-zero



The nine design principles of mission-oriented policies

14. **The three dimensions can be further disaggregated into ‘design principles’ that are expected from policy interventions matching the MOIP definition** (Figure 3). The MOIP design principles should be considered as applying only to the *ideal-type* of MOIPs since few initiatives – if any – can ‘tick all boxes’. In practice, the design principles are found in different combinations and applied in various ways reflecting the significant variations in the design of MOIPs depending on country and thematic specificities, and various other contingencies. The design principles are normative in that they help set a direction for policy change, but they are flexible enough to allow for different types of initiatives suited for different (mission and governance) contexts.

Figure 3. The design principles of mission-oriented policies



DO MISSIONS DELIVER ON THEIR MULTIPLE PROMISES?

15. **This framework can be used to assess specific MOIP initiatives or missions on each design principles.** It provides a systematic and structured framework to collectively explore questions such as:

- Are the objectives of the mission clear, understood and well-shared among the communities of public and private stakeholders relevant to each of the mission areas? (Directionality)
- Are the structures and mechanisms in place to govern the mission effective to align the plans of the whole range of relevant actors, including in sectoral policy bodies? (Horizontality)
- Is there / should there be dedicated monitoring and evaluation procedures? (Evaluability)

The four types of mission-oriented policies

16. Four main types of MOIPs are identified based on in-depth case study research on over 20 policy initiatives (Larrue, 2021) (Table 1):

- *Overarching mission-oriented strategic frameworks*: These initiatives coordinate, at the highest level, a wide array of public and private actors toward broad national (or supranational, e.g. EU) missions to tackle complex systemic challenges. They encompass several instruments and policies with various degrees of integration. They therefore vary from ‘umbrella frameworks’ to well-coordinated frameworks guided by a common concrete strategic agenda. They are led by centre-of government organisations or ministries;
- *Challenge-based programmes and schemes*: These initiatives focus on specific and ambitious (most often technological) problems and apply a targeted and integrated approach to accelerate the development of solutions through different stages of the innovation chain. These more narrow schemes often adopt management practices of ‘DARPA-like’ agencies;
- *Thematic mission-oriented programmes*: These initiatives usually build on traditional thematic research programmes and progressively reform them to make them more directional (e.g. strategic roadmaps, calls with concrete targeted results) and coordinated across sectors and disciplines (e.g. participatory governance bodies) to tackle a mix of societal and competitive challenges. Less disruptive than other types of MOIPs, these initiatives can be an entry point to mission-oriented policy where policy makers and stakeholders can learn and increase their level of ambition, leading to development of one of the other types of MOIP highlighted here.
- *Ecosystem-based mission programmes*: These initiatives provide the necessary mandate and resources to the relevant, often still nascent, ecosystem of actors to develop shared strategic agendas to tackle a systemic challenge. By empowering actors to structure their ecosystem and define their own agenda, they foster stronger directionality, legitimacy, and wider participation from a variety of partners that can then undertake various joined-up initiatives to implement the mission’s strategic agenda.

Table 1. Basic characteristics of the four main types of MOIPs

Type	Leadership	Missions	Examples
1. Overarching mission-oriented strategic frameworks	<ul style="list-style-type: none"> Center of government High-level committee 	<ul style="list-style-type: none"> Multiple missions or mission areas Pursuing ambitious challenges Long-term horizon 	<ul style="list-style-type: none"> Horizon Europe's missions (EU) Mission-driven Top Sectors policy (Netherlands) High Tech Strategy 2025 (Germany) France 2030 Acceleration Strategies (France) Hydrogen Earthshot (United-States) Moonshot R&D Program (Japan)
2. Challenge-based programmes and schemes	<ul style="list-style-type: none"> Agency 	<ul style="list-style-type: none"> Focused Seeking acceleration of innovation Mid- to long-term horizon 	<ul style="list-style-type: none"> Pilot-E (Norway) Industrial Strategy Challenge Fund (United-Kingdom) Science Foundation Ireland's Innovative Prize (IE)
3. Thematic mission-oriented programmes	<ul style="list-style-type: none"> Ministry Agency Large research institutes 	<ul style="list-style-type: none"> Build upon existing programmes to make them better targeted and coordinated Mix of societal and competitive challenges 	<ul style="list-style-type: none"> Cross-ministerial Strategic Innovation Promotion Program (Japan); CSIRO's missions (Australia); Flagship Programs (Finland); NRC Challenge program (Canada); The Alchemist (Korea) Building of Tomorrow/Cities of the Future (Austria)
4. Ecosystem-based mission programmes	<ul style="list-style-type: none"> Ministry Agency 	<ul style="list-style-type: none"> Innovation agenda developed by the innovation actors themselves, with neutral support from public authorities 	<ul style="list-style-type: none"> Green missions (Denmark) Growth Engines (Finland) Strategic Innovation Areas (Wallonia, Belgium) Strategic Innovation Programmes (Sweden)

Mission-oriented policy strengths and weaknesses

17. The main expected benefits of MOIPs are embedded in their definition and, in more details, in the MOIP 'design principles'. MOIPs can, in principle, enhance the legitimacy of policy interventions, their directionality and intentionality, and allow for better horizontal and vertical coordination. Existing MOIP initiatives 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.

18. A large number of interviews and thorough desk review allow to identify challenges more closely associated to the four types of MOIP (Table 2):

- *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’.




Table 2. Synthesis of the strengths and weaknesses of the different types of MOIPs

MOIP Types	Strengths	Weaknesses
<i>Overarching mission-oriented strategic framework</i>	<ul style="list-style-type: none"> • Visibility and inclusiveness • Broad scope • Systemic intervention 	<ul style="list-style-type: none"> • Loose coordination, umbrella type • Higher transaction costs
<i>Challenge-based programmes and schemes</i>	<ul style="list-style-type: none"> • Coordination of public support along the innovation chain • Hands-on management of projects / project portfolios • Articulation of supply and demand for knowledge 	<ul style="list-style-type: none"> • Niche solutions, need scale up • Focused on technological / engineering solutions
<i>Thematic mission-oriented programmes</i>	<ul style="list-style-type: none"> • Continuity with former thematic research and innovation programmes 	<ul style="list-style-type: none"> • Path-dependencies limit the adoption of mission-oriented policy practices (result-driven, cross sectorial coordination,) • Tend to remain focused on research
<i>Ecosystem-based mission programmes</i>	<ul style="list-style-type: none"> • Strong legitimacy, ownership, and commitment of all actors towards the co-developed strategic agenda • Role of public authorities as orchestrators/facilitator of ecosystem formation 	<ul style="list-style-type: none"> • Less challenge / mission-based. Often very open at the start. • Risk of capture of missions by and in favor of leading / historical players

Source: Adapted from Larrue (2021)

19. MOIP challenges are shaped and influenced by a number of drivers beyond the type of MOIPs, not least country and thematic specificities. Table 3 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 3. Main challenges identified in mission-oriented policy initiatives

 Strategic orientation	 Policy coordination	 Policy implementation
<ul style="list-style-type: none"> • Finding meaningful ways to consult citizens • Enlisting new 'unusual' actors in agenda-setting • Creating a broad sense of ownership around the collective initiative • Defining neutral problems that do not exclude possible solutions, in particular those that involve behavioural and social changes rather than only technological progress • Avoiding the inflation of missions or excessive broadening/dilution of missions • Setting clear and measurable goals (particularly difficult for societal challenges), with milestones • Avoiding piece-meal approach with small scale solutions to address large problems 	<ul style="list-style-type: none"> • Strengthening and/or widening co-ordination • Reducing co-ordination costs and 'mission fatigue' • Avoiding mission silos in the case of multiple missions • Sharing leadership with sectoral public authorities • Avoiding that the mission governance bodies become mere ex post monitoring bodies – making them ex ante strategic steering bodies 	<ul style="list-style-type: none"> • Keeping the mission focus during the implementation (especially when decentralised implementation) • Ensuring the funding of the missions beyond STI budgets – getting public sectoral authorities to commit funding • Leveraging public funding to attract private sector investment, despite their focus on societal issues • Connecting supply-side and demand-pull instruments, supporting market take up • Broadening the policy mix toward non-STI policy instruments (regulations, price mechanisms, public procurement) • Skills and capacity in public administration to implement portfolio management practices

Source: adapted from OECD MOIP Toolkit, <https://stip.oecd.org/stip/moip/>

3. What are mission-oriented policies delivering to achieve net-zero?

This section presents the result of the on-going OECD work on mission-oriented policies for net-zero.³

The theory of change to analyse missions for net-zero: what are the output and outcomes of mission-oriented innovation policies for net-zero?

20. **There is still limited knowledge about the extent to which, how and under what conditions mission-oriented policies do produce expected impacts.** To date, the state of the art of knowledge on missions focuses on the different designs of types MOIPs. Some of their processes have also been analysed through cases studies, focusing on the definition of their objectives and strategic agenda rather than on their implementation, since most of these policies are still at an early stage. A 'theory of change' of mission-oriented policy is still largely missing and needed (Janssen, Torrens, Wesseling, Wanzenböck, 2021; Hekkert, Janssen, Wesseling, Negro, 2020).

21. **This paper presents a theory of change (ToC) of net-zero missions, making explicit the causal relationships between the problems they tackle and their desired goals, inputs, outputs, outcomes and impacts.** This ToC is used to analyse a database of 74 'net-zero missions' (see Annex A) and twenty in-depth case studies (see Figure 4). It is composed of several stages that connect what missions are to the impact they are expected to produce:

- The starting point of the ToC is the distinction between the three already mentioned MOIP building blocks. Each of them contains the *design principles* that constitute the essence of what an MOIP approach is.
- The second stage of the ToC includes the *intermediate outcomes* of the MOIPs. For instance, it is expected that the gathering of a multiplicity of public and private actors from different disciplines, sectors and policy areas allows the development of a shared agenda that has strong legitimacy

³ <https://www.oecd.org/sti/inno/mission-orientedpoliciesfornetzero.htm>

among these actors and beyond, as well as other features, notably a high level of directionality and intentionality.⁴ In turn, this shared agenda is expected to include a broader set of potential options directed towards more ambitious and long-term objectives. In combination with elements of the policy coordination building-block, this shared agenda should also result in a higher budget for the mission, as well as stronger buy-in and commitment of private actors and stakeholders involved in the realisation of the mission, and the support to a more comprehensive range of activities being supported (i.e. not only technological aspects but also elements related to the needed skills, infrastructure, regulatory framework, user awareness, etc.).

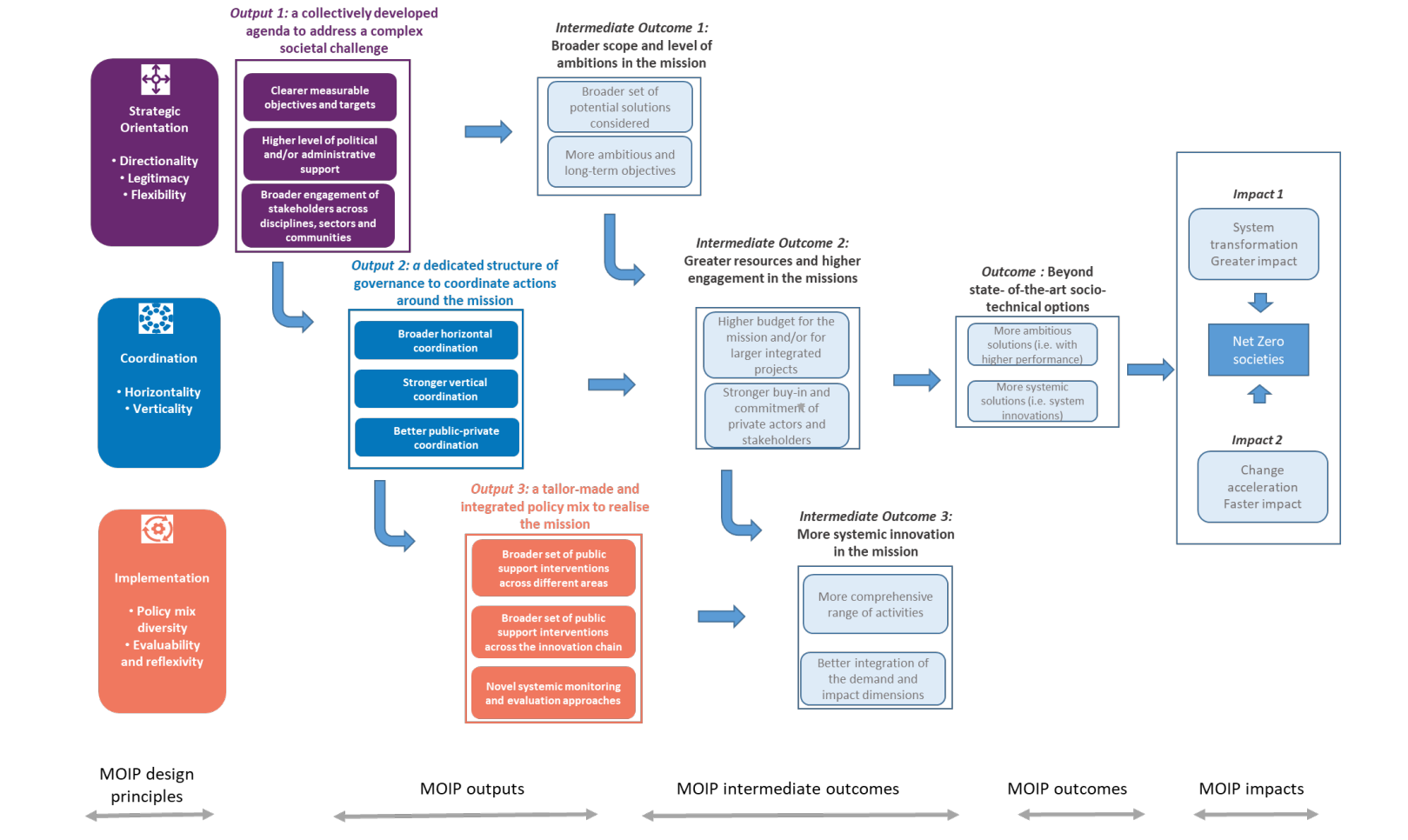
- Finally, in combination with the elements of the policy coordination building-block, missions produce *outcomes*. A wide range of actors across all silos, strongly committed to the achievement of the mission through the exploration of a broader set of potential options and a wider range of supported activities, benefiting from greater resources, could obtain more ambitious solutions (i.e. with higher performance⁵) which can be articulated in a more systemic way.
- At the end of the causal chain, the *impact* of a MOIP is the realisation of its mission. Building on the well-known distinction between acceleration and transformative missions,⁵ two main types of impact are distinguished: system transformation and change acceleration.

22. **Since missions build upon and integrate existing policies, this theory of change aims to assess whether they not only produce effects but that they have *additional effects*, on top of those produced by the existing policy instruments that they incorporate.** The legitimacy of this policy approach therefore depends on successfully passing a stringent double test: not only must they realise their missions, but they should do so more effectively and efficiently than would have been the case without them, or fulfil missions that are beyond the reach of other traditional approaches.

⁴ The so-called 'design principles' in (Larrue, 2021)

⁵ 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, etc.), 'transformer' type of missions aim at more systemic changes (often coinciding with 'wicked problems') (Kuittinen H., Polt W., & Weber M., 2018), (Wittmann, Hufnagl, Lindner, Roth, & Edler, 2021)

Figure 4. The theory of change of a net-zero mission: from MOIP design principles to net-zero achievements



Net-zero Missions outputs

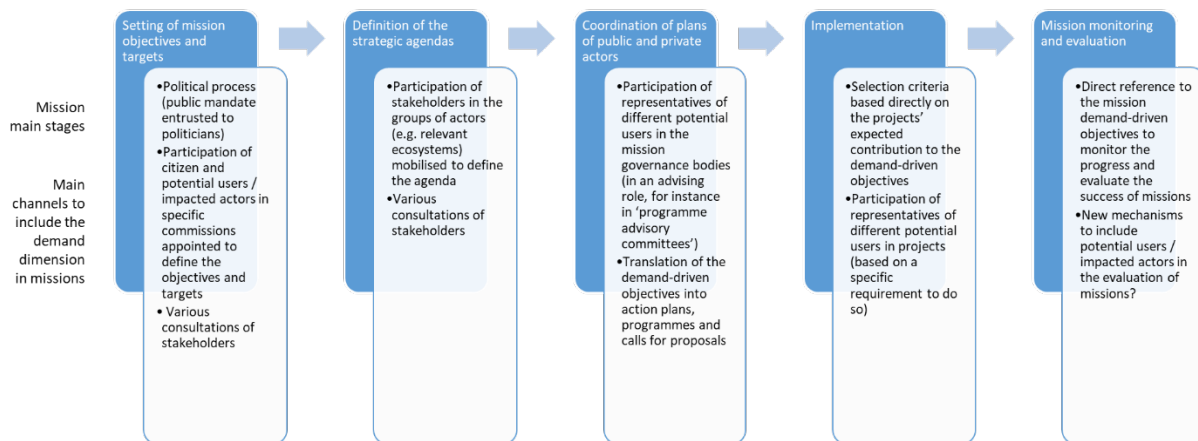
23. The analysis of existing net zero missions using the framework outlined above shows that net-zero missions produce many of their expected outputs and represent in most cases a marked improvement in terms of policy design relative to traditional STI policy mixes.

24. Panel A of Table 4 illustrates the results of the analysis of how existing net-zero MOIPs perform against the three outputs highlighted in the theory of change. They articulate a co-designed agenda, a dedicated structure of governance and, finally, a tailor-made and integrated policy mix. Compared to traditional policy mixes, net-zero missions are characterised by:

- *Stronger orientation*, with clearer objectives and measurable targets related to Greenhouse Gas (GHG) emissions reduction, although only a few of them correspond to expected 'SMART' goals.⁶ Co-developed strategic agendas that are directly associated to financial resources and modes of implementation characterise these initiatives. This is rarely the case in other strategic frameworks.
- *Broader coordination* of policy plans across administrative silos, bringing together the authorities in charge of research and innovation policy and the 'owners' of the challenges they tackle – for instance the policy and regulatory bodies in charge of transport or environment. However, to date, budgets are not commensurate to the transformative objectives of net-zero missions, and those budgets originate almost exclusively from STI public authorities.
- *Higher integration* of various support instruments across the different stages of the innovation chain (from support to research to the strengthening of skills and, for some of them, market deployment through price-based mechanisms and public procurement). One of the greatest added value of net-zero missions lies in their result-orientation, which leads mission partners to articulate societal needs and demands at different stages of the mission life cycle. Starting from the mission objectives, partners embed the demands and needs in every step of mission activities, even in the more upstream research components (Figure 5). These linkages require new proactive portfolio management practices that challenge prevailing skills, structures of incentives and processes in ministries and agencies.

⁶ Specific, Measurable, Achievable, Relevant, and Time-Bound.

Figure 5. Integration of the demand dimension in the net zero missions in the different stages of the mission lifecycle



Net-zero Missions outcomes

25. **In relation to outcomes, Panel B shows that existing Net-zero missions are not yet the frameworks for systemic collective action they are expected to be. They are therefore not yet well suited to bring about the needed transformative changes to achieve the goal of net-zero.** They are broader in scale and scope than traditional innovation programmes, but remain focused on technological innovation more or less narrowly defined. While mission managers often claim that social innovation is as important as technological innovation in their mission and far more prominent than in other STI initiatives, the social components are mainly limited to advocacy, information and communication campaigns, and various studies at individual and societal levels to prepare technology scale-up and market transition. Given the importance of the combination of both technological and social innovation, the transformative potential of these missions remains unclear. This is consistent with other studies such as the one on the missions of German HTS 2025 within which stakeholder involvement remained much limited in the mission formulation process to the traditional R&I actors, therefore not fully realising its transformative potential (Roth, Wittmann, Hufnagl, & Linder, 2022).

26. **Even in the broader and most ambitious missions, closer scrutiny of effective leadership and real commitments shows that they are also in practice funded strictly with 'STI money' and pertain to programmes with an STI mandate.** The vast scope of stakeholders needs to be mobilised far beyond STI, which raises a question of whether the Research and Innovation Programmes are the best location to 'host' such ambitious objectives.

27. **Most missions have been successful at setting legitimate and powerful objectives and targets. Joined up action is less frequent and missions are generally less integrated at implementation level than at orientation and coordination levels.** Missions have co-developed wide and systemic shared strategic agenda to realise their objectives and set up dedicated holistic governance structures, which gather a range of policy makers from different sectors to align their plans and monitor their actions against a mission strategic agenda. This is particularly the case for ecosystem-based missions which empower partners to define their own agendas, a significant share of resources is dedicated to the formation of the ecosystem and various partnerships through support to networking, coordination and orchestration. However, the influence of the strategic agenda on actual collective decision making on

budget allocation and policy implementation is less clear. Real joined up action building on the shared strategic agenda is less frequent.

28. **Beyond the issue of missions' influence on public policies, their implementation will depend on their leverage effect in mobilising the private sector, which will need to provide enormous amounts of resources to fund sustainability transitions and, more generally, engage as key change agents in these transitions.** While the attention of policy makers and analysts in this phase is still currently on public funding and cross-ministerial coordination, the ultimate test of missions will be the contribution and financial commitments of private businesses and investors.

Table 4. Synthesis of the main results across the MOIP theory of change

Panel A. Missions - outputs

Net-zero mission effects	Main results
A) The collective development of a strategic agenda to address a complex societal challenge	
Clearer measurable objectives and targets	Mission have enabled the setting of clearer goals than in traditional programmes, although few of them correspond to the expected 'SMART' goals. Only half of them have established clear targets Strategic agendas allow 'continuous directionality' and complement mission objectives in a context of high uncertainty and contestation In stark contrast with traditional strategies and roadmaps, strategic agendas are directly associated to mission budgets, coordination structures and modes of implementation
Higher level of political/administrative support	Missions are political by nature due to normative goals related to societal impacts Broad national missions attract more attention from politicians and high-level administrative levels, which strengthens their legitimacy but can add pressure to obtain early results
Broader engagement of stakeholders	Strategic agendas are developed by a wide range of actors from different communities, which increases their ownership of the mission and subsequent engagement
B) The alignment and holistic monitoring of the plans of various actors	
Broader horizontal coordination	Almost all net-zero missions subject to a case study represent a significant expansion of the scope of coordination between different actors across the government structure Leadership is assumed by the STI authorities that have launched the mission Cross-sectorial coordination is the main challenge of net-zero missions and, in the largest and most integrated ones, this generates significant transaction costs
Stronger vertical coordination	Most net-zero missions are led by national (or EU) authorities and some of them include local authorities in the governance Local authorities are involved in many mission activities to enable the solutions demonstration and early transition to market A few net-zero missions are implemented at regional level, in particular in the context of the new generation of EU Smart Specialisation Strategies
Better public-private coordination	Mission complement (and often benefit from) the existing public-private STI concertation platforms. They add a well-targeted purposive framework and ensure a more direct link to policy intervention
C) The articulation and management of a portfolio of activities	
Broader set of public support interventions across different areas	All net-zero missions bundle together under a common strategic and governance framework different types of interventions, from R&D grants to skill formation and market deployment They allow the coordination of the public support to different components of the systemic solutions
Broader set of public support interventions across the innovation chain	Several net-zero missions map and practically connect the various support instruments across the different Technology Readiness Levels with a view to provide more continuous support to different stages of the innovation chain
Novel systemic monitoring and evaluation approaches	Widely shared perception among mission partners that new evaluation methodologies and processes are needed to evaluate this approach, but very few MOIP evaluations have been undertaken to date and they do not significantly depart from traditional STI policy evaluations

Panel B. Missions - Outcomes

Net-zero mission effects	Main results
A) Broader scope and level of ambitions in missions	
Broader set of potential solutions considered	The scope of the mission is a matter of important debate within missions to strike a balance between the benefits of open (neutrality and exploration) and more narrowly defined (directionality of and integration between the different mission activities) Few missions are very open and some of them are evolving towards more narrowly-defined and directional missions
More ambitious and long-term objectives	Most missions have set objectives that are geared towards impacts in 2030 and 2050 The difference in missions' levels of ambition is difficult to assess
B) Greater resources and higher engagement in net-zero missions	
Higher and longer term funding	Missions generally benefit from longer term funding compared to traditional research and innovation schemes Funding are only informally earmarked for missions in the long run but their public announcement tends to generate some pressure to public authorities to commit the promised resources net-zero mission budgets are mainly originating from STI public authorities. Few sectoral public authorities have committed additional funding to realise the missions.
Stronger buy-in and commitment of private actors and stakeholders	Strong engagement in development of the strategic agenda but insufficient information on private sector financial contributions and, therefore, missions leverage effect
C) More systemic innovation in net-zero mission	
Better integration of the demand and impact dimensions	The connection to the needs and demands is one of the aspects most frequently raised as a novelty of the net-zero missions net-zero missions provide various means to articulate demands in missions at different stages of the mission life cycle, from mission definition to mission evaluation
More comprehensive and consistent range of activities	net-zero missions allow for a wide and more consistent range of activities from basic research to deployment, capacity building or communication and advocacy. Proactive portfolio management practices in missions are necessary to reap the systemic benefits of missions but require significant resources, new skills and new rules and procedures in ministries and agencies

4. What is the next stage for mission implementation and analysis?

Missions need to not only accelerate technological change but also transform socio-technical systems

29. **Overall the analysis presented in this issue paper enables a better understanding of the current MOIPs and highlight their achievements and limitations. Using the already mentioned typology of (Kuittinen H., Polt W., & Weber M., 2018), analysed mission-oriented policies are in several respects closer to the ‘accelerator’ mission than transformative missions.** In other words, existing missions are better at speeding scientific and technological advancement than transforming socio-technical systems.

30. **Building on their early results in terms of outputs and learning from good practices, net-zero missions will realise their transformative potential if they succeed in finding a way out of two currently common traps:**

- The ‘*STI only trap*’. Despite displaying some systemic features, net-zero missions remain for the most part focused on support to research and innovation, led by STI authorities and drawing almost exclusively on STI funds.
- The ‘*orientation only trap*’. So far, most net-zero mission achievements have been realised in the definition of strategic agendas and in setting up governance structures. Evidence of joined up implementation remain rarer and small scale.

31. **Key to mission success will be the ability of STI authorities, in their current role of ‘mission champions’, to attract stronger commitment of sectoral authorities which ‘own’ the societal challenges (and as such many of the programmes and regulations that related to these challenges).**

This raises the issue of where missions that aim for the transformation of socio-technical systems to achieve net-zero should be anchored in government structures. The three main options are STI public authorities (research and/or innovation), the ‘challenge owners’ (sectoral authorities) or centre-of-government (President, Prime Minister or Cabinet offices). A few countries with longer experience of this policy approach, such as Sweden, where missions lie in the research and innovation agencies, have tried to ‘elevate’ missions to a higher and broader level of governance, though with mixed results. The example of the French missions (the Acceleration Strategies) led by an autonomous agency attached to the Prime Minister’s Office, with strong support from the President and a dedicated budget covering a broad systemic portfolio of actions over different generations of socio-technical solutions, offers a different model of institutionalisation of missions. Novel options to steer, govern and possibly manage large systemic missions still have to be designed and experimented on different levels across government structures. Examples of potential ‘anchoring’ for missions may include a dedicated agency, a virtual cross-agency platform, a large public private partnerships/platform, and an autonomous organisation with foundation status.

Missions are learning and improving

32. **Although they are in most cases very recent, existing experimental and pilot mission initiatives have already generated important learning and continue to evolve.** For example, the missions of the German HTS 2025, that were criticised for their weak directionality and loose coordination, will be followed by a new initiative – the “Future Strategy” – with dedicated governance structures, as called upon by the advisory High-Tech Forum prior to its dissolution. In Austria, the mission-oriented thematic programmes ‘Building of tomorrow’, ‘Mobility of the Future’ and ‘City of Tomorrow’ will be taken over by (or embedded within) four national directional and cross-ministerial missions. The SFI Challenge Research programmes will benefit from the funding and institutional dynamics of the Irish Recovery and Resilience Plan to expand and ‘deepen’ their mission-oriented approach in the ‘National Challenge Fund’, an initiative

with greater directionality to allow for a more consistent and interrelated project portfolio. The Dutch MTIP will also be improved to make this broad policy framework that includes 25 missions more strategic and efficient. In Japan, the third generation of Cross-ministerial Strategic Innovation Promotion Programs will see their design significantly modified to be more targeted and integrated.

33. These are only a few initiatives, and more work remains to be done to make missions ‘fit’ to support the transition to net-zero. This process will require significant monitoring and evaluation frameworks, not least to develop adequate methodologies and processes to assess not only their results but also capture the added value and weaknesses of their mission-oriented features.

34. The transition of missions to their next stage, to escape the “STI only” and “orientation” traps mentioned above, will also depend on changes in their underpinning environment. Missions often ‘stall’ not because they are ill-designed but because they confront ministries’ and agencies’ mandates, administrative and legal rules, accounting structures, and governance models that cannot easily adapt to the mission approach (Aagaard, Norn, & Stage, 2022). Changes at this level are far out of reach of STI authorities alone and will require significant political support and active engagement.

Knowledge gaps on missions for net-zero

35. The interest for mission-oriented policy is still very recent but the five last years have been rich in learning about their implementation. Still, a lot is yet to be known to bring net-zero missions to the next stage, i.e. going beyond the two traps previously identified. The OECD ‘missions for net-zero’ study, enriched by a thorough review of the literature on missions, point to the following knowledge gaps:

- How to make them truly systemic and expand beyond the realm of STI actors, policies and funding? This issue encompasses questions such as where to anchor missions in national innovation systems, what kind of incentives could promote such joint endeavours involving STI and sectoral public authorities, and what should be the supporting mechanisms and processes (not least budgetary and evaluation ones);
- What should ‘policy integration’ within missions include and how? It is essential to provide the pragmatic tools to understand what needs to be integrated in the specific case of each specific challenge to achieve. The term policy integration, which includes a variety of items (budget, infrastructure, policy instruments, etc.) across different established policies, need to be ‘debunked’. While it is clear that a wide cross-sectoral collaborative approach is critical to achieve net-zero, little is known about what should be the boundaries and content of policy integration for different challenges at different moment in time;
- What changes in the public sector governance do mission-oriented policies require to be successful and how to promote these changes? The mission-oriented policy approach challenges public sector structures (e.g. governance, roles and responsibilities of different organisations), processes (e.g. budgetary, human resource management), skills (e.g. for portfolio project management) and mind-sets (e.g. system thinking, impact-led, future orientation). Many organisations have engaged in this policy approach without having reformed any of these, which limits the transformative potential of missions;
- What should be the linkages between net-zero missions and the broad and high-level national governance and policy framework for net-zero? Net-zero missions cannot be all encompassing and in most cases are focused on particular sources of emissions (agriculture, transport, etc.), technological domains (hydrogen, CCSU) or geographical areas (e.g. cities). There is therefore a need for coordinating these missions between themselves and with all other activities relevant to the achievement of each country’s net-zero commitment. Several countries – in particular those which translated their net-zero targets into law – have set up a dedicated governance structure to lead the progress reporting and review processes and coordinate and/ or

advise on actions on a national and holistic level. A better understanding of how these frameworks operate and how they provide and use information from and to the net-zero missions (especially the broad systemic ones) would be instrumental to understand the nested structure of systemic approaches contributing in a consistent way to the achievement of net-zero objectives.

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Annex A. Complete list of identified net-zero missions

36. The table below presents the list of missions included in the Net-zero mission database. Among these missions, those subject to an in-depth case study are in italics and marked with an asterisk.

List of net-zero missions by country and MOIP analysis

Australia

CSIRO's Missions

- Climate resilient enterprises
- Drought resilience mission
- Ending plastic waste mission
- Hydrogen Industry mission *
- Towards Net-zero**

Austria

Building of Tomorrow (plus)

- Innovative, sustainable concepts both for new buildings and for renovating existing ones

Austrian national missions

- Climate neutral cities *

Mobility of the future

- Fit4UrbanMission

Belgium

Smart Specialisation Strategy of Wallonia

- Circular materials

Canada

NRC Challenge program

- Materials for clean fuels challenge *

Denmark

Green missions

- Carbon capture and storage or utilisation *
- Climate and environment-friendly agriculture and food production
- Green fuels for transportation and industry (Power-to-X etc.)
- Recycling and reduction of plastic waste

European Union

Horizon Europe's missions

- Adaptation to climate change including societal transformation (ACC)
- Climate-neutral and smart cities *
- Healthy oceans, seas, coastal and inland waters
- Soil health and food

Finland

Flagship Programs

Atmosphere and Climate Competence Center Flagship Programme *

CERES Flagship Programme for the Materials Bioeconomy

Growth Engines

Accelerating the growth of the carbon capture market Growth Engine (Compensate platform company)

Baltic Offshore wind Growth Engine (Gaia consulting orchestrator)

From a socio-sized demo of renewable energy production to an international total solution provider Growth Engine (Flexens platform company)

GreenE2 Growth engine (CLIC Innovation orchestrator) *

France

Stratégies Nationales d'Accélération

Decarbonation de l'industrie *

Hydrogène décarboné *

Germany

Hightech Strategy 2025

Achieve substantial greenhouse gas neutrality in industry ('GGNII') *

Build up a battery cell production in Germany

Create sustainable circular economies

Develop safe, networked, and clean mobility

Ireland

National Challenge Fund

2050 Challenge

Science Foundation Ireland's Innovative Prizes

AI for Societal Good Challenge

Plastics Challenge

Zero Emissions Challenge *

Japan

Cross-ministerial Strategic Innovation Promotion Program (SIP)

Technologies for smart bio-industry and agriculture (Smart Food System)

Moonshot Research and Development Program

Moonshot goal 4: Realization of sustainable resource circulation to recover the global environment by 2050 *

Moonshot goal 5: Creation of the industry that enables sustainable global food supply by exploiting unused biological resources by 2050

Korea

Advanced Research Programme (KARPA)

Plasma-based CO₂ free waste organic material as a basic raw material

The Alchemist

Artificial eco-food

Low-cost CO₂ -free hydrogen production facilities

Lithuania

Mission-oriented science and innovation programs

Smart and climate neutral Lithuania

Netherlands

Mission Driven Top-Sector Policy

A carbon-free built environment by 2050 *

A net climate neutral agriculture and nature system in 2050 *

A sustainable and completely circular economy by 2050, with resource use halved by 2030

An entirely carbon-free electricity system by 2050

Carbon-neutral industry with reuse of raw materials and products by 2050

Zero-emission mobility of people and goods by 2050

Norway

Pilot E

"Green shipping" (amalgamated Pilot E missions) *

A zero-emissions hydrogen value chain
Zero-emissions construction and facilities

Pilot-T

New Solutions in the Interface between Transport and ICT

Spain

CDTI mission (s)

Promote a more sustainable agri-food sector adapted to the new conditions associated with climate change thanks to the relevant use of advanced biotechnological tools

Promote the substitution, recovery and valuation of mineral resources and strategic materials for the Ecological Transition

Strengthen technological capacities for safe and sustainable energy autonomy (fusion, hydrogen and renewables)

Sweden

Challenge Driven Innovation Initiative

Business model innovation for closed-loop furniture flows (Reuse of furniture to reduce climate impact)

New technology for carbon dioxide-free asphalt (Swedish Magnetite Microwave Asphalt Road Technology; SMMART)

The Swedish Innovation Platform for Textile Sorting *

Innovation Partnership Programmes

Climate neutral industry Innovation partnership programme

Skills supply and lifelong learning Innovation Partnership Programme

Strategic Innovation Programmes

Viable cities *

Vinnova's pilot missions

Healthy sustainable food: Ensuring that every student in Sweden eats healthy, sustainable, and tasty school food *

Healthy sustainable mobility (Street Move 2)

Healthy sustainable mobility (Street Moves 1)

United Kingdom

Industrial Strategy Challenge Fund

Driving the electric revolution challenge

Faraday battery challenge

Future flight challenge

Industrial decarbonisation *

Prospering from the energy revolution challenge

Smart sustainable plastic packaging (SSPP) challenge

Transforming construction challenge

Transforming food production challenge

Transforming foundation industries challenge

United-States

Energy Earthshots

Carbon Negative Shot

Hydrogen Shot *

Long Duration Storage Shot

Previous GGSD Forums

- 2021 - *A green recovery:
Rethinking the built environment and transport*
www.oecd.org/greengrowth/ggsd2021/
- 2020 - *Securing natural capital:
Resilience, risk management and COVID-19*
www.oecd.org/greengrowth/ggsd2020/
- 2019 - *Greening heavy and extractive industries:
Innovation and fiscal implications*
www.oecd.org/greengrowth/ggsd2019/
- 2018 - *Inclusive solutions for the green transition:
Competitiveness, jobs and social dimensions*
www.oecd.org/greengrowth/ggsd-2018/
- 2017 - *Greening the Ocean Economy*
www.oecd.org/greengrowth/ggsd-2017/
- 2016 - *Urban green growth, spatial planning and land use*
www.oecd.org/greengrowth/ggsd-2016/
- 2015 - *Enabling the next industrial revolution:
Systems innovation for green growth*
www.oecd.org/greengrowth/ggsd-2015.htm
- 2014 - *Addressing the social implications of green growth*
www.oecd.org/greengrowth/ggsd-2014.htm
- 2013 - *How to unlock investment in support
of green growth?*
www.oecd.org/greengrowth/gg-sd-2013.htm
- 2012 - *Encouraging the efficient and sustainable use
of natural resources: Policy instruments
and social acceptability*
www.oecd.org/greengrowth/gg-sd-2012.htm

2022 Green Growth and Sustainable Development Forum

For more information:



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